Editors:
T. Maguire, IBM
T. Sandholm, ANL
M. Williams, IBM
J. Joseph, IBM

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GWSDL to WSDL 1.1 Transformation

(GWSDL2WSDL1.1)

Version 0.1

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Status of this Memo

This document provides information to the community regarding the specification of the transformation from GWSDL to WSDL 1.1 for purposes of interoperability. Distribution of this document is unlimited.

Abstract

GWSDL provides the necessary mechanisms for architectural constructs of OGSI, namely definition of service data and inheritance of base interfaces. However, current runtime environments and development tools do not support GWSDL (or WSDL 1.2 for that matter). This situation motivates a standard mechanism by which GWSDL constructs can be expressed in terms of WSDL 1.1 to allow interoperation between existing OGSI implementations based on WSDL 1.1 tooling and runtime. This document describes the standard transformation from GWSDL to WSDL 1.1.

Contents

1   Introduction

The *Open Grid Services Architecture (OGSA)* integrates Grid technologies with *Web services* mechanisms to create a distributed computing framework based around the *Open Grid Services Infrastructure (OGSI)*. Since OGSI is based on Web services, it uses *Web Services Description Language* (*WSDL*) as the mechanism to describe the public interfaces of Grid services. However, the current version of WSDL 1.1 is deficient in two critical areas: lack of interface (portType) inheritance and the inability to describe additional information elements on a portType (lack of open content). These deficiencies have been addressed by the current "work in progress" draft of WSDL 1.2 in the W3C Web Services Description Working Group [WSDL 1.2 DRAFT]. Because WSDL 1.2 is currently "work in progress" OGSI cannot directly incorporate the entire WSDL 1.2 body of work.

Instead, OGSI defines an extension to WSDL 1.1, isolated to the wsdl:portType element, that provides the minimal required extensions to WSDL 1.1. These extensions to WSDL 1.1 match equivalent functionality agreed to by the W3C Web Services Description Working Group.

We define a separate (and temporary) namespace, with the prefix *gwsdl*, to isolate the modifications to WSDL 1.1. In particular, gwsdl adds the following new constructs to the wsdl:portType element in the fashion proposed in [WSDL 1.2 DRAFT] to support open content model and portType inheritance.

GWSDL provides the necessary mechanisms for architectural constructs of OGSI, namely definition of service data and inheritance of base interfaces. However, current runtime environments and development tools do not support GWSDL (or WSDL 1.2 for that matter). This situation motivates a standard mechanism by which GWSDL constructs can be expressed in terms of WSDL 1.1 to allow interoperation between existing OGSI implementations based on WSDL 1.1 tooling and runtime. This document describes the standard transformation from GWSDL to WSDL 1.1.

2   Notational Conventions

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

This specification uses namespace prefixes throughout; they are listed in Table 1. Note that the choice of any namespace prefix is arbitrary and not semantically significant.

Table 1: Prefixes and Namespaces used in this specification.

Prefix	Namespace
ogsi	"http://www.ggf.org/namespaces/2003/03/OGSI"
gwsdl	"http://www.ggf.org/namespaces/2003/03/gridWSDLExtensions"
sd	"http://www.ggf.org/namespaces/2003/02/serviceData"
wsdl	"http://schemas.xmlsoap.org/wsdl/"
http	"http://www.w3.org/2002/06/wsdl/http"
xsd	"http://www.w3.org/2001/XMLSchema"

xsi	"http://www.w3.org/2001/XMLSchema-instance"

Namespace names of the general form "http://example.org/..." and "http://example.com/..." represent application or context-dependent URIs [RFC 2396].

3   Transforming GWSDL to WSDL 1.1

The process of transforming GWSDL to WSDL 1.1 is a straight forward process. The fundamental approach is to retain all aspects of the original GWSDL and augment this information by generating a wsdl:portType that represents the "flattening" of the portType inheritance hierarchy. As a convenience the pertinent sections from the OGSI specification have been added to this document in Appendix A.

3.1   Transformation process (normative)

The GWSDL to WSDL 1.1 process presupposes that the GWSDL being transformed conforms to the schema for GWSDL and ServiceData defined in the OGSI specification.

3.1.1   GWSDL to WSDL 1.1 process

1. Create an exact copy of the GWSDL document. (Retain, as child elements of the wsdl:definition all gwsdl:portType elements with all attribute values and child elements.)

2. For each gwsdl:portType:

    a.   Add a wsdl:portType element, as a child of the wsdl:definitions element. The value of the name attribute of the wsdl:portType MUST be the same as the value of the name attribute from the gwsdl:portType.

    b.   For each operation child element of the gwsdl:portType:

        i.   Operation child elements with the same name MUST only occur once under the wsdl:portType. The operation name attribute value which is the same as a previously processed operation name attribute value MUST be ignored. (Note: Only same signature will be processed here as different signature "operation overloading" is not valid GWSDL).

        ii.   Create a new operation child element under the wsdl:portType. The new operation element MUST contain the same attributes, attribute values and child elements as the gwsdl:portType operation element.

        iii.   Update the new operation element such that each message child element is properly namespace qualified. Either referencing the targetNamespace of the wsdl:definitions element in which the messages are defined or if prefixed in the wsdl:definitions element using that prefix.

    c.   For each sd:serviceData element:

        i.   Create an xsd:element under the wsdl:definitions. The name attribute value MUST the same as the sd:serviceData name attribute value. The type attribute value MUST be properly qualified. Either referencing the targetNamespace of the wsdl:definitions element in which the sd:serviceData is defined or if prefixed in the wsdl:definitions element using that prefix. (Note: this may be incomplete)

       d.   For each gwsdl:portType referenced in the extends attribute which has not been previously processed:

          i.   Locate the gwsdl:portType element definition corresponding to the qname of the extension

              1.   Repeat step 2b and 2c (recursion)

Note: elements such as ServiceData declarations, that exploit the open content model of the gwsdl:portType are preserved because the original gwsdl:portType is preserved as a child of the wsdl:definitions[1] element. Any GWSDL processor that requires access to the ServiceData declarations MAY refer to the gwsdl:portType elements in the file.

3.1.2   Reverse process

1. Create an exact copy of the WSDL document. (Containing gwsdl:portType elements with all attribute values and child elements.)

2. For each wsdl:portType

       a.   Delete wsdl:portType element and all attributes and child elements.

Note: because the original gwsdl:portTypes are preserved as child elements of the wsdl:definitions element, the original GWSDL definition can be recovered from the WSDL 1.1 file generated by this process.

3.1.3   GWSDL2WSDL an example implementation (non-normative)

This section describes an example implementation of this transformation called GWSDL2WSDL. The following are the steps executed by the GWSDL2WSDL tool:

Read the gwsdl file and create an in-memory xml document. For each portType element defined in the document perform a transform process to convert the portType from gwsdl to wsdl.

The transform processes all operations defined in the gswdl:portType and caches the results with associated messages qualified with the namespace of the targetNamespace attribute of the wsdl:definitions element defined in the gwsdl document. (The current implementation does not handle operation name collision properly,

Resolve gwsdl:portType extends attribute by one of the following methods:

1. Using a locally defined portType (eg in the same file as the "root" portType)

2. Load from a different gwsdl file from a remote location identified by the wsdl:import statement through the namespace declaration.

Get all operations defined in the "extension" gwsdl:portType and cache the operations and associated messages. The messages are qualified with the namespace of the targetNamespace of the wsdl:definitions element found in the source file of the gwsdl:portType.

Recurse on gwsdl:portType extends attribute until there are no more extends attributes to be processed.

Create wsdl:portType with the name equal to the "root" gwsdl:portType and add all operation elements from the cache.

Save the modified in memory gwsdl document to the disk based on user specified name.

---

[1] WSDL 1.1 declares open content on wsdl:definitions element.

3.1.4   Typical Transformation

Consider the following example. Two GWSDL files top_port_types.gwsdl and base_port_types.gwsdl. The former defines a gwsdl:portType named TopPortType and the latter defines three gwsdl:portTypes: basePortType ,Mid1PortType and Mid2PortType. The following figure depicts the relationships between these portTypes.

```
                    «interface»
                    BasePortType
                    ────────────
                    +baseOp()


        «interface»              «interface»
        Mid1PortType             Mid2PortType
        ────────────             ────────────
        +mid1Op()                +mid2Op()


                    «interface»
                    TopPortType
                    ────────────

                    +topOp1()
                    +topOp2()
```
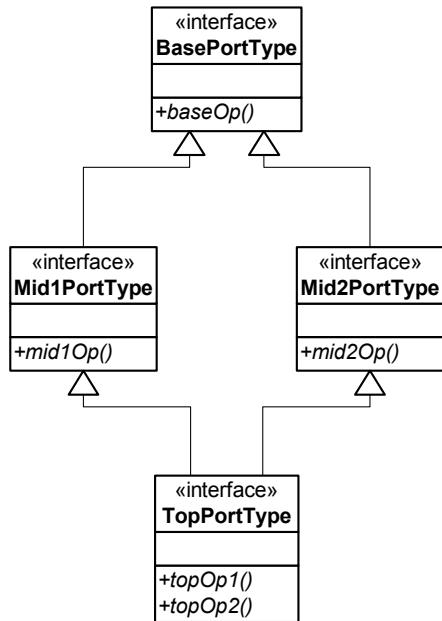
The tool may be run by invoking the following command:

```
java org.globus.ogsa.tools.wsdl.GWSDL2WSDL <top_port_types.gwsdl >
<top_port_types.wsdl>
```

The result of executing this command is a file containing a wsdl:definitions element, containing a wsdl:portType with name "TopPortType". The "TopPortType" wsdl:portType contains all the operations from the extended ports.

```
    «interface»
    TopPortType
    ────────────

    +baseOp()
    +mid1Op()
    +mid2Op()
    +topOp1()
    +topOp2()
```
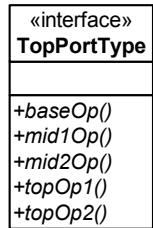
3.1.5   Example Transformation

In the following section the interface inheritance hierarchy will be used as an example for the GWSDL to WSDL 1.1 transformation.

```
            «interface»
            GridService

+findServiceData()
+setServiceData()
+requestTerminationAfter()
+requestTerminationBefore()
+destroy()
```

```
            «interface»
       BaseManageableResource


```

```
            «interface»
          OperatingSystem

+reboot()
+shutdown()
```
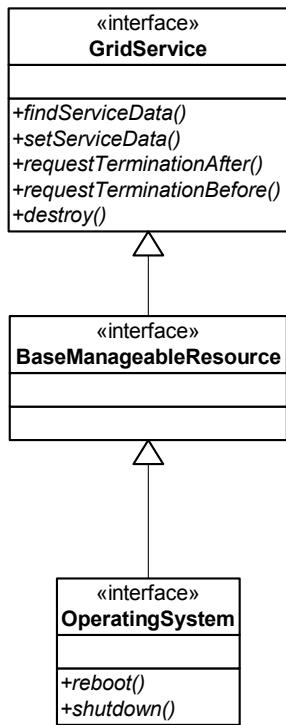
After applying the transformation to the OperatingSystem.gwsdl the following interface would appear in the resulting wsdl document.

```
            «interface»
          OperatingSystem

+findServiceData()
+setServiceData()
+requestTerminationAfter()
+requestTerminationBefore()
+destroy()
+reboot()
+shutdown()
```
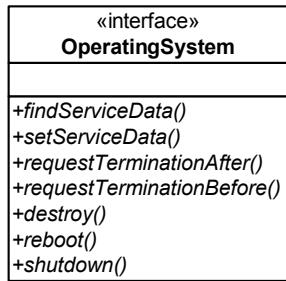
3.1.6   Example GWSDL

This section contains the gwsdl corresponding to the example above.

3.1.6.1   OperatingSystem.gwsdl

```
<!-- ?xml version="1.0" encoding="UTF-8"? -->
<wsdl:definitions name="OperatingSystem"
      targetNamespace="http://www.gridforum.org/service/crm/OperatingSystem"
      xmlns:opsys="http://www.gridforum.org/service/crm/OperatingSystem"
      xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
      xmlns ="http://schemas.xmlsoap.org/wsdl/"
      xmlns:gwsdl="http://www.gridforum.org/namespaces/2003/gridWSDLExtensions"
      xmlns:sd="http://www.gridforum.org/namespaces/2003/serviceData"
      xmlns:crm="http://www.gridforum.org/namespaces/2003/17/crm"
      xmlns:xsd="http://www.w3.org/2001/XMLSchema">
```

```
    <import location="BaseManageableResource.gwsdl"
            namespace="http://www.gridforum.org/namespaces/2003/17/crm"/>

    <wsdl:types>
        <xsd:schema targetNamespace="someURI">
            <xsd:simpleType name="OSTypeType">
                <xsd:union>
                    <xsd:simpleType>
                        <xsd:restriction base="xsd:string">
                            <xsd:enumeration value="OS400"/>
                            <xsd:enumeration value="Windows XP"/>
                        </xsd:restriction>
                    </xsd:simpleType>
                    <xsd:simpleType>
                        <xsd:restriction base="xsd:string"/>
                    </xsd:simpleType>
                </xsd:union>
            </xsd:simpleType>
        </xsd:schema>
    </wsdl:types>

    <wsdl:message name="ResultResponse">
        <wsdl:part name="Return" type="xsd:unsignedInt"/>
    </wsdl:message>

    <wsdl:message name="shutdownRequest"></wsdl:message>

    <wsdl:message name="rebootRequest"></wsdl:message>


    <gwsdl:portType name="OperatingSystem"
        extends="crm:BaseManageableResource">

        <wsdl:operation name="reboot">
            <wsdl:input message="rebootRequest"/>
            <wsdl:output message="ResultResponse"/>
        </wsdl:operation>

        <wsdl:operation name="shutdown">
            <wsdl:input message="shutdownRequest"/>
            <wsdl:output message="ResultResponse"/>
        </wsdl:operation>


        <sd:serviceData name="OSType" type="OSTypeType" minOccurs="0"
            maxOccurs="1" mutability="setOnce"
            crm:valid="down starting up stopping failed">
        </sd:serviceData>

        <sd:serviceData name="freePhysicalMemory" type="crm:gauge"
            minOccurs="0" maxOccurs="1" mutability="mutable"
            crm:units="kilobytes"
            crm:valid="starting up stopping failed"
            crm:volatile="1">
        </sd:serviceData>

    </gwsdl:portType>

</wsdl:definitions>
```

3.1.6.2   BaseManageableResource.gwsdl

```
<!-- ?xml version="1.0" encoding="UTF-8"? -->
<wsdl:definitions name="BaseManageableResource"
    targetNamespace="http://www.gridforum.org/namespaces/2003/17/crm"
    xmlns:wsdl=http://schemas.xmlsoap.org/wsdl/
    xmlns:gwsdl="http://www.gridforum.org/namespaces/2003/gridWSDLExtensions"
    xmlns:sd="http://www.gridforum.org/namespaces/2003/serviceData"
    xmlns:crm="http://www.gridforum.org/namespaces/2003/17/crm"
    xmlns:ogsi="http://www.gridforum.org/namespaces/2003/03/OGSI"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema">

    <import location="ogsi.wsdl"
            namespace="http://www.gridforum.org/namespaces/2003/03/OGSI"/>

    <gwsdl:portType name="BaseManageableResource" extends="ogsi:GridService">

        <sd:serviceData
                name="serviceGroupType"
                type="xsd:QName"
                minOccurs="0"
                maxOccurs="1"
                mutability="static" />

        <sd:serviceData
                name="searchProperty"
                type="xsd:QName"
                minOccurs="0"
                maxOccurs="unbounded"
                mutability="static"/>

    </gwsdl:portType>
</wsdl:definitions>
```

3.1.6.3   OGSI.wsdl

Refer to the OGSI specification.

3.1.7   Example GWSDL transformed to WSDL 1.1

This section contains the file generated by the GWSDL2WSDL tool based on the example above.

3.1.7.1   OperatingSystem.wsdl

```
<!-- ?xml version="1.0" encoding="UTF-8"? -->
<wsdl:definitions name="OperatingSystem"
     targetNamespace=http://www.gridforum.org/service/crm/OperatingSystem
     xmlns:opsys="http://www.gridforum.org/service/crm/OperatingSystem"
     xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
     xmlns =http://schemas.xmlsoap.org/wsdl/
     xmlns:gwsdl="http://www.gridforum.org/namespaces/2003/gridWSDLExtensions"
     xmlns:sd="http://www.gridforum.org/namespaces/2003/serviceData"
     xmlns:crm="http://www.gridforum.org/namespaces/2003/17/crm"
     xmlns:xsd="http://www.w3.org/2001/XMLSchema">

    <import location="BaseManageableResource.gwsdl"
            namespace="http://www.gridforum.org/namespaces/2003/17/crm"/>

    <wsdl:types>
      type section unchanged
    </wsdl:types>

    <!-- Flattened wsdl 1.1. portType for Operating System. -->
```

```
<wsdl:portType name="OperatingSystem">
    <wsdl:operation name="setServiceData">
        <wsdl:input message="ns49:SetServiceDataInputMessage"
          xmlns:ns49="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:output message="ns50:SetServiceDataOutputMessage"
          xmlns:ns50="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns51:ExtensibilityNotSupportedFaultMessage"
          name="ExtensibilityNotSupportedFault"
          xmlns:ns51="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns52:ExtensibilityTypeFaultMessage"
          name="ExtensibilityTypeFault"
          xmlns:ns52="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns53:CardinalityViolationFaultMessage"
          name="CadinalityViolationFault"
          xmlns:ns53="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns54:MutabilityViolationFaultMessage"
          name="MutabilityViolationFault"
          xmlns:ns54="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns55:ModifiabilityViolationFaultMessage"
          name="ModifabilityViolationFault"
          xmlns:ns55="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns56:TypeViolationFaultMessage"
          name="TypeViolationFault"
          xmlns:ns56="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns57:IncorrectValueFaultMessage"
          name="IncorrectValueFault"
          xmlns:ns57="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns58:PartialFailureFaultMessage"
          name="PartialFailureFault"
          xmlns:ns58="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns59:FaultMessage" name="Fault"
          xmlns:ns59="http://www.gridforum.org/namespaces/2003/03/OGSI" />
    </wsdl:operation>
    <wsdl:operation name="findServiceData">
        <wsdl:input message="ns43:FindServiceDataInputMessage"
          xmlns:ns43="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:output message="ns44:FindServiceDataOutputMessage"
          xmlns:ns44="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns45:ExtensibilityNotSupportedFaultMessage"
          name="ExtensibilityNotSupportedFault"
          xmlns:ns45="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns46:ExtensibilityTypeFaultMessage"
          name="ExtensibilityTypeFault"
          xmlns:ns46="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns47:TargetInvalidFaultMessage"
          name="TargetInvalidFault"
          xmlns:ns47="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns48:FaultMessage" name="Fault"
          xmlns:ns48="http://www.gridforum.org/namespaces/2003/03/OGSI" />
    </wsdl:operation>
    <wsdl:operation name="destroy">
        <wsdl:input message="ns68:DestroyInputMessage"
          xmlns:ns68="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:output message="ns69:DestroyOutputMessage"
          xmlns:ns69="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns70:ServiceNotDestroyedFaultMessage"
          name="ServiceNotDestroyedFault"
          xmlns:ns70="http://www.gridforum.org/namespaces/2003/03/OGSI" />
        <wsdl:fault message="ns71:FaultMessage" name="Fault"
          xmlns:ns71="http://www.gridforum.org/namespaces/2003/03/OGSI" />
    </wsdl:operation>
    <wsdl:operation name="requestTerminationBefore">
        <wsdl:input message="ns64:RequestTerminationBeforeInputMessage"
```

```
                 xmlns:ns64="http://www.gridforum.org/namespaces/2003/03/OGSI" />
              <wsdl:output message="ns65:RequestTerminationBeforeOutputMessage"
                xmlns:ns65="http://www.gridforum.org/namespaces/2003/03/OGSI" />
             <wsdl:fault message="ns66:TerminationTimeUnchangedFaultMessage"
               name="TerminationTimeUnchangedFault"
               xmlns:ns66="http://www.gridforum.org/namespaces/2003/03/OGSI" />
             <wsdl:fault message="ns67:FaultMessage" name="Fault"
                xmlns:ns67="http://www.gridforum.org/namespaces/2003/03/OGSI" />
         </wsdl:operation>
         <wsdl:operation name="requestTerminationAfter">
             <wsdl:input message="ns60:RequestTerminationAfterInputMessage"
                xmlns:ns60="http://www.gridforum.org/namespaces/2003/03/OGSI" />
             <wsdl:output message="ns61:RequestTerminationAfterOutputMessage"
                xmlns:ns61="http://www.gridforum.org/namespaces/2003/03/OGSI" />
             <wsdl:fault message="ns62:TerminationTimeUnchangedFaultMessage"
               name="TerminationTimeUnchangedFault"
                xmlns:ns62="http://www.gridforum.org/namespaces/2003/03/OGSI" />
             <wsdl:fault message="ns63:FaultMessage" name="Fault"
                xmlns:ns63="http://www.gridforum.org/namespaces/2003/03/OGSI" />
         </wsdl:operation>

         <wsdl:operation name="reboot">
           <wsdl:input message="ns3:rebootRequest"
            xmlns:ns3="http://www.gridforum.org/service/crm/OperatingSystem"/>
           <wsdl:output message="ns4:ResultResponse"
            xmlns:ns4="http://www.gridforum.org/service/crm/OperatingSystem"/>
         </wsdl:operation>

         <wsdl:operation name="shutdown">
           <wsdl:input message="ns5:shutdownRequest"
            xmlns:ns5="http://www.gridforum.org/service/crm/OperatingSystem"/>
           <wsdl:output message="ns6:ResultResponse"
            xmlns:ns6="http://www.gridforum.org/service/crm/OperatingSystem"/>
         </wsdl:operation>

      </wsdl:portType>

      <gwsdl:portType name="OperatingSystem"
         extends="crm:BaseManageableResource">

            gwsdl:portType unchanged

      </gwsdl:portType>

</wsdl:definitions>
```

4   Editor Information

Tom Maguire
IBM
Poughkeepsie, NY 12601
Email: tmaguire@us.ibm.com

Thomas Sandholm
Argonne National Laboratory
Argonne, IL 60439
Email: sandholm@mcs.anl.gov

Mike Williams
IBM

Poughkeepsie, NY 12601
Email: mdw@us.ibm.com

Joshy Joseph
IBM
Poughkeepsie, NY 12601
Email: joshy@us.ibm.com

5   Acknowledgements

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[WSDL 1.2 DRAFT]

Web Services Description Language (WSDL) Version 1.2, W3C Working Draft 3 March 2003, World Wide Web Consortium. Available at http://www.w3.org/TR/2003/WD-wsdl12-20030303

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