Web Services Service Group – Specification (WS-ServiceGroup)

Version 1.0

3/31/2004

Authors

Steve Graham (IBM) (Editor)

Tom Maguire (IBM) (Editor)

Jeffrey Frey (IBM)

Nataraj Nagaratnam (IBM)

Igor Sedukhin (Computer Associates International)

David Snelling (Fujitsu Laboratories of Europe)

Karl Czajkowski (Globus Alliance / USC Information Sciences Institute)

Steve Tuecke (Globus / Argonne)

William Vambenepe (Hewlett-Packard)

Copyright Notice

Abstract

A ServiceGroup is a heterogeneous by-reference collection of Web services. ServiceGroups can be used to form a wide variety of collections of services or WS-Resources [State Paper], including registries of services and associated WS-Resources.

Members of a ServiceGroup are represented using components called *entries*. A ServiceGroup entry is a WS-Resource. The Web service associated with a ServiceGroup entry can be composed from a variety of Web services standards including WS-ResourceLifetime [WS-ResourceLifetime] which defines standard patterns by which resources can be destroyed, WS-BaseNotification [WS-BaseNotification] which defines how third parties may subscribe to be informed of changes to the ServiceGroup and WS-ResourceProperties [WS-ResourceProperties] which defines how the properties of a ServiceGroup and its entries are made accessible through a Web service interface.

Status of this Document

This WS-ServiceGroup specification is an initial draft release and is provided for review and evaluation only. The Companies hope to solicit your contributions and suggestions in the near future. The Companies make no warrantees or representations regarding the specifications in any manner whatsoever.

Table of Contents

1 Introduction

In this document, we consider a distributed computing environment consisting of Web services and stateful resources. A pattern defining the relationship between Web services and stateful resources is detailed in "Modeling Stateful Resources with Web services" [State Paper]. The term WS-Resource is used to describe the relationship between a Web service and a stateful resource.

This WS-ServiceGroup specification defines a means by which Web services and WS-Resources can be aggregated or grouped together for a domain specific purpose. In order for requestors to form meaningful queries against the contents of the ServiceGroup, membership in the group must be constrained in some fashion. The constraints for membership are expressed by intension using a classification mechanism. Further, the members of each intension must share a common set of information over which queries can be expressed.

In this specification, the ServiceGroup membership rules, membership constraints and classifications are expressed using the resource property model [WS-ResourceProperties]. Groups are defined as a collection of members that meet the constraints of the group. The ServiceGroupRegistration interface extends the basic ServiceGroup capabilities with message exchanges for managing the membership of a ServiceGroup.

The ServiceGroup and ServiceGroupRegistration interfaces defined in this document are commonly expected to be composed with other application domain specific interfaces, which define more specialized interaction with the service group and/or with the services that are members of the service group. For example, specialized interfaces may offer means of querying the contents of the ServiceGroup, and for performing collective operations across members of the ServiceGroup.

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

1.1 Goals and Requirements

The goal of WS-ServiceGroup is to standardize the terminology, concepts, message exchanges, WSDL and XML needed to express the aggregations of Web services and resources as defined by the implied resource pattern [State Paper].

1.1.1 Requirements

This specification intends to satisfy the following requirements:

- Define the standard resource properties by which a requestor can query and retrieve contents of a service group.
- Define the standard resource properties by which a requestor can query and retrieve details of an entry in the service group.
- Define standard message exchanges and resource properties by which a requestor can add new entries for a member in a service group.

1.1.2 Non-Goals

The following topics are outside the scope of this specification:

- It is not an objective of this specification to define the message exchanges representing the function of a member.

1.2 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 RFC 2119.

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

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

1.3 Namespaces

The following namespaces are used in this document:

Prefix	Namespace
s12	http://www.w3.org/2003/05/soap-envelope
xsd	http://www.w3.org/2001/XMLSchema
wsp	http://schemas.xmlsoap.org/ws/2002/12/policy
wsa	http://schemas.xmlsoap.org/ws/2003/02/addressing
wsbf	http://www.ibm.com/xmlns/stdwip/web-services/WS-BaseFaults
wsrp	http://www.ibm.com/xmlns/stdwip/web-services/WS-ResourceProperties
wsrl	http://www.ibm.com/xmlns/stdwio/web-services/WS-ResourceLifetime
wsnt	http://www.ibm.com/xmlns/stdwip/web-services/WS-BaseNotification
wssg (this spec)	http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup
wstop	http://www.ibm.com/xmlns/stdwip/web-services/WS-Topics

2 Example

As an example of using a service group, let's consider a group containing services that one has accessed recently. In effect, this is a Web services equivalent of a Web

browser's "history" feature. The services that have been accessed can implement any interface. They could be simple Web services or Web services that are part of a WS-Resource, so they can have resource properties or not.

The only constraint the group has on its members is that the membership information of the members contains the date of last interaction with the service and whether the outcome or this interaction was successful or not. This constraint is exposed by the following membership rule:

```
…
<MembershipContentRule

  ContentElements="ns1:DateOfLastInvoke ns1:Outcome"/>

…
```

In the schema for the namespace referenced by prefix ns1, ns1:DateOfLastInvoke has been defined as an xsd:dateTime representing when the member service was last invoked and ns1:Outcome has been defined as either "success" or "failure" and is used to represent the outcome of the last invocation.
Let us now modify the example to one where the services invoked can only be of one of two different types: either a catalog service or a purchase service. In addition, if the service invoked was a purchase service, we want the amount of the purchase to be specified as a content element in the membership. The set of rules to describe the constraints of this group now is:

```
…
<wssg:MembershipContentRule

  ContentElements="ns1:DateOfLastInvoke ns1:Outcome"/>


<wssg:MembershipContentRule

    MemberInterface="ns2:CatalogPortType"

    ContentElements=""/>


<wssg:MembershipContentRule

    MemberInterface="ns3:PurchasePortType"

    ContentElements="ns3:PurchaseAmount"/>

…
```

As a result, the WS-Resource that represents the membership of a service of type ns3:PurchasePortType in the service group is guaranteed to include the elements described by the following pseudo-schema:

```
…
<wssg:Content>

  <ns1:DateOfLastInvoke>xsd:dateTime</ns1:DateOfLastInvoke>

  <ns1:Outcome>xsd:string</ns1:Outcome>

  <ns3:PurchaseAmount>xsd:nonNegativeInteger</ns3:PurchaseAmount>

</wssg:Content>

…
```

The WS-Resource that represents the membership of a service of type ns2:CatalogPortType is not required to contain the property ns3:PurchaseAmount.

Once this service group has been established, requestors can retrieve the composition of the group, subscribe for notifications on modification of the group composition (if supported) and retrieve content elements of the memberships by using the mechanisms described in this specification.

3 Terminology and Concepts

The following definitions outline the terminology and usage in this specification. This section gives only brief description of these terms

Member:

- A Web service that belongs to a ServiceGroup. Note, this Web service may be a component of a WS-Resource as defined in "Modeling Stateful Resources with Web services" [State Paper].

ServiceGroup:

- A Web service that is a collection of other Web services or WS-Resources and the information that pertains to them. The purpose of the group is application domain specific. The means by which the membership in the ServiceGroup is formed may be through ServiceGroupRegistration, or through other means not defined by this specification.

ServiceGroupEntry:

- An atomic entry in a ServiceGroup which associates a member to a ServiceGroup. A ServiceGroupEntry also contains content information by which the member's participation in the ServiceGroup is advertised.

ServiceGroupRegistration:

- A ServiceGroup that provides the means to allow users of the service to explicitly insert new members.

WS-Resource:

- A Web service having an association with a stateful resource, where the stateful resource is defined by a resource properties document type and the association is expressed by annotating a WSDL portType with the type definition of the resource properties document.

Implied Resource Pattern:

- The way WS-Addressing must be used to designate the stateful resource component of the WS-Resource to be used in the execution of message exchanges.

- An EndpointReference that follows the implied resource pattern may include a ReferenceProperties child element that identifies the stateful resource component of the WS-Resource to be used in the execution of all message exchanges performed using this EndpointReference.

- A message that follows the implied resource pattern MUST be sent to a Web service referred to by an EndpointReference that follows the implied resource pattern, and MUST conform to the WS-Addressing requirements on that message including adding the ReferenceProperties information, if present, from that EndpointReference to the message.

- A Web service that follows the implied resource pattern MAY use the ReferenceProperties information from a message that follows the implied

resource pattern in order to identify the stateful resource to be used in the execution requested by that message.

WS-Resource Qualified Endpoint Reference

- An Endpoint Reference used to refer to a WS-Resource composed of a Web service and a stateful resource.
- A stateful resource identifier MAY be contained within the ReferenceProperties element of the Endpoint Reference.
- The address of the Web service associated with the WS-Resource MUST be contained in the Address element of the Endpoint Reference.

Resource Property:

- A resource property is a piece of information defined as part of the state model of a WS-Resource.
- A resource property may reflect a part of the resource's state, meta-data, manageability information, etc.

4 Grouping Services

A ServiceGroup maintains information about a collection of Web services. Each of the Web services represented in the collection may be a component of a WS-Resource. These Web services may be members of a ServiceGroup for a specific reason, such as being part of a federated service, or they may have no specific relationship, such as the Web services contained in an index or registry operated for Web service discovery purposes.

Three sets of message exchanges provide the interface to service groups ServiceGroup, ServiceGroupEntry and ServiceGroupRegistration. The member interface is not a part of the WS-ServiceGroup specification but is included for completeness. The depiction below details the interfaces relevant to ServiceGroups.
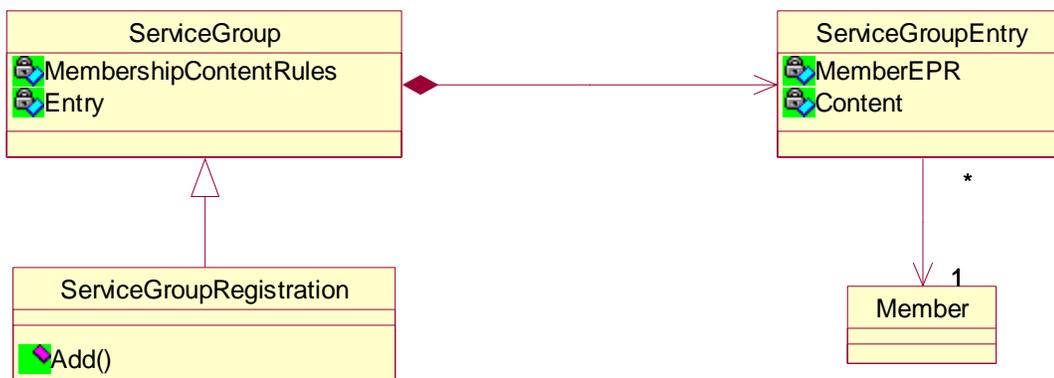
5 ServiceGroup

A ServiceGroup is a WS-Resource, following the implied resource pattern [State Paper], which represents a collection of other Web services. The individual services represented within the ServiceGroup are the ServiceGroup's members, or its membership. The model for membership of a ServiceGroup is an *entry* WS-Resource.

An entry WS-Resource represents an association with a given member in the ServiceGroup. Additionally a ServiceGroup has the following characteristics:

- When a ServiceGroup WS-Resource is destroyed, all of the ServiceGroupEntry WS-Resources, modeling the membership of the ServiceGroup, are also RECOMMENDED to be destroyed. Note however, that the actual member Web services or WS-Resources are not affected.

- Once a ServiceGroup is destroyed, a requestor MUST make no assumptions about either the existence of the entry WS-Resources that represent the ServiceGroup membership or the validity of the contents of those WS-Resources.

- A member MAY belong to several ServiceGroups.

- A member MAY belong to the same ServiceGroup more then once.

- The member of a ServiceGroup MAY implement message exchanges from various interfaces.

- If a member WS-Resource is destroyed, the ServiceGroup MAY destroy the corresponding entry WS-Resource that represents the membership of that WS-Resource in the ServiceGroup.

- The grouping and membership aspects of a ServiceGroup are only manifest in the linkage between a ServiceGroup and a ServiceGroupEntry. Accordingly, a ServiceGroupEntry in isolation has no semantic meaning.

5.1 ServiceGroup ResourceProperties

In addition to the message exchanges described in this specification, a ServiceGroup MUST also support the required message exchanges defined in the WS-ResourceProperties specification and MAY support the optional message exchanges defined in the WS-ResourceProperties specification. The resource property document defined by the ServiceGroup MUST include the following resource property elements.

5.1.1 MembershipContentRule Resource Property

The resource property document contains a potentially empty set of MembershipContentRule elements that specify the intensional constraints on *membership* of the *service group*. That is, membership can be restricted to members that implement a particular interface and/or it can require the presence of particular child elements in the wssg:Content resource property of the ServiceGroupEntry representing the membership in the group.

The ServiceGroup resource property document MAY contain zero MembershipContentRule child elements. When no MembershipContentRule elements are specified, the members of the ServiceGroup are unconstrained. When the ServiceGroup is unconstrained any member MAY be present in the ServiceGroup.

When at least one MembershipContentRule element specification exists, the members of the ServiceGroup are constrained. When the ServiceGroup is constrained, the ServiceGroup MUST NOT include a member that does not conform to at least one MembershipContentRule element. If more than one rule applies to a given member all rules that apply MUST be satisfied. Membership conformance to an individual MembershiptContentRule is described below in the MembershipContentRule component constraints.

The general form of a MembershipContentRule resource property element is:

```
<wssg:MembershipContentRule
```

```
    MemberInterface="QName"?

    ContentElements="list of QName"

/>
```

(see Appendix I: MembershipContentRule element definition & Appendix II: ServiceGroup resource property)

This resource property element is further constrained as follows:

/wssg:MembershipContentRule

> The MembershipContentRule constrains the ServiceGroup membership to those members that implement the interface described below in /wssg:membershipContentRule/@MemberInterface if present. A MembershipContentRule is further satisfied according to the rules defined below in wssg:membershipContentRule/@ContentElements.

/wssg:membershipContentRule/@MemberInterface

> This optional attribute, when present, specifies the members to which this MembershipConentRule applies according to the interface (WSDL 1.1 portType) of the member Web service. For MembershipContentRules where @MemberInterface is specified, there MUST be at most one MembershipContentRule for any given value of @MemberInterface.

> A MembershipContentRule applies to a member if the value of @MemberInterface matches the QName of the member's interface. Two QNames are equivalent when they have the same local part and they have prefixes which have been bound to namespace names that are identical [XML-Names]. If this attribute is not present, all members MUST satisfy the enclosing MembershipContentRule's @ContentElements constraint.

/wssg:membershipContentRule/@ContentElements

> This attribute specifies the content restrictions according to the list of QNames, each of which refer to a XML Schema global element declaration. This list defines the constraints on the wssg:Content resource property of the ServiceGroupEntry that MUST be satisfied for membership. The list MAY be an empty list. When an empty list is specified there are no content constraints on the resource properties of the ServiceGroupEntries that match the enclosing MembershipContentRule.

> A member satisfies a MembershipContentRule if, for each QName in the value of @ContentElements, there is at least one child element of the wssg:Content of the ServiceGroupEntry's resource properties document whose name matches that QName. Two QNames are equivalent when they have the same local part and they have prefixes which have been bound to namespace names that are identical [XML-Names].

Note: It is possible to construct a MembershipContentRule without a MemberInterface and with an empty list for the ContentElements. Such a MembershipContentRule would have no effect on the membership as per the normative semantics described for this component.

5.1.2 Entry Resource Property

An Entry resource property is a projection of the aggregation of the resource property documents of the ServiceGroup's entry resources. An Entry resource property has the following form:

```
<wssg:Entry>

   <wssg:ServiceGroupEntryEPR>

      wsa:EndpointReferenceType

   </wssg:ServiceGroupEntryEPR>

   <wssg:MemberServiceEPR>

      wsa:EndpointReferenceType

   </wssg:MemberServiceEPR>

   <wssg:Content> {any} </wssg:Content> ?

</wssg:Entry>
```

(see Appendix I: Entry type and element definition & Appendix II: ServiceGroup resource property)

This resource property element is further constrained as follows

/wssg:Entry

> The entry provides the logical structure of the constituent members of the ServiceGroup. There is one entry element for each entry in the ServiceGroup. In the event of an entry's removal or destruction from a ServiceGroup, the corresponding element in the ServiceGroup's resource property MUST also be removed. The removal of the element from the ServiceGroup's resource property SHOULD occur temporally near the removal or destruction of the entry.

/wssg:Entry/ServiceGroupEntryEPR

> Endpoint reference as defined in [WS-Addressing] to the ServiceGroupEntry WS-Resource with which the entry is associated. This WS-Resource is the representation of the membership of the member in the group. Existence of this WS-Resource is the definitive test that the member is indeed part of the group. If the WS-Resource referenced by ServiceGroupEntryEPR is not available, the consumer MUST NOT assume that the Web service referenced by the @MemberServiceEPR is a member of the service group.

/wssg:Entry/MemberServiceEPR

> Endpoint reference as defined in [WS-Addressing] to the member to which the entry refers.

/wssg:Entry/Content

> The optional Content element contains the resource property values that conform to the wssg:MembershipContentRule/@ContentElements of the ServiceGroup. In the absence of concurrency controls a requestor MUST NOT assume that this element will be identical to the element that the WS-Resource, referenced by @ServiceGroupEntryEPR, contains in its wssg:Content resource property. In the case that wssg:Entry/Content is not identical to the wssg:Content resource property of the WS-Resource referenced by the @ServiceGroupEntryEPR then the wssg:Content is assumed to be authoritative. (For further discussion reference "WS-Resource and ACID Properties" [State Paper])

5.2 ServiceGroup: Operations

The ServiceGroup interface defines no message exchanges. A ServiceGroup SHOULD implement one of the message exchange sets defined in WS-ResourceLifetime if it needs to support either immediate resource destruction or scheduled resource destruction.

6 ServiceGroupEntry

The representation of a member Web service within the ServiceGroup is a WS-Resource. The Web service component this WS-Resource implements the ServiceGroupEntry interface. The ServiceGroupEntry interface describes the requirements on the Web service through which management of the entry occurs.

A member MAY appear in a ServiceGroup multiple times. A separate ServiceGroupEntry WS-Resource represents each appearance of that member in a ServiceGroup. A ServiceGroupEntry WS-Resource MUST belong to exactly one service group.

A ServiceGroupEntry interface MAY provide additional management functions for a ServiceGroupEntry WS-Resource. In particular, it MAY provide independent lifetime management functions for individual ServiceGroupEntry WS-Resources (if it implements message exchanges defined in WS-ResourceLifetime). In the case where the ServiceGroupEntry Web service implements one of the message exchange sets defined in WS-ResourceLifetime, a ServiceGroupEntry WS-Resource MAY be removed from a ServiceGroup by managing the lifetime of the ServiceGroupEntry WS-Resource. Additional message exchanges MAY be defined to provide more advanced ServiceGroupEntry capabilities.

6.1 ServiceGroupEntry: Resource Property Declarations

In addition to the message exchanges described in this specification, a ServiceGroupEntry MUST also support the required message exchanges defined in the WS-ResourceProperties specification and MAY support the optional message exchanges defined in the WS-ResourceProperties specification.

6.1.1 ServiceGroupEPR

The general form of a ServiceGroupEPR resource property element is:

```
<wssg:ServiceGroupEPR>
  wsa:EndpointReferenceType
</wssg:ServiceGroupEPR>
```

(see Appendix I: ServiceGroupEPR element definition & Appendix II: ServiceGroupEntry resource property)

This resource property element is further constrained as follows:

/wssg:ServiceGroupEPR

> Contains an endpoint reference [WS-Addressing] to the ServiceGroup of which this entry represents membership. This endpoint reference MUST refer to the same Web service or WS-Resource throughout the lifetime of the ServiceGroupEntry.

6.1.2 MemberEPR

The general form of a MemberEPR resource property element is:

```
<wssg:MemberEPR>
```

```
  wsa:EndpointReferenceType
</wssg:MemberEPR>
```

(see Appendix I: MemberEPR element definition & Appendix II: ServiceGroupEntry resource property)

This resource property element is further constrained as follows:

/wssg:MemberEPR

> Contains an endpoint reference [WS-Addressing] to the member to which this entry pertains. This endpoint reference MUST refer to the same Web service or WS-Resource throughout the lifetime of the ServiceGroupEntry.

6.1.3 Content

The general form of the Content resource property element is:

```
<wssg:Content>
  {any}
</wssg:Content>
```

(see Appendix I: Content element definition & Appendix II: ServiceGroupEntry resource property)

This resource property element is further constrained as follows:

/wssg:Content

> This XML element contains information pertinent to the group membership represented by the ServiceGroupEntry. The Content elements conform to the XSD element declarations listed (by QName) in the membershipContentRule resource property of the ServiceGroup containing this ServiceGroupEntry.

6.2 *ServiceGroupEntry: Message Exchanges*

The ServiceGroupEntry interface defines no operations. The service implementing the ServiceGroupEntry interface SHOULD implement the message exchanges and resource properties from one of the interfaces described in WS-ResourceLifetime if it supports immediate destruction and scheduled destruction of ServiceGroupEntry resources. In addition, the service implementing the ServiceGroupEntry interface SHOULD implement the message exchanges and resource properties for the NotificationProducer interface [WS-BaseNotification]. The service implementing the ServiceGroupEntry SHOULD also support resource property value change notification as defined in [WS-ResourceProperties]. In particular, it SHOULD include wssg:Content as a value of its Topics resource property.

7 ServiceGroupRegistration

The ServiceGroupRegistration interface is an extension of the ServiceGroup interface. ServiceGroupRegistration defines the message exchanges allow a requestor to add entries to a ServiceGroup WS-Resource explicitly. Third party controlled aggregations of services are made possible by the ServiceGroupRegistration extension of ServiceGroup.

7.1 *ServiceGroupRegistration: Resource Property Declarations*

The ServiceGroupRegistration interface defines no resource properties. The resource properties defined by the interfaces in WS-ResourceLifetime SHOULD be included in the ResourceProperty document of a ServiceGroupRegistration. The resource

properties defined in the ServiceGroup interface MUST be included in the resource property document of a ServiceGroupRegistration.

7.2 Add

When a requestor wishes to add a new entry to a ServiceGroup WS-Resource, the requestor must issue a request message of the following form:

```
<wssg:Add>

  <wssg:MemberEPR>

    wsa:EndpointReferenceType

  </wssg:MemberEPR>

  <wssg:Content>

    {any}

  </wssg:Content>

  <wssg:InitialTerminationTime>

    xsd:dateTime

  </wssg:InitialTerminationTime>?

</wssg:Add>
```

The components of the Add message are further described as follows:

/wssg:Add/MemberEPR

> This component contains the endpoint reference of the member Web service to include in the ServiceGroup. It MUST satisfy the semantics as specified by the ServiceGroup resource property /wssg:MemberhipContentRules.

/wssg:Add/Content

> This component contains information to associate with the MemberEPR in the ServiceGroup. This component MUST be an element that conforms to those MembershipContentRules that apply to the member within the ServiceGroup. This component represents input for the ServiceGroupEntry content element. This input MAY be augmented or modified with other information that the ServiceGroup may derive. This allows the ServiceGroup to tailor or modify the content.

/wssg:Add/InitialTerminationTime

> An optional element, indicating the requestor's suggestion for the initial setting of the termination time resource property [WS-ResourceLifetime] of the ServiceGroupEntry WS-Resource.

If the ServiceGroupRegistration accepts the request to add a member, it MUST respond with an AddResponse message of the following form:

```
<wssg:AddResponse>

  wsa:endpointReferenceType

</wssg:AddResponse>
```

The content of a AddResponse message is an EndpointReference as described in [WS-Addressing]. This endpoint reference refers to the ServiceGroupEntry WS-Resource created by the ServiceGroup to represent the association of the member within the ServiceGroup. The Web service associated with the ServiceGroupEntry returned by the AddResponse MUST implement the message exchanges and resource properties

specified by the ScheduledResourceTermination interface and the ImmediateResourceTermination interface [WS-ResourceLifetime].

Instead of the AddResponse message, the Web service may also send the following faults in response to an Add message. For those faults associated with failure to process an Add message

- ContentCreationFailedFault:
  - o   The operation was unable to create a valid Content element (as defined by the membershipContentRule resource property) from the provided Content and MemberEPR components of the Add request message.

- UnsupportedMemberInterfaceFault:
  - o   The type of the member service referred to by the MemberEPR argument is not conformant with the MembershipContentRule.

- AddRefusedFault:
  - o   The ServiceGroupRegistration refused to create a new entry for the member service based the semantics of the ServiceGroupRegistration (or subtype).

- *Other Faults*

7.2.1 Example SOAP Encoding of the Add Message Exchange

The following is a non-normative example of an Add request message using SOAP 1.2 [SOAP 1.2]:

```
<s12:Envelope
    xmlns:s12="http://www.w3.org/2003/05/soap-envelope"
    xmlns:wsa="http://schemas.xmlsoap.org/ws/2003/03/addressing"
    xmlns:wsnt=
      "http://www.ibm.com/xmlns/stdwip/web-services/WS-Notification"
    xmlns:wsrl=
      "http://www.ibm.com/xmlns/stdwip/web-services/WS-ResourceLifetime"
    xmlns:wssg=
      "http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup"
    xmlns:npex="http://www.producer.org/RefProp">
  <s12:Header>
    <wsa:Action>
        http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup/Add
    </wsa:Action>
    <wsa:To s12:mustUnderstand="1">
        http://www.producer.org/ServiceGroupEndpoint
    </wsa:To>
  </s12:Header>
  <s12:Body>
    <wssg:Add>
      <wssg:MemberEPR>
        <wsa:Address>
            http://www.producer.org/ProducerEndpoint
```

```
            </wsa:Address>
            <wsa:ReferenceProperties>
              <npex:NPResourceId>
                    uuid:84decd55-7d3f-65ad-ac44-675d9fce5d22
              </npex:NPResourceId>
            </wsa:ReferenceProperties>
        </wssg:MemberEPR>
        <wssg:Content>
          <wstop:Topic>wsrp:ResourcePropertiesValueChanges</wstop:Topic>
        <wssg:Content>
        <wssg:InitialTerminationTime>
            2003-12-25T00:00:00.00000Z
        </wssg:InitialTerminationTime>
      </wssg:Add>
    </s12:Body>
</s12:Envelope>
```

The following is a non-normative example of an Add response message using SOAP
1.2 [SOAP 1.2]:

```
<s12:Envelope
    xmlns:s12="http://www.w3.org/2003/05/soap-envelope"
    xmlns:wsa="http://schemas.xmlsoap.org/ws/2003/03/addressing"
    xmlns:npex="http://www.consumer.org/RefProp">
    xmlns:wssg=
      "http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup"
  <s12:Header>
    <wsa:Action>
        http://www.ibm.com/xmlns/stdwip/web-services/WS-
ServiceGroup/AddResponse
    </wsa:Action>
    <wsa:To s12:mustUnderstand="1">
        http://www.producer.org/ProducerEndpoint
    </wsa:To>
    <npex:NPResourceId>
        uuid:84decd55-7d3f-65ad-ac44-675d9fce12ef
    </npex:NPResourceId>
  </s12:Header>
  <s12:Body>
    <wssg:AddResponse>
      <wsa:EndpointReference>
        <wsa:Address>
            http://www.producer.org/ServiceGroupEndpoint
```

```
        </wsa:Address>
        <wsa:ReferenceProperties>
          <npex:NPubResourceId>
             uuid:95fefeb3-f37d-5dfe-44fe-675d9fce12df
          </npex:NPubResourceId>
        </wsa:ReferenceProperties>
      </wsa:EndpointReference>
    </wssg:AddResponse>
  </s12:Body>
</s12:Envelope>
```

8 Notification of ServiceGroup Modification

If the Web service component of the ServiceGroup WS-Resource also implements the NotificationProducer interface defined by the WS-BaseNotification specification [WS-BaseNotification], then it MUST provide a topic [WS-Topics] to allow requestors to subscribe for notification of the modification of the ServiceGroup. The form of the TopicSpace [WS-Topics] is:

```
<wstop:TopicSpace name="ServiceGroupTopicSpace"
   targetNamespace=
      "http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup"
    xmlns:wsrp=
     "http://www.ibm.com/xmlns/stdwip/web-services/WS-ResourceProperties"
   xmlns:wstop=
      "http://www.ibm.com/xmlns/stdwip/web-services/WS-Topics" >
   <wstop:topic name="ServiceGroupModification" >
      <wstop:MessagePattern>
         <wsrp:QueryExpression
           dialect="http://www.w3.org/TR/1999/REC-xpath-19991116" >
              boolean((/*/*EntryAdditionNotification
                \[namespace-uri()='http://www.ibm.com/xmlns/stdwip/web-
services/WS-ServiceGroup']) |
                (/*/*EntryRemovalNotification
                \[namespace-uri()='http://www.ibm.com/xmlns/stdwip/web-
services/WS-ServiceGroup']))
            boolean(/*/EntryAdditionNotification |
                    /*/ EntryRemovalNotification)
         </wsrp:QueryExpression>
      </wstop:MessagePattern>
   </wstop:topic>
</wstop:topicSpace>
```

This TopicSpace defines the TopicSpace associated with the WS-ServiceGroup XML namespace (http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup). The TopicSpace is further constrained as follows:

/wstop:TopicSpace/@name

> The name of the TopicSpace associated with the WS-ServiceGroup XML namespace MUST be "ServiceGroupTopicSpace".

/wstop:Topic

> This topic is associated with notification messages when a ServiceGroupEntries are added or removed from a ServiceGroup. A Web service that supports the message exchanges associated with the NotificationProducer role as specified in WS-Notification and that wishes to support subscriptions and notifications related to ServiceGroup modifications SHOULD include this topic in its list of supported topics. When a ServiceGroup detects that the contents of the group have been modified, it SHOULD create a notification message artifact recording the situation and, if the message artifact is generated, it MUST associate this notification message with this topic. Note: there are many circumstances in which a modification of a ServiceGroup does not result in the generation of a notification message.

/wstop:Topic/@name

> The name of the Topic representing ServiceGroup modifications MUST be named "ServiceGroupModification". The namespace property of this topic MUST be the WS-ServiceGroup XML namespace (http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup").

/wstop:Topic/wstop:messagePattern

> This topic is associated with messages that MUST contain an wssg:EntryAdditionNotification element or an wssg:EntryRemovalNotification element. These elements and their corresponding complexTypes are described later in this section.

8.1 EntryAdditionNotification Message

The wssg:EntryAdditionNotification element is a form of notification message associated with the wssg:ServiceGroupModification topic. This element is defined as follows:

```
<wssg:EntryAdditionNotification>

   <wssg:ServiceGroupEntryEPR>

     wsa:EndpointReferenceType

   </wssg:ServiceGroupEntryEPR>

   <wssg:MemberServiceEPR>

     wsa:EndpointReference

   </wssg:MemberServiceEPR>

   <wssg:Content>{any}</wssg:Content>?

</wssg:EntryAddtionNotification>
```

The form of the EntryAdditionNotification is further constrained as follows:

/wssg:EntryAdditionNotification

One EntryAdditionNotification element is created for each ServiceGroupEntry addition situation detected by the service associated with ServiceGroup resource. This artifact records the addition of an entry to the ServiceGroup.

/wssg:EntryAdditionNotification/ServiceGroupEntryEPR

This element MUST contain the EndpointReference of the ServiceGroupEntry that was added to the ServiceGroup.

/wssg:EntryAdditionNotification/MemberServiceEPR

This element MUST contain the EndpointReference of the member service that the WS-Resource referenced by @ServiceGroupEntryEPR contains in its MemberEPR resource property.

/wssg:EntryAdditionNotification/Content

If this optional element is present, it MUST contain a copy of the Contents resource property element of the ServiceGroupEntry referenced by @ServiceGroupEntryEPR.

8.2 *EntryRemovalNotification Message*

The wssg:EntryRemovalNotification element is a form of notification message associated with the wssg:ServiceGroupModification topic. This element is defined as follows:

```
<wssg:EntryRemovalNotification>

   <wssg:ServiceGroupEntryEPR>

     wsa:EndpointReferenceType

   </wssg:ServiceGroupEntryEPR>

   <wssg:MemberServiceEPR>

     wsa:EndpointReferenceType

   </wssg:MemberServiceEPR>

   <wssg:Content>{any}</wssg:Content>?

   <wssg:Reason>xsd:string</wssg:Reason>?

</wssg:EntryRemovalNotification>
```

The form of the EntryRemovalNotification is further constrained as follows:

/wssg:EntryRemovalNotification

One EntryRemovalNotification element is created for each ServiceGroupEntry removal situation detected by the service associated with ServiceGroup resource. This artifact records the removal of an entry to the ServiceGroup.

/wssg:EntryRemovalNotification/ServiceGroupEntryEPR

This element MUST contain the EndpointReference of the ServiceGroupEntry that was removed to the ServiceGroup. Note: The EndpointReference for the ServiceGroupEntry will not be a valid reference since the removal mechanism from a ServiceGroup is removal of the ServiceGroupEntry.

/wssg:EntryRemovalNotification/MemberServiceEPR

This element MUST contain the EndpointReference of the member service that the WS-Resource referenced by @serviceGroupEntryEPR contains in its MemberEPR resource property.

/wssg:EntryRemovalNotification/Content

If this optional element is present, it MUST contain a copy, from some point prior to the removal, of the Contents resource property element of the ServiceGroupEntry referenced by @ServiceGroupEntryEPR.

/wssg:EntryRemovalNotification/Reason

If this optional element is present it will contain human readable text regarding the reason for the removal for the ServiceGroup.

9 Security Model

In the context of this specification, there are two categories of security aspects that need to be considered: (a) securing the message exchanges and (b) securing the resource properties.

9.1 Securing the message exchanges

When messages exchanges occur between a requestor and a Web service in order to access or act on one or more resource properties, it is RECOMMENDED that the communication between services be secured using the mechanisms described in WS-Security. In order to properly secure messages, the message body and all relevant headers need to be included in the digital signature so as to prove the integrity of the message. In addition, the ReferenceProperties from an EndpointReference, used as part of any message exchange, may be encrypted to ensure their privacy. In the event that a requestor communicates frequently with a Web service to access resource properties, either directly through a query or accomplished through notification of state change, it is RECOMMENDED that a security context be established using mechanisms like those described in WS-Trust [WS-Trust] and WS-SecureConversation [WS-SecureConversation] allowing for potentially more efficient means of authentication.

It is common for communication between requestors and Web service component of a WS-Resource to exchange multiple messages. As a result, the usage profile may be susceptible to key attacks. For this reason, it is RECOMMENDED that the keys used to secure the channel be changed frequently. This "re-keying" can be effected a number of ways. The following list outlines four common techniques:

- Attaching a nonce to each message and using it in a derived key function with the shared secret
- Using a derived key sequence and switch "generations"
- Closing and re-establishing a security context
- Exchanging new secrets between the parties

It should be noted that the mechanisms listed above are independent of the security context token (SCT). That is, the keys used to secure the channel during message exchanges may be independent of the key used to prove the right to access WS-ResourceProperties.

The security context MAY be re-established using the mechanisms described in WS-Trust and WS-SecureConversation. Similarly, secrets can be exchanged using the mechanisms described in WS-Trust. Note, however, that the current shared secret SHOULD NOT be used to encrypt the new shared secret. Derived keys, the preferred solution from this list, can be specified using the mechanisms described in WS-SecureConversation.

The following list summarizes common classes of attacks that apply to this protocol and identifies the mechanism to prevent/mitigate the attacks:

- **Message alteration** – Alteration is prevented by including signatures of the message information using WS-Security.

- **Message disclosure** – Confidentiality is preserved by encrypting sensitive data using WS-Security.

- **Key integrity** – Key integrity is maintained by using the strongest algorithms possible (by comparing secured policies – see WS-Policy [WS-Policy] and WS-SecurityPolicy [WS-SecurityPolicy]).

- **Authentication** – Authentication is established using the mechanisms described in WS-Security and WS-Trust. Each message is authenticated using the mechanisms described in WS-Security.

- **Accountability** – Accountability is a function of the type of and string of the key and algorithms being used. In many cases, a strong symmetric key provides sufficient accountability. However, in some environments, strong PKI signatures are required.

- **Availability** – Many services are subject to a variety of availability attacks. Replay is a common attack and it is RECOMMENDED that this be addressed as described in the next bullet. Other attacks, such as network-level denial of service attacks are harder to avoid and are outside the scope of this specification. That said, care should be taken to ensure that minimal processing be performed prior to any authenticating sequences.

- **Replay** – Messages may be replayed for a variety of reasons. To detect and eliminate this attack, mechanisms should be used to identify replayed messages such as the timestamp/nonce outlined in WS-Security and the sequences outlined in WS-ReliableMessaging [WS-ReliableMessaging].

9.2 Securing the resource properties

Given WS-ServiceGroup defines a mechanism to expose properties about its member WS-Resources through its "Content" resource property on ServiceGroupEntry, security considerations specified in WS-ResourceProperties are applicable to ServiceGroupEntry. Therefore, security policies should be established that ensure that only authorized requestors can access the value of a resource property of a member WS-Resource. It should also be noted that the authorization policies on the properties of a WS-Resource accessible through a ServiceGroup should be consistent with the authorization policies that are applicable when those properties are accessed directly form the resource itself. Similarly, the security policies about message exchanges (e.g., requiring the resource property value to be encrypted when sent in a response) should be equivalent in order to provide the same protection irrespective of the access point.

9.2.1 A Note on MembershipContentRules

The MembershipContentRules resource property along with Entry resource property provide a mechanism to allow for requestors to query about the members of a service group based on their interface or a resource property that is contained in member Ws-Resource's resource properties document, as well as the value of a resource property itself. There may need to be privacy considerations with respect to exposing those values. Therefore, authorization policies as well as message protection policies should

be consistent between these values retrieved through ServiceGroup, and those values retrieved through the WS-Resource itself. In general, it is not a good practice to form membership rules based on properties whose values are to remain confidential.

10 Acknowledgements

Special thanks to the Global Grid Forum's Open Grid Services Infrastructure working group, which defined the OGSI v1.0 [OGSI] specification that was a large inspiration for the ideas expressed in this specification.

This specification has been developed as a result of joint work with many individuals and teams. The authors wish to acknowledge the contributions from many people, including: Tim Banks, Dave Booz, Rob High, Jim Knutson, Heather Kreger, Frank Leymann, and Jay Unger.

11 References

[OGSI 1.0]

Open Grid Services Infrastructure (OGSI) V1.0
http://forge.gridforum.org/projects/ggf-editor/document/draft-ogsi-service-1/en/1

[SOAP 1.2]

http://www.w3.org/TR/soap12-part1/

[State Paper]

http://www-106.ibm.com/developerworks/webservices/library/ws-resource/ws-modelingresources.pdf

[URI]

T. Berners-Lee, R. Fielding, L. Masinter, "Uniform Resource Identifiers (URI): Generic Syntax," RFC 2396, MIT/LCS, U.C. Irvine, Xerox Corporation, August 1998.

[WS-Addressing]

http://www.ibm.com/developerworks/webservices/library/ws-add/

[WS-BaseNotification]

ftp://www6.software.ibm.com/software/developer/library/ws-notification/WS-BaseN.pdf

[WS-ResourceLifetime]

http://www-106.ibm.com/developerworks/webservices/library/ws-resource/ws-resourcelifetime.pdf

[WS-ResourceProperties]

http://www-106.ibm.com/developerworks/webservices/library/ws-resource/ws-resourceproperties.pdf

[WS-SecureConversation]

http://www.ibm.com/developerworks/library/ws-secon/

[WS-Security]

http://www.oasis-open.org/committees/download.php/5531/oasis-200401-wss-soap-message-security-1.0.pdf

[WS-SecurityPolicy]

http://www.ibm.com/developerworks/library/ws-secpol/

[WS-Topics]

ftp://www6.software.ibm.com/software/developer/library/ws-notification/WS-Topics.pdf

[WS-Trust]

http://www.ibm.com/developerworks/library/ws-trust/

[XML-Infoset]

W3C Recommendation "XML Information Set". Available at http://www.w3.org/TR/xml-infoset/

[XML-Names]

W3C Recommendation "Namespaces in XML". Available at http://www.w3.org/TR/REC-xml-names/

Appendix I – XML Schema

The XML types and elements used in this specification are defined in the following XML Schema

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!--
  Legal Disclaimer

  Copyright Notice

   (c) Copyright Computer Associates International, Inc.,
       Fujitsu Limited, Hewlett-Packard Development Company,
       International Business Machines Corporation and
       The University of Chicago 2003, 2004. All Rights Reserved.
-->
<xsd:schema
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:wsrp=
  "http://www.ibm.com/xmlns/stdwip/web-services/WS-ResourceProperties"
  xmlns:wssg=
    "http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup"
  xmlns:wsa="http://schemas.xmlsoap.org/ws/2003/03/addressing"
  elementFormDefault="qualified" attributeFormDefault="unqualified"
  targetNamespace=
    "http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup" >
<!-- ======================= Imports =========================== -->

  <xsd:import
    namespace="http://schemas.xmlsoap.org/ws/2003/03/addressing"
    schemaLocation=
```

```
              "http://schemas.xmlsoap.org/ws/2003/03/addressing" />
    <xsd:import
      namespace="http://www.ibm.com/xmlns/stdwip/web-services/WS-
ResourceProperties"
      schemaLocation="http://www-
106.ibm.com/developerworks/webservices/library/ws-resource/WS-
ResourceProperties.xsd" />


<!-- =============== Resource Property Related  ================== -->
<!-- ============ Resource Properties for ServiceGroup ============ -->

  <xsd:simpleType name="ContentElementsType">
    <xsd:list itemType="xsd:QName"/>
  </xsd:simpleType>


  <xsd:element name="MembershipContentRule">
    <xsd:complexType>
      <xsd:attribute name="MemberInterface" type="xsd:QName"/>
      <xsd:attribute name="ContentElements"
                     type="wssg:ContentElementsType"
                     use="required"/>
    </xsd:complexType>
  </xsd:element>


  <xsd:complexType name="EntryType">
    <xsd:sequence>
      <xsd:element name="ServiceGroupEntryEPR"
                   type="wsa:EndpointReferenceType"
                   minOccurs="1" maxOccurs="1"
                   nillable="true"/>
      <xsd:element name="MemberServiceEPR"
                   type="wsa:EndpointReferenceType"
                   minOccurs="1" maxOccurs="1"/>
      <xsd:element name="Content"
                   type="xsd:anyType"
                   minOccurs="1" maxOccurs="1"/>
    </xsd:sequence>
  </xsd:complexType>


<!-- ========== Resource Properties for ServiceGroupEntry ========= -->
```

```
  <xsd:element name="Entry"
               type="wssg:EntryType"/>


  <xsd:element name="Content"
               type="xsd:anyType"/>


  <xsd:element name="MemberEPR"
               type="wsa:EndpointReferenceType"/>


  <xsd:element name="ServiceGroupEPR"
               type="wsa:EndpointReferenceType"/>

<!-- = Messages Related to ServiceGroup Change Notification ======= -->
  <xsd:complexType name="ServiceGroupModificationNotificationType">
    <xsd:sequence>
      <xsd:element name="ServiceGroupEntryEPR"
                   type="wsa:EndpointReferenceType"
                   minOccurs="1" maxOccurs="1"
                   nillable="true"/>
      <xsd:element name="MemberServiceEPR"
                   type="wsa:EndpointReferenceType"
                   minOccurs="1" maxOccurs="1"/>
      <xsd:element name="Content"
                   type="xsd:anyType"
                   minOccurs="0" maxOccurs="1"/>
    </xsd:sequence>
  </xsd:complexType>


  <xsd:complexType name="ServiceGroupRemovalNotificationType">
    <xsd:complexContent>
      <xsd:extension
          base="wssg:ServiceGroupModificationNotificationType">
        <xsd:sequence>
          <xsd:element name="Reason"
                       type="xsd:string"
                       minOccurs="0" maxOccurs="1"/>
        </xsd:sequence>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
```

```
   <xsd:element name="EntryAdditionNotification"
             type="wssg:ServiceGroupModificationNotificationType" />


   <xsd:element name="EntryRemovalNotification"
             type="wssg:ServiceGroupRemovalNotificationType" />


</xsd:schema>
```

Appendix II – WSDL 1.1

The following illustrates the WSDL 1.1 for the Web service methods described in this
specification:

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
  Legal Disclaimer


  Copyright Notice


   (c) Copyright Computer Associates International, Inc.,
       Fujitsu Limited, Hewlett-Packard Development Company,
       International Business Machines Corporation and
       The University of Chicago 2003, 2004. All Rights Reserved.
-->


<wsdl:definitions name="ServiceGroup"
  xmlns="http://schemas.xmlsoap.org/wsdl/"
  xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:wsa="http://schemas.xmlsoap.org/ws/2003/03/addressing"
  xmlns:wsbf=
    "http://www.ibm.com/xmlns/stdwip/web-services/WS-BaseFaults"
  xmlns:wsrp=
    "http://www.ibm.com/xmlns/stdwip/web-services/WS-ResourceProperties"
  xmlns:wsrl=
     "http://www.ibm.com/xmlns/stdwip/web-services/WS-ResourceLifetime"
  xmlns:wssg=
     "http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup"
  targetNamespace=
     "http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup">
```

```
<!-- ========================= Imports =========================== -->
   <wsdl:import
     namespace=
"http://www.ibm.com/xmlns/stdwip/web-services/WS-ResourceProperties"
     location=
"http://www-106.ibm.com/developerworks/webservices/library/ws-
resource/WS-ResourceProperties.wsdl" />


   <wsdl:import
     namespace=
 "http://www.ibm.com/xmlns/stdwip/web-services/WS-ResourceLifetime"
     location=
"http://www-106.ibm.com/developerworks/webservices/library/ws-
resource/WS-ResourceLifetime.wsdl" />


<!-- ==================== Types Definitions ====================== -->
   <wsdl:types>
      <xsd:schema
        targetNamespace=
        "http://www.ibm.com/xmlns/stdwip/web-services/WS-ServiceGroup">


        <xsd:include schemaLocation=
"http://www-106.ibm.com/developerworks/webservices/library/ws-
resource/WS-ServiceGroup.xsd" />


        <xsd:import
           namespace=
  "http://www.ibm.com/xmlns/stdwip/web-services/WS-ResourceLifetime"
           schemaLocation=
  "http://www-106.ibm.com/developerworks/webservices/library/ws-
resource/WS-ResourceLifetime.xsd"
        />


       <xsd:import namespace=
"http://www.ibm.com/xmlns/stdwip/web-services/WS-ResourceProperties"
        schemaLocation=
"http://www-106.ibm.com/developerworks/webservices/library/ws-
resource/WS-ResourceProperties.xsd"
       />


       <xsd:import
```

```
            namespace=
        "http://www.ibm.com/xmlns/stdwip/web-services/WS-BaseFaults"
            schemaLocation=
   "http://www-106.ibm.com/developerworks/webservices/library/ws-
resource/WS-BaseFaults.xsd"
        />



<!-- =============== Resource Property Related  =================== -->
<!-- =========== Resource Properties for ServiceGroup =========== -->
        <xsd:element name="ServiceGroupRP">
          <xsd:complexType>
            <xsd:sequence>
               <xsd:element ref="wssg:MembershipContentRule"
                           minOccurs="0" maxOccurs="unbounded"/>
               <xsd:element ref="wssg:Entry"
                           minOccurs="0" maxOccurs="unbounded"/>
            </xsd:sequence>
          </xsd:complexType>
          <xsd:unique name="UniqueInterfaces">
            <xsd:selector
               xpath="./*MembershipContentRule
              [namespace-uri()='http://www.ibm.com/xmlns/stdwip/web-
services/WS-ServiceGroup']"/>
               <xsd:field xpath="@MemberInterface"/>
          </xsd:unique>
        </xsd:element>


<!-- ========= Resource Properties for ServiceGroupEntry ========= -->
        <xsd:element name="ServiceGroupEntryRP">
          <xsd:complexType>
             <xsd:sequence>
               <xsd:element ref="wssg:ServiceGroupEPR"
                           minOccurs="1" maxOccurs="1"/>
               <xsd:element ref="wssg:MemberEPR"
                           minOccurs="1" maxOccurs="1"/>
               <xsd:element ref="wssg:Content"
                           minOccurs="1" maxOccurs="1"/>
             </xsd:sequence>
          </xsd:complexType>
        </xsd:element>
```

```
<!-- ================= Message Specific Types  ==================== -->
<!-- ======= Message Types for ServiceGroupRegistration  ========= -->
       <xsd:element name="Add">
         <xsd:complexType>
           <xsd:sequence>
             <xsd:element name="MemberEPR"
                           type="wsa:EndpointReferenceType" />
             <xsd:element name="Content"
                           type="xsd:anyType" />
             <xsd:element name="InitialTerminationTime"
                           type="xsd:dateTime"
                           minOccurs="0" maxOccurs="1" />
           </xsd:sequence>
         </xsd:complexType>
       </xsd:element>

       <xsd:element name="AddResponse"
                     type="wsa:EndpointReferenceType" />

       <xsd:complexType name="ContentCreationFailedFaultType">
         <xsd:complexContent>
           <xsd:extension base="wsbf:BaseFaultType"/>
         </xsd:complexContent>
       </xsd:complexType>
       <xsd:element name="ContentCreationFailedFault"
                     type="wssg:ContentCreationFailedFaultType"/>

       <xsd:complexType name="UnsupportedMemberInterfaceFaultType">
         <xsd:complexContent>
           <xsd:extension base="wsbf:BaseFaultType"/>
         </xsd:complexContent>
       </xsd:complexType>
       <xsd:element name="UnsupportedMemberInterfaceFault"
                     type="wssg:UnsupportedMemberInterfaceFaultType"/>

       <xsd:complexType name="AddRefusedFaultType">
         <xsd:complexContent>
           <xsd:extension base="wsbf:BaseFaultType"/>
         </xsd:complexContent>
```

```
            </xsd:complexType>
            <xsd:element name="AddRefusedFault"
                          type="wssg:AddRefusedFaultType"/>


        </xsd:schema>
    </wsdl:types>


<!-- ==================== Message Definitions ===================== -->
<!-- =============== ServiceGroupRegistration::Add ================
    Add(MemberEPR, Content, [InitialTerminationTime])
    returns: EPR to ServiceGroupEntry
-->
    <wsdl:message name="AddRequest">
        <wsdl:part name="AddRequest" element="wssg:Add"/>
    </wsdl:message>


    <wsdl:message name="AddResponse">
        <wsdl:part name="AddResponse" element="wssg:AddResponse"/>
    </wsdl:message>


    <wsdl:message name="ContentCreationFailedFault">
        <wsdl:part name="ContentCreationFailedFault"
                    element="wssg:ContentCreationFailedFault" />
    </wsdl:message>


    <wsdl:message name="UnsupportedMemberInterfaceFault">
        <wsdl:part name="UnsupportedMemberInterfaceFault"
                    element="wssg:UnsupportedMemberInterfaceFault" />
    </wsdl:message>


    <wsdl:message name="AddRefusedFault">
        <wsdl:part name="AddRefusedFault"
                    element="wssg:AddRefusedFault" />
    </wsdl:message>


<!-- ================= PortType Definitions ==================== -->
    <wsdl:portType name="ServiceGroup"
              wsrp:ResourceProperties="wssg:ServiceGroupRP">
    <!-- ========= extends wsrp:ResourceProperties ============ -->
        <wsdl:operation name="GetResourceProperty">
```

```
      <wsdl:input name="GetResourcePropertyRequest"
            message="wsrp:GetResourcePropertyRequest" />
      <wsdl:output name="GetResourcePropertyResponse"
            message="wsrp:GetResourcePropertyResponse" />
      <wsdl:fault name="ResourceUnknownFault"
            message="wsrp:ResourceUnknownFault" />
      <wsdl:fault name="InvalidResourcePropertyQNameFault"
            message="wsrp:InvalidResourcePropertyQNameFault" />
  </wsdl:operation>
</wsdl:portType>


<wsdl:portType name="ServiceGroupEntry"
                wsrp:ResourceProperties="wssg:ServiceGroupEntryRP">
  <!-- ========= extends wsrp:ResourceProperties ============ -->
  <wsdl:operation name="GetResourceProperty">
    <wsdl:input name="GetResourcePropertyRequest"
                message="wsrp:GetResourcePropertyRequest" />
    <wsdl:output name="GetResourcePropertyResponse"
                 message="wsrp:GetResourcePropertyResponse" />
    <wsdl:fault name="ResourceUnknownFault"
                message="wsrp:ResourceUnknownFault" />
    <wsdl:fault name="InvalidResourcePropertyQNameFault"
                message="wsrp:InvalidResourcePropertyQNameFault" />
  </wsdl:operation>
</wsdl:portType>


<wsdl:portType name="ServiceGroupRegistration"
                wsrp:ResourceProperties="wssg:ServiceGroupRP">
  <!-- ========= extends wsrp:ResourceProperties ============ -->
  <wsdl:operation name="GetResourceProperty">
    <wsdl:input name="GetResourcePropertyRequest"
                message="wsrp:GetResourcePropertyRequest" />
    <wsdl:output name="GetResourcePropertyResponse"
                message="wsrp:GetResourcePropertyResponse" />
    <wsdl:fault name="ResourceUnknownFault"
                message="wsrp:ResourceUnknownFault" />
    <wsdl:fault name="InvalidResourcePropertyQNameFault"
                message="wsrp:InvalidResourcePropertyQNameFault" />
      </wsdl:operation>
  <wsdl:operation name="Add">
```

```
        <wsdl:input name="AddRequest" message="wssg:AddRequest"/>
        <wsdl:output name="AddResponse" message="wssg:AddResponse"/>
        <wsdl:fault name="ContentCreationFailedFault"
                    message="wssg:ContentCreationFailedFault"/>
        <wsdl:fault name="UnsupportedMemberInterfaceFault"
                    message="wssg:UnsupportedMemberInterfaceFault"/>
        <wsdl:fault name="AddRefusedFault"
                    message="wssg:AddRefusedFault"/>
    </wsdl:operation>
  </wsdl:portType>


</wsdl:definitions>
```