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WS-Naming Specification

Status of This Memo

This memo provides information to the Grid and Web Services communities on naming and name resolution. Distribution is unlimited.

Abstract

Past experience has led developers to the conclusion that successful distributed systems must provide robust forms of naming. Naming is the mechanism by which the concept of identity is maintained and gives endpoints in the system the ability to talk about other endpoints in a high-level, abstract way. Further, naming and dynamic name resolution are the means by which some of the classic distributed systems transparencies, such as location transparency and fault transparency, are achieved.

This document follows the recommendations of "OGSA Profile Definition Version 1.0" [GFD.59] and describes an extension to the WS-Addressing [WS-Addressing] specification to include extensibility elements for abstract names and for resolvers, as well as port types for the WS-Naming resolution services.

Contents

1. Introduction

WS-Addressing [WS-Addressing] has achieved almost universal acceptance as the *de-facto* standard for endpoint addressing within the web services community; targeting this addressing mechanism for use by WS-Naming is a reasonable and obvious choice.

Rather than proposing changes or extensions to the WS-Addressing specification itself, we have chosen the alternative route of defining WS-Naming as a profile on top of the WS-Addressing specification. Neither web service clients nor web service endpoints need to be aware of this profile and either is free to fail to generate or understand the WS-Naming elements described within. In such a case, the normal WS-Addressing behavior works exactly as described in the WS-Addressing specification. However, should a client, which is aware of the WS-Naming profile, encounter WS-Naming elements in a WS-Addressing Endpoint Reference, it will have the opportunity to take additional actions with its communication to that web service endpoint in the event of certain communication failures or for the purposes of more robust or efficient communication.

WS-Addressing describes an Endpoint Reference type with a single required element (the *Address* element) and a number of optional elements. WS-Addressing Endpoint References allow for extensibility elements to be added (via an xsd:any declaration in the schema) without changing the specification. Furthermore, the specification also notes that this information is not authoritative and may be stale or incoherent. The WS-Naming profile takes advantage of the open-content nature of WS-Addressing and uses WS-Addressing extensibility elements for various pieces of naming and rebinding information. Clients choosing not to participate in the WS-Naming profile continue to communicate without modification as per the WS-Addressing specification.

WS-Naming is built in three parts.

1. The first and only required part is a profile on the behavior endpoint providers with respect addressing and accessing endpoints, called the Unambiguous Web Service Endpoint Profile, see section 3.
2. The second part called Endpoint Identifiers Profile, see section 4, profiles the use of IRIs as names within a distributed computing environment, constraining them to be unique in space and time and comparable for equality. Section 4.2 profiles how an EnpointIdentifier appears in an Endpoint Reference. Also in section 4.3 "Web Service Endpoint Address Identifier Profile", we profile the Address element of the WS-Addressing Endpoint Reference Type such that, if adhered to, it guarantees conformance with the Unambiguous Web Service Endpoint Profile.
3. The third part is a collection of Web Service portType definitions providing resolution of Endpoint Identifiers and renewal of Endpoint References, called Endpoint Resolvers, see section 5.

A complete discussion of the use cases motivating and justifying this decomposition can be found in [WSERI].

1.1   Terminology

The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", "OPTIONAL" in this document are to be interpreted as described in [**RFC 2119**].

In addition to the terms introduced in [**RFC 2119**], additional terms commonly used in this document are defined in the Glossary in the back.

When describing abstract data models, this specification uses the notational convention used by the [**XML Infoset**].

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/>).

1.2   Namespaces

The following namespaces are used in this document:

Table 1 Namespaces used by the WS-Naming Profile

Prefix	Namespace
naming	http://schemas.ogf.org/naming/2006/08/naming
naming-w	http://schemas.ogf.org/naming/2006/08/naming/wsdl
s11	http://schemas.xmlsoap.org/soap/envelope
wsa	http://www.w3.org/2005/08/addressing
wsbf	http://docs.oasis-open.org/wsrf/bf-2
wsdl	http://schemas.xmlsoap.org/wsdl
xsd	http://www.w3.org/2001/XMLSchema

2.   Profile Conformance

Conformance to the Profile is defined normatively in WS-I Basic Profile 1.1 **[WS-I BP 1.1]**. This Profile abides by those definitions.

2.1   Conformance Targets

This Profile places additional restrictions on conformance targets defined in WS-I Basic Profile 1.1. Further, this specification defines an additional conformance target called ENDPOINTREFERENCE.

The following conformance targets are used in the Profile:

- **ENDPOINTREFERENCE** – the serialization of the wsa:EndpointReference element and its content
- **ENVELOPE** – the serialization of the s11:Envelope element and its content (from WS-I Basic Profile 1.1)
- **DESCRIPTION** – descriptions of types, messages, interfaces and their concrete protocol and data format bindings, and the network access points associated with Web services (e.g., WSDL descriptions) (from WS-I Basic Profile 1.1)
- **INSTANCE** – software that implements a wsdl:port (from WS-I Basic Profile 1.1, without "bindingTemplate" from the namespace urn:uddi-org:api_v2)
- **CONSUMER** – software that invokes an INSTANCE (from WS-I Basic Profile 1.1)
- **SENDER** – software that generates a particular message according to the protocol(s) associated with that message (from WS-I Basic Profile 1.1)
- **RECEIVER** – software that consumes a message according to the protocol(s) associated with that message (e.g., SOAP processors) (from WS-I Basic Profile 1.1)

2.2   Claiming Conformance

Claims of conformance to the Profile and the attachments mechanisms are the same as normatively described in WS-I Basic Profile 1.1.

The Profile defines the following conformance claim URIs.

Table 2 Conformance Claim URIs defined by the WS-Naming Profile

Profile	Conformance Claim URI
Unambiguous Web Service Endpoint Profile (§3)	http://www.ogf.org/naming/2006/08/naming-uwsep-pf
Endpoint Identifier Profile (§4.2)	http://www.ogf.org/naming/2006/08/naming-epi-pf
Web Service Endpoint Address Identifier Profile (§4.3)	http://www.ogf.org/naming/2006/08/naming-wsepai-pf
Endpoint Resolvers Profile (§5)	http://www.ogf.org/naming/2006/08/naming-epr-pf

Any combination of conformance claims defined in Table 2 may be made. The minimum conformance claim URI for this Profile as a whole is http://www.ogf.org/naming/2006/08/naming-uwsep-pf.

2.3   Extensibility Points

This section of the Profile incorporates the following specification by reference, and defines extensibility points within it:

- Web Services Addressing 1.0 - Core [WS-Addressing]
  Extensibility points:
  o E0231 **– WS-Addressing Extensibility –** WS-Addressing allows extensibility elements for the wsa:EndpointReference element.
  o E0232 **– WS-Addressing Metadata Extensibility –** WS-Addressing allows extensibility elements for metadata as children of the wsa:Metadata element.
  o E0233 **– WS-Addressing Reference Parameters Extensibility –** WS-Addressing allows extensibility elements for Reference Parameters as children of the wsa:ReferenceParameters element.

This profile defines extensions to the wsa:Metadata extensibility point within WS-Addressing.

3.   Unambiguous Web Service Endpoint Profile

This mandatory profile defines restrictions on the creation and use of a WS-Addressing Endpoint Reference (EPR) necessary to ensure unique delivery within a prescribed context. By adhering to this profile, the EPR-minter guarantees to the consumer that the EPR will always either refer to the same endpoint, or fail.

The conformance claim URI for this section of the Profile is
http://www.ogf.org/naming/2006/08/naming-uwsep-pf.

> *R0301* INSTANCES conforming to the WS-Naming Profile MUST conform to the Unambiguous Web Service Endpoint Profile.

> *R0302* INSTANCES conforming to the Unambiguous Web Service Endpoint Profile MUST include sufficient information within all ENDPOINTREFERENCEs, minted to refer to the INSTANCE, to guarantee that all messages sent using that ENDPOINTREFERENCE are routed to a unique endpoint within the context of the implementation.

> *R0302* INSTANCES conforming to the Unambiguous Web Service Endpoint Profile MUST guarantee that all messages sent to the INSTANCE are received by a unique endpoint within the context of the implementation or the message is rejected and a fault returned.

3.1   Non Normative Discussion

This profile makes no recommendations as to how an implementation addresses these requirements or what type of fault is raised in the event of a failure to deliver a message.

4. Endpoint Identifier and Web Service Address Identifier Profiles

Both the Endpoint Identifier Profile and the Web Service Address Identifier Profiles rely on the definition of an EndpointIdentifier.

4.1   Endpoint Identifier

WS-Addressing describes the Endpoint Reference type in such a way as to make naming based solely on this element difficult. Certain fields within the type are considered opaque and can be highly dynamic, even within the lifetime of a given endpoint. Because naming is such a key component of any distributed system[1], we define the notion of an Endpoint Identifier (EPI).

- An EndpointIdentifier MUST uniquely identify the same endpoint in both space and time.

- An EndpointIdentifier MUST conform to IRI syntax [RFC 3987].

- For two equal EndpointIdentifiers (as defined by RFC 3987), a client MAY assume that the two EndpointIdentifiers refer to the same endpoint.

The schema for the EndpointIdentifier is included in Appendix D. Note that the EndPointIdentifier is defined as an xsd:anyURI in the schema because XML schema does not provide an IRI type.

4.1.1   Non Normative Discussion

The Endpoint Identifiers are "abstract" in the sense that the client should not infer any property (e.g., type, location) from inspection of the EPI. Clients should treat EPIs as opaque.

The global uniqueness in both space and time requirement can be achieved by a number of means. Implementers are free to choose any name generation scheme that they wish to use provided the scheme generates unique names. Some options include various combinations and hashes of public keys, MAC addresses, generated IP address (not current web service endpoint address as that may change), timestamp, random number, etc. In particular, the authors of this document recommend that name generators refer to RFC 4122 [RFC4122], which gives a motivation for and description of UUIDs or Universally Unique IDs. One may also choose to acquire a name from an existing naming authority.

Symmetry in Endpoint Identifier equality is not required. If two Endpoint Identifiers are not bit-wise equal, then no conclusions can be drawn as to whether or not they refer to different endpoints.

4.2   Endpoint Identifier Profile

This profile defines how an EnpointIdentifier appears in an Endpoint Reference. The conformance claim URI for this section of the Profile is http://www.ogf.org/naming/2006/08/naming-epi-pf.

INSTANCEs conforming to the WS-Naming Profile MAY conform to the Endpoint Identifier Profile.

> R0421 A SENDER MAY include an EndpointIdentifier element in the SOAP header information for an outgoing message request.

---

[1] For an excellent description of naming in distributed systems, see Andrew Tanenbaum and Maarten van Steen's book "Distributed Systems: Principles and Paradigms" which contains a chapter completely devoted to naming in a distributed system (a sample of which is available at http://www.prenhall.com/divisions/esm/app/author_tanenbaum/custom/dist sys_1e/files/pdf/04.pdf).

R0422 The RECEIVER MUST NOT depend on the presence of an EndpointIdentifier to conform to the Unambiguous Web Service Endpoint Profile.

R0423 If one or more EndpointIdentifiers are included in an ENDPOINTREFERENCE, the ENDPOINTREFERENCE MUST contain the EndpointIdentifiers within the wsa:Metadata element and each EndpointIdentifier MUST be in contained in a naming:EndpointIdentifier element defined in Appendix D.

4.2.1   Non Normative Discussion

The following shows an example of how an EndpointIdentifier would appear in an Endpoint Reference.

```
<wsa:EndpointReference
        xmlns:wsa="http://www.w3.org/2005/08/addressing"
        xmlns:naming="http://schemas.ogf.org/naming/2006/08/naming">
        <wsa:Address>http://tempuri.org/example</wsa:Address>
        <wsa:Metadata>
                <naming:EndpointIdentifier>
                        urn:guid:B94C4186-0923-4dbb-AD9C-39DFB8B54388
                </name:EndpointIdentifier>
        </wsa:Metadata>
</wsa:EndpointReference>
```

Figure 1: EndpointIdentifier in EPR

4.3   Web Service Endpoint Address Identifier Profile

This profile restricts the "Unambiguous Web Service Endpoint Profile" further, and defines the requirements placed on an EPR wsa:Address field (IRI) to ensure that it is unique in space and time, and that it by itself identifies the endpoint/resource. In other words, the wsa:Address field contains an EndpointIdentifier as defined in §4.1.

The conformance claim URI for this section of the Profile is http://www.ogf.org/naming/2006/08/naming-wsepai-pf.

R0431 INSTANCES conforming to the Web Service Endpoint Address Identifier Profile MUST conform to the Unambiguous Web Service Endpoint Profile.

R0432 All information necessary to adhere to the Web Service Endpoint Address Identifier Profile MUST be present in the wsa:Address field of the ENDPOINTREFERENCE.

R0433 The wsa:Address field of the ENDPOINTREFERENCE MUST be an EndpointIdentifier as defined in §4.1.

4.4   Non Normative Discussion

Adherence to this profile allows consumers to use the wsa:Address value as a web service endpoint identifier. The advantage of this approach to creating an endpoint identifier is that it will, by default, be part of SOAP messages, and can thus be used for audit and policy enforcement in intermediaries and server runtimes.

On the client side, its use is equivalent to the use of the Endpoint Identifier, except that the latter may provide more stable in the case of endpoint mobility.

Clients are expected to discover, through the WSDL of the service from which the EPR was obtained, that the returned EPR conforms to this profile. The conformance URI will appear in the WSDL.

5. Endpoint Resolvers Profile

This section of the WS-Naming profile provides for the inclusion, within an EPR (referred to below as an Application EPR), two types of Resolver EPRs that refer to endpoint reference resolution services. These resolution services or resolvers can be used by clients to obtain new physical endpoints (EPRs) for an existing EPR or EPI.

The conformance claim URI for this section of the Profile is
http://www.ogf.org/naming/2006/08/naming-epr-pf.

WS-Naming is a profile on top of the already existing WS-Addressing specification. In order to fully specify this profile a specification for the message exchange between clients and resolvers must exist. This specification is provided in Appendix C. It is important to note that the message exchange and related claims by this profile do not in any way alter the existing WS-Addressing specification. Only clients wishing to participate in WS-Naming resolution need be aware of the additional message exchanges.

5.1   Resolution interfaces

The Profile requires a resolution service to implement at least one of the resolution interfaces defined in Appendix C.

>   R0511 A resolver INSTANCE MUST implement at least one of the resolution interfaces
>   defined in Appendix C.

>   R0512 A resolver INSTANCE implementing a resolution interface defined in Appendix C
>   MUST implement all message exchanges, including faults and other behaviors, as
>   defined in Appendix C.

5.2   Resolver information in WS-Addressing metadata

A client obtains Resolver EPRs from the metadata of the Application EPR used by the client to contact the Application endpoint. These Application EPRs need to be minted such that Resolver EPRs contain enough information to identify uniquely the Application endpoint.

An Application EPR may contain any number of Resolver EPRs—reference resolver EPRs or EndpointIdentifier resolver EPRS—in its wsa:Metadata element. The resolver information is contained in the naming:ReferenceResolver or naming:EndpointIdentifierResolver elements defined in Appendix D.

>   R0521 An ENDPOINTREFERENCE MAY contain any number of reference resolver
>   ENDPOINTREFERENCEs in its wsa:Metadata element.

>   R0522 An ENDPOINTREFERENCE MAY contain any number of EndpointIdentifier resolver
>   ENDPOINTREFERENCEs in its wsa:Metadata element.

>   R0523 A reference resolver ENDPOINTREFERENCE, when included in the wsa:Metadata
>   element of an ENDPOINTREFERENCE, MUST be contained in the
>   naming:ReferenceResolver element defined in Appendix D.

>   R0524 A EndpointIdentifier resolver ENDPOINTREFERENCE, when included in the
>   wsa:Metadata element of an ENDPOINTREFERENCE, MUST be contained in the
>   naming: EndpointIdentifierResolver element defined in Appendix D.

5.3   Non Normative Discussion

The elements naming:EndpointIdentifierResolver and naming:ReferenceResolver are of type EndpointReferenceType and are themselves Endpoint Reference Types. They can be as arbitrarily simple (see Figure 2**Error! Reference source not found.**) or as complex (see Figure 4) as desired.

```
<wsa:EndpointReference
        xmlns:wsa="http://www.w3.org/2005/08/addressing"
        xmlns:naming="http://schemas.ogf.org/naming/2006/08/naming">
        <wsa:Address>http://tempuri.org/example_application</wsa:Address>
        <wsa:Metadata>
                <naming:EndpointIdentifier>
                        urn:guid:B94C4186-0923-4dbb-AD9C-39DFB8B54388
                </naming:EndpointIdentifier>
                <naming:ReferenceResolver>
                        <wsa:Address>http://tempuri.org/resolver1</wsa:Address>
                </naming:ReferenceResolver>
                <naming:EndpointIdentifierResolver>
                        <wsa:Address>http://tempuri.org/resolver1</wsa:Address>
                </naming:EndpointIdentifierResolver>
                <naming:ReferenceResolver>
                        <wsa:Address>http://tempuri.org/resolver2</wsa:Address>
                </naming:ReferenceResolver>
        </wsa:Metadata>
</wsa:EndpointReference>
```

Figure 2: Simple WS-Naming Resolution EPR

```
<wsa:EndpointReference
        xmlns:wsa="http://www.w3.org/2005/08/addressing"
        xmlns:naming="http://schemas.ogf.org/naming/2006/08/naming">
        <wsa:Address>http://tempuri.org/example_applocation</wsa:Address>
        <wsa:Metadata>
              <naming:ReferenceResolver>
                    <wsa:Address> http://tempuri.org/resolver1 </wsa:Address>
                    <wsa:ReferenceParameters>
                          <naming:EndpointIdentifier>
                                urn:guid:8733111B-84FA-4da8-89FE-
                          417932B3B92C
                          </naming:EndpointIdentifier>
                    </wsa:ReferenceParameters>
                    <wsa:Metadata>
                          <naming:EndpointIdentifier>
                                urn:guid:55AD06F6-2F35-409a-9DCE-
                          E5F304E557AA
                          </naming:EndpointIdentifier>
                          <naming:ReferenceResolver>
                                <wsa:Address>
                                      http://tempuri.org/resolver_resolver1
                                </wsa:Address>
                          </naming:ReferenceResolver>
                    </wsa:Metadata>
              </naming:ReferenceResolver>
        </wsa:Metadata>
        <naming:EndpointIdentifier>
              urn:guid:B94C4186-0923-4dbb-AD9C-39DFB8B54388
        </naming:EndpointIdentifier>
</wsa:EndpointReference>
```

Figure 4: EPR with Nested Resolvers

EPRs with or without EndpointIdentifier elements may be rebound using an EPR-to-EPR resolver. EPRs that contain resolvers but do not contain an EndpointIdentifier are known as *renewable references*. Thus, clients attempting to communicate with stale or invalid endpoint references can use a Reference Resolver to obtain new, up-to-date, bindings. Note, however, that it is *not* necessary to use the resolvers provided in the EPR; any means for resolving EPIs or stale EPRs may be tried at the discretion of the client.

Note also that in the case of resolution in absence of an EndpointIdentifier argument, the resolution service may use various means to provide a new EPR. How that is done is outside of the scope of this document.

6. Security Considerations

There are many security considerations in naming and name resolution. For example, how does the client know if it is communicating with the service named by the EPR as opposed to an imposter? Similarly, how does the client know it can "trust" a particular resolver to return an EPR that refers to the service it requested? These questions were considered out of scope for this document. We mention only that one can exploit the flexibility of the EndpointIdentifier IRI to embed information such as a service's public key.

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8. Glossary

EndpointIdentifier	An IRI that uniquely identifies the same Endpoint in both space and time
EPI	See *EndpointIdentifier*
EPR	A WS-Addressing Endpoint Reference
Renewable reference	A WS-Addressing Endpoint Reference that contains a reference resolver *EPR*
Resolver	A service that can can be used to obtain updated Endpoint information (*EPR*s) for an existing *EPR* or *EPI*
WS-Name	A WS-Addressing Endpoint Reference that contains an *EndpointIdentifier* element

9. Intellectual Property Statement

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11. Full Copyright Notice

12. References

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[WS-I BP 1.1]   K. Ballinger, D. Ehnebuske, C. Ferris, M. Gudgin, C.K. Liu, M. Nottingham, and P. Yendluri (ed.) Basic Profile Version 1.1, Web Services Interoperability Organization Final Material, 24 August 2004. http://www.ws-i.org/Profiles/BasicProfile-1.1.html

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Appendix A   Referenced Specifications

The following specifications' requirements are incorporated into the Profile by reference, except where superseded by the Profile:
*   Web Services Addressing 1.0 – Core (WS-Addressing) **[WS-Addressing]**

Appendix B   Extensibility Points

This section identifies extensibility points for the Profile's component specifications. Except for the use of **WS-Addressing Metadata Extensibility** as profiled in WS-Naming (this profile), these mechanisms are out of the scope of the Profile; their use may affect interoperability, and may require private agreement between the parties to a Web service.

In Web Services Addressing **[WS-Addressing]**:

*   E0231 **– WS-Addressing Extensibility –** WS-Addressing allows extensibility elements for the wsa:EndpointReference.
*   E0232 **– WS-Addressing Metadata Extensibility –** WS-Addressing allows extensibility elements for metadata as children of the wsa:Metadata element.
*   E0233 **– WS-Addressing Reference Parameters Extensibility –** WS-Addressing allows extensibility elements for Reference Parameters as children of the wsa:ReferenceParameters element.

Appendix C   Endpoint Resolver — Normative

This is a specification for the message exchange between clients and resolvers. A resolver, or resolution service, can be used by clients to obtain new physical endpoints (EPRs) for an existing EPR or EPI. Two types of resolvers are defined: EndpointIdentifier resolver; and Reference resolver.

An EPR may include information in its metadata that refers to endpoint reference resolution services. In particular an EPR may include Resolver EPRs. An EPR containing such additional information is referred to below as an Application EPR.

Figure 5**Error! Reference source not found.** below illustrates the interface for an EndpointIdentifier Resolver. The WSDL for the EndpointIdentifierResolver portType is included in Appendix E.

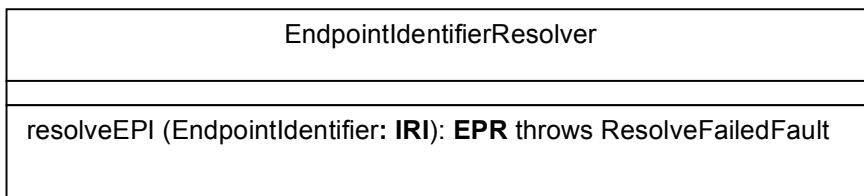| EndpointIdentifierResolver |
| --- |
| resolveEPI (EndpointIdentifier**: IRI**): **EPR** throws ResolveFailedFault |

Figure 5: Pseudo-Interface for WS-Naming Endpoint Identifier Resolver

Figure 7**Error! Reference source not found.** below illustrates the interface for a Reference Resolver. The WSDL for the ReferenceResolver portType is included in Appendix E.

ReferenceResolver
resolve (): **EPR** throws ResolveFailedFault

Figure 7: Pseudo-Interface for WS-Naming Reference Resolver

If, for any reason, either type of resolver cannot resolve an EndpointIdentifier or renew an existing reference, that resolver MUST throw a naming:ResolveFailedFault.

If, for any reason, either type of resolver cannot resolve an EndpointIdentifier or renew an existing reference, that resolver MAY choose to insert an alternative resolver EPR into the infoset of the SOAP fault thrown as a consequence, thus indicating to the client that another attempt on the new resolver may yield better results. In this case the endpoint MUST throw naming:ResolveFailedWithReferralFault, which is a subtype of naming:ResolveFailedFault.

A client obtains Resolver EPRs from the metadata of the Application EPR used by the client to contact the Application endpoint. These Application EPRs need to be minted such that Resolver EPRs contain enough information to identify uniquely the Application endpoint.

C.1   PortType Details

The two resolution port types are defined below.

C.1.1   EndpointIdentifierResolver PortType :: ResolveEPI

The ResolveEPI message is sent to the resolution portType when a client wishes to resolve a given EPI to a communicable endpoint. The resolver MUST respond with a naming:ResolveResponse message or naming:ResolveFailedFault (or subtype thereof) fault message. The resolver MAY respond with an EPR that is no longer valid. It is up to the client to determine whether or not the EPR returned is still valid.

The format of the ResolveEPI message is:

```
…
<naming:ResolveEPI>
        <naming:endpoint-identifier>xsd:anyURI</naming:endpoint-identifier>
</naming:ResolveEPI>
…
```

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

/naming:endpoint-identifier

        A valid WS-Naming EPI as defined above.

The naming:ResolveResponse message received in response to the ResolveEPI message is a message of the following form:

```
…
<naming:ResolveResponse>
        <naming:resolved-epr>wsa:EndpointReferenceType</naming:resolved-epr>
</naming:ResolveResponse >
…
```

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

/naming:resolved-epr

        An EndpointReference provided by the resolver that references the Application endpoint.

C.1.2   ReferenceResolver PortType :: Resolve

The Resolve message is sent to the resolution portType when a client wishes to obtain a new EPR to an Application endpoint using the renewable reference provided in the original Application EPR. The resolver MUST respond with a naming:ResolveResponse message or naming:ResolveFailedFault (or subtype thereof) fault message. The resolver MAY respond with an EPR that is no longer valid. It is up to the client to determine whether or not the EPR returned is still valid.

The format of the Resolve message is:

```
…
<naming:Resolve/>
…
```

The naming:ResolveResponse message received in response to the Resolve message is a message of the following form:

```
…
<naming:ResolveResponse>
        <naming:resolved-epr>wsa:EndpointReferenceType</naming:resolved-epr>
</naming:ResolveResponse >
…
```

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

/naming:resolved-epr

        An EndpointReference provided by the resolver that references the Application endpoint.

C.1.3   Fault Types

The following fault MUST be supported by both the ResolveEPI and Resolve operations.

The naming:ResolveFailedFault (or subtype thereof) MUST be returned when a resolver cannot provide a resolution to the resolution request. The format of the fault message is:

```
…
<naming:ResolveFailedFault/>
…
```

The following fault MAY be supported by both the ResolveEPI and Resolve operations.

The naming:ResolveFailedWithReferralFault MAY be returned, as an extension of the naming:ResolveFailedFault, when a resolver cannot provide a resolution to the resolution request. The format of the fault message is:

```
…
<naming:ResolveFailedWithReferralFault>
   <naming:referral-epr> wsa:EndpointReferenceType </naming:referral-epr>
</naming:ResolveFailedWithReferralFault>
…
```

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

/naming:referral-epr

> An EndpointReference, provided by the resolver, that references an alternative resolution service. The referral-epr element contains either a naming:EndpointIdentifierResolver and naming:ReferenceResolver element, as defined in Appendix D.

Appendix D   WS-Naming XML Schema

This section contains the normative XML Schema definitions for WS-Naming.

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

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```

```
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-->

<xsd:schema
    targetNamespace="http://schemas.ogf.org/naming/2006/08/naming"
    elementFormDefault="qualified" attributeFormDefault="qualified"
    xmlns:naming="http://schemas.ogf.org/naming/2006/08/naming"
    xmlns:wsa="http://www.w3.org/2005/08/addressing"
    xmlns:wsbf="http://docs.oasis-open.org/wsrf/bf-2"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema">

    <xsd:import namespace="http://www.w3.org/2005/08/addressing"
            schemaLocation="http://www.w3.org/2006/03/addressing/ws-
addr.xsd"/>
    <xsd:import namespace="http://docs.oasis-open.org/wsrf/bf-2"
            schemaLocation="http://docs.oasis-open.org/wsrf/bf-2.xsd"/>

    <!-- ===== naming:EndpointIdentifier ===== -->
    <xsd:element name="EndpointIdentifier" type="xsd:anyURI"/>

    <!-- ===== naming:ReferenceResolver =====  -->
    <xsd:element name="ReferenceResolver"
                type="wsa:EndpointReferenceType"/>

    <!-- ===== naming:ReferenceResolver =====  -->
    <xsd:element name="EndpointIdentifierResolver"
                type="wsa:EndpointReferenceType"/>

    <!-- ===== naming:ResolveFailedFault ===== -->
    <xsd:complexType name="ResolveFailedFaultType">
        <xsd:complexContent>
            <xsd:extension base="wsbf:BaseFaultType"/>
        </xsd:complexContent>
    </xsd:complexType>
    <xsd:element name="ResolveFailedFault"
                type="naming:ResolveFailedFaultType"/>

    <!-- ===== naming:ResolveFailedWithReferralFault ===== -->
    <xsd:complexType name="ResolveFailedWithReferralFaultType">
        <xsd:complexContent>
            <xsd:extension base="naming:ResolveFailedFaultType">
                <xsd:sequence>
                    <xsd:element ref="ReferenceResolver"
                                minOccurs="0"
                                maxOccurs="unbounded"/>
                    <xsd:element ref="EndpointIdentifier"
                                minOccurs="0"
                                maxOccurs="unbounded"/>
                </xsd:sequence>
            </xsd:extension>
        </xsd:complexContent>
    </xsd:complexType>
    <xsd:element name="ResolveFailedWithReferralFault"
```

```
                  type="naming:ResolveFailedWithReferralFaultType"/>

</xsd:schema>
```

Appendix E   WS-Naming WSDL

This section contains the normative WSDL definitions for the Endpoint and Reference Resolvers.

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

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-->

<wsdl:definitions
    name="OGSANaming"
    targetNamespace="http://schemas.ogf.org/naming/2006/08/naming/wsdl"
```

```
xmlns:naming-w="http://schemas.ogf.org/naming/2006/08/naming/wsdl"
xmlns:naming="http://schemas.ogf.org/naming/2006/08/naming"
xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:wsa="http://www.w3.org/2005/08/addressing"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">

<!-- ===== Type Definitions ===== -->
<wsdl:types>
  <xsd:schema>
     <xsd:import
        namespace="http://schemas.ogf.org/naming/2006/08/naming"/>
     <xsd:import
        namespace="http://www.w3.org/2005/08/addressing"
        schemaLocation="http://www.w3.org/2006/03/addressing/ws-
     addr.xsd"/>
     </xsd:schema>
</wsdl:types>

<!-- ===== Messages ===== -->
<wsdl:message name="ResolveEPI">
    <wsdl:part name="EPI" element="naming:EndpointIdentifier"/>
</wsdl:message>

<wsdl:message name="Resolve"/>

<wsdl:message name="ResolveResponse">
    <wsdl:part name="resolved-epr" type="wsa:EndpointReference"/>
</wsdl:message>

<!-- ===== Faults ===== -->
<wsdl:message name="ResolveFailedFault">
    <wsdl:part name="Fault" element="naming:ResolveFailedFault"/>
</wsdl:message>

<wsdl:message name="ResolveFailedWithReferralFault">
    <wsdl:part name="Fault"
               element="naming:ResolveFailedWithReferralFault"/>
</wsdl:message>

<!-- ===== PortTypes ===== -->
<wsdl:portType name="EndpointIdentifierResolver">
    <wsdl:operation name="resolveEPI">
        <wsdl:input message="naming-w:ResolveEPI"/>
        <wsdl:output message="naming-w:ResolveResponse"/>
        <wsdl:fault name="ResolveFailedFault"
              message="naming-w:ResolveFailedFault"/>
        <wsdl:fault name="ResolveFailedWithReferralFault"
              message="naming-w:ResolveFailedWithReferralFault"/>
    </wsdl:operation>
</wsdl:portType>

<wsdl:portType name="ReferenceResolver">
    <wsdl:operation name="resolve">
        <wsdl:input message="naming-w:Resolve"/>
        <wsdl:output message="naming-w:ResolveResponse"/>
        <wsdl:fault name="ResolveFailedFault"
              message="naming-w:ResolveFailedFault"/>
```

```
            <wsdl:fault name="ResolveFailedWithReferralFault"
                    message="naming-w:ResolveFailedWithReferralFault"/>
        </wsdl:operation>
    </wsdl:portType>

</wsdl:definitions>
```

Appendix F   Referenced Specification Status and Adoption Level Classification

The classification of this Profile's referenced specifications at the time of writing are in Table 3.

Table 3 Status of specifications referenced by WS-Naming 1.0

OGSA Referenced Specifications: WS-Naming Specification 1.0														
November 10, 2006	Status							Adoption						
Specification/Profile Name	De Facto	Institutional	Evolving Institutional	Draft Institutional	Consortium	Evolving Consortium	Draft	Ubiquitous	Adopted	Community	Interoperable	Implemented	Unimplemented	Note
Specifications														
WS-Addressing 1.0		X									<	X		W3C Recommendation
Profiles														
None														

Legend: **X**   Specification or profile is currently at this status or adoption level
<   Specification or profile is approaching this status or adoption level
Status or adoption level is not applicable