Web Services Description Language (WSDL) Version 2.0 Part 1: Core Language

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Editors:

Roberto Chinnici, Sun Microsystems
Jean-Jacques Moreau, Canon
Arthur Ryman, IBM
Sanjiva Weerawarana, WSO2

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Abstract

This document describes the Web Services Description Language Version 2.0 (WSDL 2.0), an XML language for describing Web services. This specification defines the core language which can be used to describe Web services based on an abstract model of what the service offers. It also defines the conformance criteria for documents in this language.

Status of this Document

This section describes the status of this document at the time of its publication. Other documents may supersede this document. A list of current W3C publications and the latest revision of this technical report can be found in the W3C technical reports index at http://www.w3.org/TR/.

This is an updated version of the W3C Candidate Recommendation of Web Services Description Language (WSDL) Version 2.0 Part 1: Core Language for review by W3C Members and other interested parties. It has been produced by the Web Services Description Working Group, which is part of the W3C Web Services Activity. The publication of this document signifies a call for implementations of this specification.

The Candidate Recommendation period specified in the previous draft (15 March 2006) has passed. The Working Group does not anticipate garnering enough implementation experience to fulfill its Candidate Recommendation exit criteria until at least 1 July 2006.

This version addresses the modest number of comments received to date on the Candidate Recommendation of Web Services Description Language (WSDL) Version 2.0 Part 1: Core Language, and primarily differs from the previous version in the inclusion of marked test assertions to help implementers. The detailed disposition of the comments received can be found in the Candidate Recommendation issues list. A diff-marked version against the previous version of this document is available. For a detailed list of changes since the last publication of this document, please refer to appendix **E Part 1 Change Log**.

The Working Group plans to submit this specification for consideration as a W3C Proposed Recommendation if the following exit criteria have been met:

- Two interoperable implementations of all the features, both mandatory and optional, of the specifications have been produced.
- The Working Group releases a test suite along with an implementation report.

The sections **2.7 Feature** and **2.8 Property** in this specification, defining the feature and property components, are considered at risk. The Working Group may recommend to remove the components from the specification, depending on their use and the implementations.

Implementers are invited to send feedback on this document to the public public-ws-desc-comments@w3.org mailing list (public archive).

Issues about this document are recorded in the Candidate Recommendation issues list maintained by the Working Group. A list of formal objections against the set of WSDL 2.0 Working Drafts is also available.

Publication as a Candidate Recommendation does not imply endorsement by the W3C Membership. This is a draft document and may be updated, replaced or obsoleted by other documents at any time. It is inappropriate to cite this document as other than work in progress.

This document was produced by a group operating under the 24 January 2002 CPP as amended by the W3C Patent Policy Transition Procedure. W3C maintains a public list of any patent disclosures made in connection with the deliverables of the group; that page also includes instructions for disclosing a patent. An individual who has actual knowledge of a patent which the individual believes contains Essential Claim(s) must disclose the information in accordance with section 6 of the W3C Patent Policy.

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Chapter 1

Introduction

Web Services Description Language Version 2.0 (WSDL 2.0) provides a model and an XML format for describing Web services. WSDL 2.0 enables one to separate the description of the abstract functionality offered by a service from concrete details of a service description such as "how" and "where" that functionality is offered.

This specification defines a language for describing the abstract functionality of a service as well as a framework for describing the concrete details of a service description. It also defines the conformance criteria for documents in this language. The *WSDL Version 2.0 Part 2: Adjuncts* specification [*WSDL 2.0 Adjuncts*] describes extensions for Message Exchange Patterns, SOAP modules, and a language for describing such concrete details for SOAP 1.2 [*SOAP 1.2 Part 1: Messaging Framework*] and HTTP [*IETF RFC 2616*].

1.1 Web Service

WSDL 2.0 describes a Web service in two fundamental stages: one abstract and one concrete. Within each stage, the description uses a number of constructs to promote reusability of the description and to separate independent design concerns.

At an abstract level, WSDL 2.0 describes a Web service in terms of the messages it sends and receives; messages are described independent of a specific wire format using a type system, typically XML Schema.

An *operation* associates a message exchange pattern with one or more messages. A *message exchange pattern* identifies the sequence and cardinality of messages sent and/or received as well as who they are logically sent to and/or received from. An *interface* groups together operations without any commitment to transport or wire format.

At a concrete level, a *binding* specifies transport and wire format details for one or more interfaces. An *endpoint* associates a network address with a binding. And finally, a *service* groups together endpoints that implement a

common interface.

1.2 Document Conformance

An *element information item* (as defined in [*XML Information Set*]) whose namespace name is `"http://www.w3.org/2006/01/wsdl"` and whose local part is `description` conforms to this specification if it is valid according to the XML Schema for that element as defined by this specification (http://www.w3.org/2006/01/wsdl/wsdl20.xsd) and additionally adheres to all the constraints contained in this specification family and conforms to the specifications of any extensions contained in it. Such a conformant *element information item* constitutes a *WSDL 2.0 document*.

The definition of the WSDL 2.0 language is based on the XML Information Set [*XML Information Set*] but also imposes many semantic constraints over and above structural conformance to this XML Infoset. In order to precisely describe these constraints, and as an aid in precisely defining the meaning of each WSDL 2.0 document, the WSDL 2.0 specification defines a component model **2 Component Model** as an additional layer of abstraction above the XML Infoset. Constraints and meaning are defined in terms of this component model, and the definition of each component includes a mapping that specifies how values in the component model are derived from corresponding items in the XML Infoset.

An XML 1.0 document that is valid with respect to the WSDL 2.0 XML Schema and that maps to a valid WSDL 2.0 Component Model is conformant to the WSDL 2.0 specification.

1.3 The Meaning of a Service Description

A WSDL 2.0 service description indicates how potential clients are intended to interact with the described service. It represents an assertion that the described service fully implements and conforms to what the WSDL 2.0 document describes. For example, as further explained in section **6.1.1 Mandatory extensions**, if the WSDL 2.0 document specifies a particular optional extension, the functionality implied by that extension is only optional to the client. It must be supported by the Web service.

A WSDL 2.0 interface describes potential interaction with a service–not required interaction. The declaration of an operation in a WSDL 2.0 interface is not an assertion that the interaction described by the operation must occur. Rather it is an assertion that if such an interaction is (somehow) initiated, then the declared operation describes how that interaction is intended to occur.

1.4 Notational Conventions

All parts of this specification are normative, with the EXCEPTION of notes, pseudo-schemas, examples, and sections explicitly marked as “Non-Normative”.

1.4.1 RFC 2119 Keywords

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 [*IETF RFC 2119*].

1.4.2 RFC 3986 Namespaces

Namespace names of the general form:

- `"http://example.org/..."` and
- `"http://example.com/..."`

represent application or context-dependent URIs [*IETF RFC 3986*].

1.4.3 XML Schema anyURI

This specification uses the XML Schema type `xs:anyURI` (see [*XML Schema: Datatypes*]). It is defined so that `xs:anyURI` values are essentially IRIs (see [*IETF RFC 3987*]). The conversion from `xs:anyURI` values to an actual URI is via an escaping procedure defined by (see [*XML Linking Language (XLink) 1.0*]), which is identical in most respects to IRI Section 3.1.

For interoperability, WSDL authors are advised to avoid the US-ASCII characters: "¡", "¿", "'", space, "{", "}", "—", "\", "^", and "`", which are allowed by the `xs:anyURI` type, but disallowed in IRIs.

1.4.4 Prefixes and Namespaces Used in This Specification

This specification uses predefined namespace prefixes throughout; they are given in the following list. Note that the choice of any namespace prefix is arbitrary and not semantically significant (see [*XML Namespaces*]).

wsdl `"http://www.w3.org/2006/01/wsdl"`

Defined by this specification.

wsdli `"http://www.w3.org/2006/01/wsdl-instance"`

Defined by this specification **7.1** `wsdli:wsdlLocation` ***attribute information item***.

wsdlx `"http://www.w3.org/2006/01/wsdl-extensions"`

Defined by this specification **3.3 Describing Messages that Refer to Services and Endpoints**.

wrpc `"http://www.w3.org/2006/01/wsdl/rpc"`

Defined by WSDL 2.0: Adjuncts [*WSDL 2.0 Adjuncts*].

wsoap `"http://www.w3.org/2006/01/wsdl/soap"`

Defined by WSDL 2.0: Adjuncts [*WSDL 2.0 Adjuncts*].

whttp `"http://www.w3.org/2006/01/wsdl/http"`

Defined by WSDL 2.0: Adjuncts [*WSDL 2.0 Adjuncts*].

xs `"http://www.w3.org/2001/XMLSchema"`

Defined in the W3C XML Schema specification [*XML Schema: Structures*], [*XML Schema: Datatypes*].

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

Defined in the W3C XML Schema specification [*XML Schema: Structures*], [*XML Schema: Datatypes*].

1.4.5 Terms Used in This Specification

This section describes the terms and concepts introduced in Part 1 of the WSDL Version 2.0 specification (this document).

Actual Value As in [*XML Schema: Structures*], the phrase actual value is used to refer to the member of the value space of the simple type definition associated with an attribute information item which corresponds to its normalized value. This will often be a string, but may also be an integer, a boolean, an IRI-reference, etc.

Inlined Schema An XML schema that is defined in the `xs:types` *element information item* of a WSDL 2.0 description. For example, an XML Schema defined in an `xs:schema` *element information item* **3.1.2 Inlining XML Schema**.

1.4.6 XML Information Set Properties

This specification refers to properties in the XML Information Set [*XML Information Set*]. Such properties are denoted by square brackets, e.g. [children], [attributes].

1.4.7 WSDL 2.0 Component Model Properties

This specification defines and refers to properties in the WSDL 2.0 Component Model **2 Component Model**. Such properties are denoted by curly brackets, e.g. name, interfaces.

This specification uses a consistent naming convention for component model properties that refer to components. If a property refers to a required or optional component, then the property name is the same as the component name. If a property refers to a set of components, then the property name is the pluralized form of the component name.

1.4.8 Z Notation

Z Notation [*Z Notation Reference Manual*] was used in the development of this specification. Z Notation is a formal specification language that is based on standard mathematical notation. The Z Notation for this specification has been verified using the Fuzz 2000 type-checker [*Fuzz 2000*].

Since Z Notation is not widely known, it is not included the normative version of this specification. However, it is included in a non-normative version which allows to dynamically hide and show the Z Notation. Browsers correctly display the mathematical Unicode characters, provided that the required fonts are installed. Mathematical fonts for Mozilla Firefox can be downloaded from the Mozilla Web site.

The Z Notation was used to improve the quality of the normative text that defines the Component Model, and to help ensure that the test suite covered all important rules implied by the Component Model. However, the Z Notation is non-normative, so any conflict between it and the normative text is an error in the Z Notation. Readers and implementors may nevertheless find the Z Notation useful in cases where the normative text is unclear.

There are two elements of Z Notation syntax that conflict with the notational conventions described in the preceding sections. In Z Notation, square brackets are used to introduce basic sets, e.g. $[ID]$, which conflicts with the use of square brackets to denote XML Information Set properties **1.4.6 XML Information Set Properties**. Also, in Z Notation, curly brackets are used to denote set display and set comprehension, e.g. $\{1, 2, 3\}$, which conflicts with the use of curly brackets to denote WSDL 2.0 Component Model properties **1.4.7 WSDL 2.0 Component Model Properties**. However, the intended meaning of square and curly brackets should be clear from their context and this minor notational conflict should not cause any confusion.

1.4.9 BNF Pseudo-Schemas

Pseudo-schemas are provided for each component, before the description of the component. They use BNF-style conventions for attributes and elements: `"?"` denotes optionality (i.e. zero or one occurrences), `"*"` denotes zero or more occurrences, `"+"` one or more occurrences, `"["` and `"]"` are used to form groups, and `"|"` represents choice. Attributes are conventionally assigned a value which corresponds to their type, as defined in the normative schema. Elements with simple content are conventionally assigned a value which corresponds to the type of their content, as defined in the normative schema. Pseudo schemas do not include extensibility points for brevity.

```
<!-- sample pseudo-schema -->
<defined_element
      required_attribute_of_type_string="xs:string"
      optional_attribute_of_type_int="xs:int"? >
  <required_element />
  <optional_element />?
```

```
  <one_or_more_of_these_elements />+
  [ <choice_1 /> | <choice_2 /> ]*
</defined_element>
```

1.4.10 Assertions

Assertions about WSDL 2.0 documents and components that are not enforced by the normative XML schema for WSDL 2.0 are marked by a dagger symbol () at the end of a sentence. Each assertion has been assigned a unique identifier that consists of a descriptive textual prefix and a unique numeric suffix. The numeric suffixes are assigned sequentially and never reused so there may be gaps in the sequence. The assertion identifiers MAY be used by implementations of this specification for any purpose, e.g. error reporting.

The assertions and their identifiers are summarized in section **F Assertion Summary**.

Chapter 2

Component Model

This section describes the conceptual model of WSDL 2.0 as a set of components with attached properties, which collectively describe a Web service. This model is called the *Component Model* of WSDL 2.0. A *valid WSDL 2.0 component model* is a set of WSDL 2.0 components and properties that satisfy all the requirements given in this specification as indicated by keywords whose interpretation is defined by RFC 2119 [*IETF RFC 2119*].

A WSDL 2.0 document, and its related documents, defines a set of components that together form an instance of a Component Model. This specification defines the structure and constraints on the components in a valid component model instance.

Let *ComponentModel* be the set of valid component model instances:

ComponentModel

DescriptionCM
ElementDeclarationCM
TypeDefinitionCM
FeatureCM
PropertyCM
InterfaceCM
InterfaceFaultCM
InterfaceOperationCM
InterfaceMessageReferenceCM
InterfaceFaultReferenceCM
BindingCM
BindingFaultCM
BindingOperationCM
BindingMessageReferenceCM
BindingFaultReferenceCM
ServiceCM
EndpointCM

See *DescriptionCM, ElementDeclarationCM, TypeDefinitionCM, FeatureCM, PropertyCM, InterfaceCM, InterfaceFaultCM, InterfaceOperationCM, InterfaceMessageReferenceCM, InterfaceFaultReferenceCM, BindingCM, BindingFaultCM, BindingOperationCM, BindingMessageReferenceCM, BindingFaultReferenceCM, ServiceCM, EndpointCM.*

The definition of *ComponentModel* is built up from definitions for each of the component types. A component model instance is valid if and only if the constraints on each of the component types are satisfied. The component type definitions are given in the following sections.

Components are typed collections of properties that correspond to different aspects of Web services. Each subsection herein describes a different type of component, its defined properties, and its representation as an XML Infoset [*XML Information Set*].

Let *Component* be the union of each of the component types that appear in the WSDL 2.0 component model:

$$
\begin{aligned}
&Component ::= \\
&\quad description\langle\langle Description\rangle\rangle \mid \\
&\quad elementDecl\langle\langle ElementDeclaration\rangle\rangle \mid \\
&\quad typeDef\langle\langle TypeDefinition\rangle\rangle \mid \\
&\quad interface\langle\langle Interface\rangle\rangle \mid \\
&\quad interfaceFault\langle\langle InterfaceFault\rangle\rangle \mid \\
&\quad interfaceOp\langle\langle InterfaceOperation\rangle\rangle \mid \\
&\quad interfaceMessageRef\langle\langle InterfaceMessageReference\rangle\rangle \mid \\
&\quad interfaceFaultRef\langle\langle InterfaceFaultReference\rangle\rangle \mid \\
&\quad feature\langle\langle Feature\rangle\rangle \mid \\
&\quad property\langle\langle Property\rangle\rangle \mid \\
&\quad binding\langle\langle Binding\rangle\rangle \mid \\
&\quad bindingFault\langle\langle BindingFault\rangle\rangle \mid \\
&\quad bindingOp\langle\langle BindingOperation\rangle\rangle \mid \\
&\quad bindingMessageRef\langle\langle BindingMessageReference\rangle\rangle \mid \\
&\quad bindingFaultRef\langle\langle BindingFaultReference\rangle\rangle \mid \\
&\quad service\langle\langle Service\rangle\rangle \mid \\
&\quad endpoint\langle\langle Endpoint\rangle\rangle
\end{aligned}
$$

See *Description, ElementDeclaration, TypeDefinition, Interface, InterfaceFault, InterfaceOperation, InterfaceMessageReference, InterfaceFaultReference, Feature, Property, Binding, BindingFault, BindingOperation, BindingMessageReference, BindingFaultReference, Service, Endpoint.*

The *Component* type is an example of a Z Notation *free type*. The structure of a free type is similar to that of a variant record or discriminated union datatype that are found in some common programming languages. Each of the members of this union is formally defined in the following sections.

When a component property is said to contain another component or a set of other components, the intended meaning is that the component property

contains a reference to another component or a set of references to other components. Every component contains an unique identifier that is used to express references.

Let *ID* be the set of all component identifier values:

$$[ID]$$

The *ID* type is an example of a Z Notation *basic set*. The structure of a basic set is immaterial. The only relevant aspect of *ID* is that it contains enough members to uniquely identify each component, and that these identifiers can be compared for equality. These identifiers are similar to XML element ids or object identifiers that are found in common object-oriented programming languages.

Every component has an identifier which uniquely identifies it within a component model instance.

Let *Identifier* be the set of component identifier properties:

- Let *id* be the identifier of the component.

$$\begin{array}{|l} \textit{Identifier} \\ \hline id : ID \\ \hline \end{array}$$

See *ID*.

The *Identifier* set is a an example of Z Notation *schema*. The structure of a Z schema is similar to that of a record or struct datatype that are found in many common programming languages. The fields of an instance of a Z schema are selected using the usual dot notation, e.g. $x.id$ selects the *id* field of the instance x.

All component properties that contain an *ID*, except for *Identifier*, refer to other components. Every *ID* value that appears in a component reference corresponds to a unique component in the component model with that identifier.

Let *Id* map components to their identifiers:

$$
\begin{array}{|l}
Id : Component \longrightarrow ID \\
\hline
\forall\, x : Description \bullet Id(description(x)) = x.id \\
\forall\, x : ElementDeclaration \bullet Id(elementDecl(x)) = x.id \\
\forall\, x : TypeDefinition \bullet Id(typeDef(x)) = x.id \\
\forall\, x : Interface \bullet Id(interface(x)) = x.id \\
\forall\, x : InterfaceFault \bullet Id(interfaceFault(x)) = x.id \\
\forall\, x : InterfaceOperation \bullet Id(interfaceOp(x)) = x.id \\
\forall\, x : InterfaceMessageReference \bullet Id(interfaceMessageRef(x)) = x.id \\
\forall\, x : InterfaceFaultReference \bullet Id(interfaceFaultRef(x)) = x.id \\
\forall\, x : Feature \bullet Id(feature(x)) = x.id \\
\forall\, x : Property \bullet Id(property(x)) = x.id \\
\forall\, x : Binding \bullet Id(binding(x)) = x.id \\
\forall\, x : BindingFault \bullet Id(bindingFault(x)) = x.id \\
\forall\, x : BindingOperation \bullet Id(bindingOp(x)) = x.id \\
\forall\, x : BindingMessageReference \bullet Id(bindingMessageRef(x)) = x.id \\
\forall\, x : BindingFaultReference \bullet Id(bindingFaultRef(x)) = x.id \\
\forall\, x : Service \bullet Id(service(x)) = x.id \\
\forall\, x : Endpoint \bullet Id(endpoint(x)) = x.id
\end{array}
$$

See *Component, ID, Description, ElementDeclaration, TypeDefinition, Interface, InterfaceFault, InterfaceOperation, InterfaceMessageReference, InterfaceFaultReference, Feature, Property, Binding, BindingFault, BindingOperation, BindingMessageReference, BindingFaultReference, Service, Endpoint.*

The *Id* function is an example of a Z Notation *axiomatic definition*. An axiomatic definition declares an object and then characterises it with a set of axioms or logical constraints that it satisfies. In this case, the *Id* function is constrained by giving its value on each possible type of component, which uniquely defines it.

A component model is a set of uniquely identified components that satisfy a set of validity constraints which are described in the following sections.

Let *ComponentModel*1 be the base set of component models. This set will be further constrained in the following sections:

- Let *components* be the set of components in the component model.
- Let *componentIds* be the set of identifiers of components in the component model.

$$
\begin{array}{|l}
\textit{ComponentModel}1 \\
\hline
components : \mathbb{P}\, Component \\
componentIds : \mathbb{P}\, ID \\
\hline
\forall\, x, y : components \bullet \\
\qquad Id(x) = Id(y) \Rightarrow x = y \\
componentIds = \{\, x : components \bullet Id(x) \,\}
\end{array}
$$

See *Component, Id.*

- No two components have the same identifier.

An identifier is valid if it is the identifier of a component in the component model.

Let *IdentifierValid* express this validity constraint:

IdentifierValid

$ComponentModel1$

$Identifier$

$id \in componentIds$

See *ComponentModel1, Identifier.*

In order to express the additional contraints on the component model, it is convenient to define the subsets of components of each type and their corresponding subsets of identifiers.

Let *InterfaceComponents* define the subsets of components that are related to the Interface component:

- Let *interfaceComps* be the subset of Interface components.
- Let *interfaceFaultComps* be the subset of Interface Fault components.
- Let *interfaceOpComps* be the subset of Interface Operation components.
- Let *interfaceMessageRefComps* be the subset of Interface Message Reference components.
- Let *interfaceFaultRefComps* be the subset of Interface Fault Reference components.

InterfaceComponents

$ComponentModel1$
$interfaceComps : \mathbb{P}\ Interface$
$interfaceFaultComps : \mathbb{P}\ InterfaceFault$
$interfaceOpComps : \mathbb{P}\ InterfaceOperation$
$interfaceMessageRefComps : \mathbb{P}\ InterfaceMessageReference$
$interfaceFaultRefComps : \mathbb{P}\ InterfaceFaultReference$

$interfaceComps = \{ x : Interface \mid interface(x) \in components \}$

$interfaceFaultComps = \{ x : InterfaceFault \mid interfaceFault(x) \in components \}$

$interfaceOpComps = \{ x : InterfaceOperation \mid interfaceOp(x) \in components \}$

$interfaceMessageRefComps = \{ x : InterfaceMessageReference \mid interfaceMessageRef(x) \in components \}$

$interfaceFaultRefComps = \{ x : InterfaceFaultReference \mid interfaceFaultRef(x) \in components \}$

See *ComponentModel1, Interface, InterfaceFault, InterfaceOperation, InterfaceMessageReference, InterfaceFaultReference.*

The definition of *InterfaceComponents* is an example of Z Notation *schema inclusion*. In Z schema inclusion all the fields and constraints of the included Z schema, e.g. *ComponentModel*1 are added to the including Z schema, e.g. *InterfaceComponents*.

Let *InterfaceComponentIds* define the subsets of component identifiers that are related to the Interface component:

- Let *interfaceIds* be the subset of Interface component identifiers.
- Let *interfaceFaultIds* be the subset of Interface Fault component identifiers.
- Let *interfaceOpIds* be the subset of Interface Operation component identifiers.
- Let *interfaceMessageRefIds* be the subset of Interface Message Reference component identifiers.
- Let *interfaceFaultRefIds* be the subset of Interface Fault Reference component identifiers.

InterfaceComponentIds

InterfaceComponents
$interfaceIds : \mathbb{P}\ ID$
$interfaceFaultIds : \mathbb{P}\ ID$
$interfaceOpIds : \mathbb{P}\ ID$
$interfaceMessageRefIds : \mathbb{P}\ ID$
$interfaceFaultRefIds : \mathbb{P}\ ID$

$interfaceIds = \{\ x : interfaceComps \bullet x.id\ \}$
$interfaceFaultIds = \{\ x : interfaceFaultComps \bullet x.id\ \}$
$interfaceOpIds = \{\ x : interfaceOpComps \bullet x.id\ \}$
$interfaceMessageRefIds = \{\ x : interfaceMessageRefComps \bullet x.id\ \}$
$interfaceFaultRefIds = \{\ x : interfaceFaultRefComps \bullet x.id\ \}$

See *InterfaceComponents, ID.*

Let *BindingComponents* define the subsets of components that are related to the Binding component:

- Let *bindingComps* be the subset of Binding components.
- Let *bindingFaultComps* be the subset of Binding Fault components.
- Let *bindingOpComps* be the subset of Binding Operation components.
- Let *bindingMessageRefComps* be the subset of Binding Message Reference components.
- Let *bindingFaultRefComps* be the subset of Binding Fault Reference components.

$$
\begin{array}{|l}
\textit{BindingComponents} \\
\hline
\textit{ComponentModel}1 \\
\textit{bindingComps} : \mathbb{P}\ \textit{Binding} \\
\textit{bindingFaultComps} : \mathbb{P}\ \textit{BindingFault} \\
\textit{bindingOpComps} : \mathbb{P}\ \textit{BindingOperation} \\
\textit{bindingMessageRefComps} : \mathbb{P}\ \textit{BindingMessageReference} \\
\textit{bindingFaultRefComps} : \mathbb{P}\ \textit{BindingFaultReference} \\
\hline
\textit{bindingComps} = \{\, x : \textit{Binding} \mid \\
\quad \textit{binding}(x) \in \textit{components} \,\} \\
\\
\textit{bindingFaultComps} = \{\, x : \textit{BindingFault} \mid \\
\quad \textit{bindingFault}(x) \in \textit{components} \,\} \\
\\
\textit{bindingOpComps} = \{\, x : \textit{BindingOperation} \mid \\
\quad \textit{bindingOp}(x) \in \textit{components} \,\} \\
\\
\textit{bindingMessageRefComps} = \{\, x : \textit{BindingMessageReference} \mid \\
\quad \textit{bindingMessageRef}(x) \in \textit{components} \,\} \\
\\
\textit{bindingFaultRefComps} = \{\, x : \textit{BindingFaultReference} \mid \\
\quad \textit{bindingFaultRef}(x) \in \textit{components} \,\} \\
\hline
\end{array}
$$

See *ComponentModel1, Binding, BindingFault, BindingOperation, BindingMessageReference, BindingFaultReference.*

Let *BindingComponentIds* define the subsets of component identifiers that are related to the Binding component:

- Let *bindingIds* be the subset of Binding component identifiers.
- Let *bindingFaultIds* be the subset of Binding Fault component identifiers.
- Let *bindingOpIds* be the subset of Binding Operation component identifiers.
- Let *bindingMessageRefIds* be the subset of Binding Message Reference component identifiers.
- Let *bindingFaultRefIds* be the subset of Binding Fault Reference component identifiers.

BindingComponentIds

BindingComponents
$bindingIds : \mathbb{P}\ ID$
$bindingFaultIds : \mathbb{P}\ ID$
$bindingOpIds : \mathbb{P}\ ID$
$bindingMessageRefIds : \mathbb{P}\ ID$
$bindingFaultRefIds : \mathbb{P}\ ID$

$bindingIds = \{\ x : bindingComps \bullet x.id\ \}$
$bindingFaultIds = \{\ x : bindingFaultComps \bullet x.id\ \}$
$bindingOpIds = \{\ x : bindingOpComps \bullet x.id\ \}$
$bindingMessageRefIds = \{\ x : bindingMessageRefComps \bullet x.id\ \}$
$bindingFaultRefIds = \{\ x : bindingFaultRefComps \bullet x.id\ \}$

See *BindingComponents, ID.*

Let *ServiceComponents* define the subsets of components that are related to the Service component:

- Let *serviceComps* be the subset of Service components.
- Let *endpointComps* be the subset of Endpoint components.

ServiceComponents

*ComponentModel*1
$serviceComps : \mathbb{P}\ Service$
$endpointComps : \mathbb{P}\ Endpoint$

$serviceComps = \{\ x : Service \mid$
$\quad service(x) \in components\ \}$

$endpointComps = \{\ x : Endpoint \mid$
$\quad endpoint(x) \in components\ \}$

See *ComponentModel1, Service, Endpoint.*

Let *ServiceComponentIds* define the subsets of component identifiers that are related to the Service component:

- Let *serviceIds* be the subset of Service component identifiers.
- Let *endpointIds* be the subset of Endpoint component identifiers.

ServiceComponentIds

ServiceComponents
$serviceIds : \mathbb{P}\ ID$
$endpointIds : \mathbb{P}\ ID$

$serviceIds = \{\ x : serviceComps \bullet x.id\ \}$
$endpointIds = \{\ x : endpointComps \bullet x.id\ \}$

See *ServiceComponents, ID.*

Let *OtherComponents* define the subsets of the other component types:

- Let *descriptionComps* be the subset of Description components.
- Let *elementDeclComps* be the subset of Element Declaration components.
- Let *typeDefComps* be the subset of Type Definition components.
- Let *featureComps* be the subset of Feature components.
- Let *propertyComps* be the subset of Property components.

OtherComponents

$$
\begin{array}{l}
ComponentModel1 \\
descriptionComps : \mathbb{P}\ Description \\
elementDeclComps : \mathbb{P}\ ElementDeclaration \\
typeDefComps : \mathbb{P}\ TypeDefinition \\
featureComps : \mathbb{P}\ Feature \\
propertyComps : \mathbb{P}\ Property \\
\hline
descriptionComps = \{\, x : Description \mid \\
\quad description(x) \in components \,\} \\
\\
elementDeclComps = \{\, x : ElementDeclaration \mid \\
\quad elementDecl(x) \in components \,\} \\
\\
typeDefComps = \{\, x : TypeDefinition \mid \\
\quad typeDef(x) \in components \,\} \\
\\
featureComps = \{\, x : Feature \mid \\
\quad feature(x) \in components \,\} \\
\\
propertyComps = \{\, x : Property \mid \\
\quad property(x) \in components \,\}
\end{array}
$$

See *ComponentModel1, Description, ElementDeclaration, TypeDefinition, Feature, Property.*

Let *OtherComponentIds* define the subsets of other component identifiers:

- Let *descriptionIds* be the subset of Description component identifiers.
- Let *elementDeclIds* be the subset of Element Declaration component identifiers.
- Let *typeDefIds* be the subset of Type Definition component identifiers.
- Let *featureIds* be the subset of Feature component identifiers.

- Let *propertyIds* be the subset of Property component identifiers.

$$
\begin{array}{|l}
\hline
\textit{OtherComponentIds} \\
\textit{OtherComponents} \\
\textit{descriptionIds} : \mathbb{P}\ \textit{ID} \\
\textit{elementDeclIds} : \mathbb{P}\ \textit{ID} \\
\textit{typeDefIds} : \mathbb{P}\ \textit{ID} \\
\textit{featureIds} : \mathbb{P}\ \textit{ID} \\
\textit{propertyIds} : \mathbb{P}\ \textit{ID} \\
\hline
\textit{descriptionIds} = \{\, x : \textit{descriptionComps} \bullet x.\textit{id} \,\} \\
\textit{elementDeclIds} = \{\, x : \textit{elementDeclComps} \bullet x.\textit{id} \,\} \\
\textit{typeDefIds} = \{\, x : \textit{typeDefComps} \bullet x.\textit{id} \,\} \\
\textit{featureIds} = \{\, x : \textit{featureComps} \bullet x.\textit{id} \,\} \\
\textit{propertyIds} = \{\, x : \textit{propertyComps} \bullet x.\textit{id} \,\} \\
\hline
\end{array}
$$

See *OtherComponents, ID.*

Let *ComponentModel*2 be the basic component model, augmented with the definitions of the subsets of each component type and their corresponding identifiers:

$$
\begin{array}{l}
\textit{ComponentModel}2 \mathrel{\widehat{=}} \\
\quad \textit{InterfaceComponentIds} \land \\
\quad \textit{BindingComponentIds} \land \\
\quad \textit{ServiceComponentIds} \land \\
\quad \textit{OtherComponentIds}
\end{array}
$$

See *InterfaceComponentIds, BindingComponentIds, ServiceComponentIds, OtherComponentIds.*

The definition of *ComponentModel*2 is an example of Z Notation *schema conjunction*. In Z schema conjunction, the resulting Z schema, e.g. *ComponentModel*2, contains all the fields of the conjoined Z schemas, e.g. *InterfaceComponentIds*, *BindingComponentIds*, *ServiceComponentIds*, and *OtherComponentIds*, and its constraint is the conjunction (logical and) of their constraints.

Many of the component types in the component model have a set of Feature components and a set of Property components, in addition to an identifer. It is convenient to group these common fields into a base Z schema that can be included in other component schemas.

Let *Base* be the common base Z schema for all component types that have an identifier and contain sets of Feature and Property components:

$$
\begin{array}{|l}
\hline
\textit{Base} \\
\textit{Identifier} \\
\textit{Features} \\
\textit{Properties} \\
\hline
\end{array}
$$

See *Identifier, Features, Properties.*

The base properties of a component are valid when the Features and Properties properties are valid:

Let *BaseValid* be this validity constraint on the base fields of a component:

BaseValid

IdentifierValid
FeaturesValid
PropertiesValid

See *IdentifierValid, FeaturesValid, PropertiesValid.*

Nested components have an additional parent property.

Let *NestedBase* be the common base schema for all nested component types:

NestedBase

Base
Parent

See *Base, Parent.*

The properties of a nested base component are valid when the base properties are valid and the parent property is valid.

Let *NestedBaseValid* be the validity constraints for nested components:

NestedBaseValid

BaseValid
ParentValid

See *BaseValid, ParentValid.*

Properties are unordered and unique with respect to the component they are associated with. Individual properties' definitions may constrain their content (e.g., to a typed value, another component, or a set of typed values or components), and components may require the presence of a property to be considered conformant. Such properties are marked as REQUIRED, whereas those that are not required to be present are marked as OPTIONAL. By convention, when specifying the mapping rules from the XML Infoset representation of a component to the component itself, an optional property that is absent in the component in question is described as being "empty". Unless otherwise specified, when a property is identified as being a collection (a set or a list), its value may be a 0-element (empty) collection. In order to simplify the presentation of the rules that deal with sets of components, for all OPTIONAL properties whose type is a set, the absence of such a property from a component MUST be treated as semantically equivalent to the presence of a property with the same

name and whose value is the empty set. In other words, every OPTIONAL set-valued property MUST be assumed to have the empty set as its default value, to be used in case the property is absent.

An OPTIONAL simple property type is treated as a set-valued type that contains at most one member. If the property is absent then its value is the empty set. If the property is present then its value is the singleton set that contains the actual value of the property.

Let $OPTIONAL[X]$ be the OPTIONAL values of type X where X is a property type:

$$[X]$$
$$OPTIONAL : \mathbb{P}(\mathbb{P}\, X)$$
$$OPTIONAL = \{\varnothing\} \cup \{\, x : X \bullet \{x\}\,\}$$

- An optional value of type X is either the empty set or a singleton set that contains one member of X.

For example, $OPTIONAL[\{True, False\}] = \{\varnothing, \{True\}, \{False\}\}$.

The definition of $OPTIONAL$ is an example of Z Notation *generic definition*. A Z generic definition defines an object whose type depends on the types of one or more sets that are given as arguments to the definition. A Z generic definition is similar to a generic, template, or parameterized type that are found in common programming languages.

Component definitions are serializable in XML 1.0 format but are independent of any particular serialization of the component model. Component definitions use a subset (see **2.16 XML Schema 1.0 Simple Types Used in the Component Model**) of the simple types defined by the XML Schema 1.0 specification [*XML Schema: Datatypes*].

In addition to the direct XML Infoset representation described here, the component model allows components external to the Infoset through the mechanisms described in **4 Modularizing WSDL 2.0 descriptions**.

A component model can be extracted from a given XML Infoset which conforms to the XML Schema for WSDL 2.0 by recursively mapping Information Items to their identified components, starting with the `wsdl:description` *element information item*. This includes the application of the mechanisms described in **4 Modularizing WSDL 2.0 descriptions**.

This document does not specify a means of producing an XML Infoset representation from a component model instance. In particular, there are in general many valid ways to modularize a given component model instance into one or more XML Infosets.

2.1 Description

2.1.1 The Description Component

At the abstract level, the Description component is just a container for two categories of components: WSDL 2.0 components and type system components.

WSDL 2.0 components are interfaces, bindings and services. Type system components are element declarations and type definitions.

Type system components describe the constraints on a message's content. By default, these constraints are expressed in terms of the [*XML Information Set*], i.e. they define the [local name], [namespace name], [children] and [attributes] properties of an *element information item*. Type systems based upon other data models are generally accommodated by extensions to WSDL 2.0; see **6 Language Extensibility**. In the case where they define information equivalent to that of a XML Schema global element declaration, they can be treated as if they were such a declaration.

This specification does not define the behavior of a WSDL 2.0 document that uses multiple schema languages for describing type system components simultaneously.

Let *ElementContentModel* be the set of all models that define the allowable values for the [children] and [attribute] properties of an *element information item*:

[*ElementContentModel*]

The detailed structure of *ElementContentModel* is immaterial for the purposes of this specification. It is can be safely thought of as some superset of the set of all XML Schema complex type definitions.

An Element Declaration component defines the name and content model of an *element information item* such as that defined by an XML Schema global element declaration. It has a name property that is the QName of the *element information item* and a system property that is the namespace IRI of the extension *element information item*s for the type system, e.g. the namespace of XML Schema.

Let *ElementDeclaration* be the type of Element Declaration components:

- Let *name* be the QName defined by the [local name] and [namespace name] properties of the *element information item*.
- Let *system* be the namespace IRI of the type system.
- Let *elementContentModel* be the element content model that constrains the allowable contents of the [children] and [attribute] properties of the *element information item*.

ElementDeclaration

Identifier
name : *QName*
system : *AbsoluteURI*
elementContentModel : *ElementContentModel*

See *QName, AbsoluteURI, ElementContentModel.*

Each Element Declaration component is uniquely identified by the combination of its name and system properties within the component model.

Let *ElementDeclarationCM* express this constraint:

ElementDeclarationCM

*ComponentModel*2

$$\forall x, y : elementDeclComps \mid x.name = y.name \land x.system = y.system \bullet x = y$$

See *ComponentModel2.*

- No two Element Declaration components have the same name and system properties.

A Type Definition component defines the content model of an *element information item* such as that defined by an XML Schema global type definition. It has a name property that is the QName of the type and a system property that is the namespace IRI of the extension *element information item*s for the type system, e.g. the namespace of XML Schema.

Let *TypeDefinition* be the type of the Type Definition component:

- Let *name* be the QName of the type definition.
- Let *system* be the namespace IRI of the type system.
- Let *elementContentModel* be the element content model that constrains the allowable contents of the [children] and [attribute] properties of the *element information item* described by the type definition.

TypeDefinition

Identifier
name : *QName*
system : *AbsoluteURI*
elementContentModel : *ElementContentModel*

See *QName, AbsoluteURI, ElementContentModel.*

Each Type Definition component is uniquely identified by the combination of its name and system properties within the component model.

Let *TypeDefinitionCM* express this constraint:

TypeDefinitionCM

*ComponentModel*2

$$\forall x, y : typeDefComps \mid x.name = y.name \land x.system = y.system \bullet x = y$$

See *ComponentModel2*.

- No two Type Definition components have the same name and system properties.

Interface, Binding, Service, Element Declaration, and Type Definition components are directly contained in the Description component and are referred to as *top-level components*. The top-level WSDL 2.0 components contain other components, e.g. Interface Operation and Endpoint, which are referred to as *nested components*. Nested components may contain other nested components. The component that contains a nested component is referred to as the *parent* of the nested components. Nested components have a parent property that is a reference to their parent component.

Let *TopLevelComponent* be the set of all top-level components:

$$TopLevelComponent == \text{ran}\, elementDecl \cup \text{ran}\, typeDef \cup \text{ran}\, interface \cup \text{ran}\, binding \cup \text{ran}\, service$$

See *Component*.

Let *Name* map a top-level component to its QName name property:

$$Name : TopLevelComponent \longrightarrow QName$$

$$\forall x : ElementDeclaration \bullet Name(elementDecl(x)) = x.name$$

$$\forall x : TypeDefinition \bullet Name(typeDef(x)) = x.name$$

$$\forall x : Interface \bullet Name(interface(x)) = x.name$$

$$\forall x : Binding \bullet Name(binding(x)) = x.name$$

$$\forall x : Service \bullet Name(service(x)) = x.name$$

See *TopLevelComponent, QName, Component, ElementDeclaration, TypeDefinition, Interface, Binding, Service.*

Let *Parent* represent the parent property of a nested component:

Parent

$Identifier$
$parent : ID$

See *Identifier, ID.*

The parent of a nested component in the component model MUST also be in the component model. No component is its own parent.

Let *ParentValid* represent these validity constraints:

ParentValid

$ComponentModel1$
$Parent$

$parent \in componentIds$
$parent \neq id$

See *ComponentModel1, Parent.*

Let *NestedComponent* be the set of all nested components:

$$
\begin{aligned}
&\mathit{NestedComponent} == \\
&\quad \operatorname{ran} \mathit{interfaceFault} \cup \\
&\quad \operatorname{ran} \mathit{interfaceOp} \cup \\
&\quad \operatorname{ran} \mathit{interfaceMessageRef} \cup \\
&\quad \operatorname{ran} \mathit{interfaceFaultRef} \cup \\
&\quad \operatorname{ran} \mathit{bindingFault} \cup \\
&\quad \operatorname{ran} \mathit{bindingOp} \cup \\
&\quad \operatorname{ran} \mathit{bindingMessageRef} \cup \\
&\quad \operatorname{ran} \mathit{bindingFaultRef} \cup \\
&\quad \operatorname{ran} \mathit{endpoint} \cup \\
&\quad \operatorname{ran} \mathit{feature} \cup \\
&\quad \operatorname{ran} \mathit{property}
\end{aligned}
$$

See *Component.*

Let *ParentId* map a nested component to its parent component identifier:

$$
\begin{aligned}
&\mathit{ParentId} : \mathit{NestedComponent} \longrightarrow \mathit{ID} \\
&\hline
&\forall\, x : \mathit{InterfaceFault} \bullet \\
&\quad \mathit{ParentId}(\mathit{interfaceFault}(x)) = x.\mathit{parent} \\
&\forall\, x : \mathit{InterfaceOperation} \bullet \\
&\quad \mathit{ParentId}(\mathit{interfaceOp}(x)) = x.\mathit{parent} \\
&\forall\, x : \mathit{InterfaceMessageReference} \bullet \\
&\quad \mathit{ParentId}(\mathit{interfaceMessageRef}(x)) = x.\mathit{parent} \\
&\forall\, x : \mathit{InterfaceFaultReference} \bullet \\
&\quad \mathit{ParentId}(\mathit{interfaceFaultRef}(x)) = x.\mathit{parent} \\
&\forall\, x : \mathit{BindingFault} \bullet \\
&\quad \mathit{ParentId}(\mathit{bindingFault}(x)) = x.\mathit{parent} \\
&\forall\, x : \mathit{BindingOperation} \bullet \\
&\quad \mathit{ParentId}(\mathit{bindingOp}(x)) = x.\mathit{parent} \\
&\forall\, x : \mathit{BindingMessageReference} \bullet \\
&\quad \mathit{ParentId}(\mathit{bindingMessageRef}(x)) = x.\mathit{parent} \\
&\forall\, x : \mathit{BindingFaultReference} \bullet \\
&\quad \mathit{ParentId}(\mathit{bindingFaultRef}(x)) = x.\mathit{parent} \\
&\forall\, x : \mathit{Endpoint} \bullet \\
&\quad \mathit{ParentId}(\mathit{endpoint}(x)) = x.\mathit{parent} \\
&\forall\, x : \mathit{Feature} \bullet \\
&\quad \mathit{ParentId}(\mathit{feature}(x)) = x.\mathit{parent} \\
&\forall\, x : \mathit{Property} \bullet \\
&\quad \mathit{ParentId}(\mathit{property}(x)) = x.\mathit{parent}
\end{aligned}
$$

See *NestedComponent, ID, InterfaceFault, InterfaceOperation, InterfaceMessageReference, InterfaceFaultReference, BindingFault, BindingOperation, BindingMessageReference, BindingFaultReference, Endpoint, Feature, Property.*

The properties of the Description component are as follows:

- interfaces OPTIONAL. A set of Interface components.
- bindings OPTIONAL. A set of Binding components.
- services OPTIONAL. A set of Service components.
- element declarations OPTIONAL. A set of Element Declaration components.
- type definitions OPTIONAL. A set of Type Definition components.

Let *Description* be the set of all Description components:

Description

$$
\begin{array}{l}
Identifier \\
interfaces : \mathbb{P}\ ID \\
bindings : \mathbb{P}\ ID \\
services : \mathbb{P}\ ID \\
elementDeclarations : \mathbb{P}\ ID \\
typeDefinitions : \mathbb{P}\ ID
\end{array}
$$

See *ID.*

The type definitions property of the Description component contains all of the built-in datatypes defined by XML Schema Part 2: Datatypes Second Edition [*XML Schema: Datatypes*], namely the nineteen primitive datatypes `xs:string`, `xs:boolean`, `xs:decimal`, `xs:float`, `xs:double`, `xs:duration`, `xs:dateTime`, `xs:time`, `xs:date`, `xs:gYearMonth`, `xs:gYear`, `xs:gMonthDay`, `xs:gDay`, `xs:gMonth`, `xs:hexBinary`, `xs:base64`, `xs:Binary`, `xs:anyURI`, `xs:QName`, `xs:NOTATION`, and the twenty-five derived datatypes `xs:normalizedString`, `xs:token`, `xs:language`, `xs:NMTOKEN`, `xs:NMTOKENS`, `xs:Name`, `xs:NCName`, `xs:ID`, `xs:IDREF`, `xs:IDREFS`, `xs:ENTITY`, `xs:ENTITIES`, `xs:integer`, `xs:nonPositiveInteger`, `xs:negativeInteger`, `xs:long`, `xs:int`, `xs:short`, `xs:byte`, `xs:nonNegativeInteger`, `xs:unsignedLong`, `xs:unsignedInt`, `xs:unsignedShort`, `xs:unsignedByte`, `xs:positiveInteger`.

Let the built-in XML schema datatypes correspond to the following Type Definition components:

$$stringTD, booleanTD, decimalTD, floatTD, doubleTD,$$
$$durationTD, dateTimeTD, timeTD, dateTD,$$
$$gYearMonthTD, gYearTD, gMonthDayTD, gDayTD,$$
$$gMonthTD, hexBinaryTD, base64TD, BinaryTD,$$
$$anyURITD, QNameTD, NOTATIONTD, normalizedStringTD,$$
$$tokenTD, languageTD, NMTOKENTD, NMTOKENSTD,$$
$$NameTD, NCNameTD, IDTD, IDREFTD, IDREFSTD,$$
$$ENTITYTD, ENTITIESTD, integerTD,$$
$$nonPositiveIntegerTD, negativeIntegerTD,$$
$$longTD, intTD, shortTD, byteTD,$$
$$nonNegativeIntegerTD, unsignedLongTD, unsignedIntTD,$$
$$unsignedShortTD, unsignedByteTD, positiveIntegerTD : TypeDefinition$$

See *TypeDefinition*.

Let *BuiltInTypeDefComps* be the set of all the built-in XML schema Type Definition components:

$$BuiltInTypeDefComps ==$$
$$\{stringTD, booleanTD, decimalTD, floatTD, doubleTD,$$
$$durationTD, dateTimeTD, timeTD, dateTD,$$
$$gYearMonthTD, gYearTD, gMonthDayTD, gDayTD,$$
$$gMonthTD, hexBinaryTD, base64TD, BinaryTD,$$
$$anyURITD, QNameTD, NOTATIONTD, normalizedStringTD,$$
$$tokenTD, languageTD, NMTOKENTD, NMTOKENSTD,$$
$$NameTD, NCNameTD, IDTD, IDREFTD, IDREFSTD,$$
$$ENTITYTD, ENTITIESTD, integerTD,$$
$$nonPositiveIntegerTD, negativeIntegerTD,$$
$$longTD, intTD, shortTD, byteTD,$$
$$nonNegativeIntegerTD, unsignedLongTD, unsignedIntTD,$$
$$unsignedShortTD, unsignedByteTD, positiveIntegerTD\}$$

See *stringTD....*

Let *XMLSchemaURI* be the namespace URI of XML Schema:

$$XMLSchemaURI : AbsoluteURI$$

See *AbsoluteURI*.

Both the namespace name of the name property and the system property of each built-in datatypes is the XML Schema URI:

$$\forall x : BuiltInTypeDefComps \bullet$$
$$x.name.namespaceName = x.system = XMLSchemaURI$$

See *BuiltInTypeDefComps*.

Let *BuiltInTypeDefIds* be the set of ids of the built-in datatypes:

$$BuiltInTypeDefIds == \{ x : BuiltInTypeDefComps \bullet x.id \}$$

See *BuiltInTypeDefComps.*

The built-in datatypes are distinct so there are forty-four ids in total:

$$\#BuiltInTypeDefIds = 44$$

The XML Schema built-in datatypes are also built into WSDL 2.0.
Let *DescriptionTypeDefs* express this constraint on the Description:

DescriptionTypeDefs

$$ComponentModel2$$

$$BuiltInTypeDefComps \subseteq typeDefComps$$

See *ComponentModel2, BuiltInTypeDefComps.*

The component model contains a unique Description component.
Let *DescriptionKey* express this constraint on the Description component:

- Let *descriptionComp* be the unique Description component.

DescriptionKey

$$ComponentModel2$$
$$descriptionComp : Description$$

$$descriptionComps = \{descriptionComp\}$$

See *ComponentModel2, Description.*

- The component model contains a unique Description component.

Each component refered to by the properties of the Description component must exist in the component model.

Let *DescriptionCM* express these referential integrity constraints on the Description component:

DescriptionCM

$$DescriptionTypeDefs$$
$$DescriptionKey$$

$$descriptionComp.interfaces = interfaceIds$$
$$descriptionComp.bindings = bindingIds$$
$$descriptionComp.services = serviceIds$$
$$descriptionComp.elementDeclarations = elementDeclIds$$
$$descriptionComp.typeDefinitions = typeDefIds$$

See *DescriptionTypeDefs, DescriptionKey.*

- The Description component contains exactly the set of Interface components contained in the component model.
- The Description component contains exactly the set of Binding components contained in the component model.
- The Description component contains exactly the set of Service components contained in the component model.
- The Description component contains exactly the set of Element Declaration components contained in the component model.
- The Description component contains exactly the set of Type Definition components contained in the component model.

The set of top-level components contained in the Description component associated with an initial WSDL 2.0 document consists of the components defined in the initial document and the components associated with the documents that the initial document includes and the namespaces that the initial document imports. The component model makes no distinction between the components that are defined in the initial document versus those that are defined in the included documents or imported namespaces.

However, any WSDL 2.0 document that contains component definitions that refer by QName to WSDL 2.0 components that belong to a different namespace MUST contain a `wsdl:import` *element information item* for that namespace (see **4.2 Importing Descriptions**).

Furthermore, all QName references, whether to the same or to different namespaces MUST resolve to components (see **2.19 QName resolution**).

In addition to WSDL 2.0 components and type system components, additional extension components MAY be added via extensibility **6 Language Extensibility**. Further, additional properties to WSDL 2.0 and type system components MAY also be added via extensibility.

2.1.2 XML Representation of Description Component

```
<description
      targetNamespace="xs:anyURI" >
  <documentation />*
  [ <import /> | <include /> ]*
  <types />?
  [ <interface /> | <binding /> | <service /> ]*
</description>
```

WSDL 2.0 definitions are represented in XML by one or more WSDL 2.0 Information Sets (Infosets), that is one or more `description` *element information item*s. A WSDL 2.0 Infoset contains representations for a collection of

WSDL 2.0 components that share a common target namespace. A WSDL 2.0 Infoset that contains one or more `wsdl:import` *element information items* **4.2 Importing Descriptions** corresponds to a collection with components drawn from multiple target namespaces.

The components directly defined or included within a Description component are said to belong to the same *target namespace*. The target namespace therefore groups a set of related component definitions and represents an unambiguous name for the intended semantics of the collection of components. The value of the `targetNamespace` *attribute information item* SHOULD be dereferenceable. It SHOULD resolve to a human or machine processable document that directly or indirectly defines the intended semantics of those components. It MAY resolve to a WSDL 2.0 document that provides service description information for that namespace.

If a WSDL 2.0 document is split into multiple WSDL 2.0 documents (which may be combined as needed via **4.1 Including Descriptions**), then the `targetNamespace` *attribute information item* SHOULD resolve to a master WSDL 2.0 document that includes all the WSDL 2.0 documents needed for that service description. This approach enables the WSDL 2.0 component designator fragment identifiers to be properly resolved.

Imported components have different target namespace values from the WSDL 2.0 document that is importing them. Thus importing is the mechanism to use components from one namespace in definition of components from another namespace.

Each WSDL 2.0 or type system component of the same kind MUST be uniquely identified by its qualified name.

That is, if two distinct components of the same kind (Interface, Binding, etc.) are in the same target namespace, then their QNames MUST be unique. However, different kinds of components (e.g., an Interface component and a Binding component) MAY have the same QName. Thus, QNames of components must be unique within the space of those components in a given target namespace.

The `description` *element information item* has the following Infoset properties:

- A [local name] of `description`.
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`.
- One or more *attribute information items* amongst its [attributes] as follows:
  - A REQUIRED `targetNamespace` *attribute information item* as described below in **2.1.2** `targetNamespace` ***attribute information item***.
  - Zero or more namespace qualified *attribute information items* whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

- Zero or more *element information item*s amongst its [children], in order as follows:

  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. Zero or more *element information item*s from among the following, in any order:
     - Zero or more `include` *element information item*s (see **4.1 Including Descriptions**)
     - Zero or more `import` *element information item*s (see **4.2 Importing Descriptions**)
     - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
  3. An OPTIONAL `types` *element information item* (see **3 Types**).
  4. Zero or more *element information item*s from among the following, in any order:
     - `interface` *element information item*s (see **2.2.2 XML Representation of Interface Component**).
     - `binding` *element information item*s (see **2.9.2 XML Representation of Binding Component**).
     - `service` *element information item*s (see **2.14.2 XML Representation of Service Component**).
     - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

`targetNamespace` ***attribute information item***

The `targetNamespace` *attribute information item* defines the namespace affiliation of top-level components defined in this `description` *element information item*. Interface, Binding and Service are top-level components.

The `targetNamespace` *attribute information item* has the following Infoset properties:

- A [local name] of `targetNamespace`
- A [namespace name] which has no value

The type of the `targetNamespace` *attribute information item* is *xs:anyURI*. Its value MUST be an absolute IRI (see [*IETF RFC 3987*]) and should be dereferenceable.

2.1.3 Mapping Description's XML Representation to Component Properties

The mapping from the XML Representation of the `description` *element information item* (see **2.1.2 XML Representation of Description Component**) to the properties of the Description component is described in Table 2.1 .

Table 2.1: Mapping from XML Representation to Description Component Properties

Property	Value
interfaces	The set of Interface components corresponding to all the `interface` *element information item*s in the [children] of the `description` *element information item*, if any, plus any included (via `wsdl:include`) or imported (via `wsdl:import`) Interface components (see **4 Modularizing WSDL 2.0 descriptions**).
bindings	The set of Binding components corresponding to all the `binding` *element information item*s in the [children] of the `description` *element information item*, if any, plus any included (via `wsdl:include`) or imported (via `wsdl:import`) Binding components (see **4 Modularizing WSDL 2.0 descriptions**).
services	The set of Service components corresponding to all the `service` *element information item*s in the [children] of the `description` *element information item*, if any, plus any included (via `wsdl:include`) or imported (via `wsdl:import`) Service components (see **4 Modularizing WSDL 2.0 descriptions**).
element declarations	The set of Element Declaration components corresponding to all the element declarations defined as descendants of the `types` *element information item*, if any, plus any included (via `xs:include`) or imported (via `xs:import`) Element Declaration components. At a minimum this will include all the global element declarations defined by XML Schema `element` *element information item*s. It MAY also include any declarations from some other type system which describes the [local name], [namespace name], [attributes] and [children] properties of an *element information item*. Each XML Schema element declaration MUST have a unique QName.
type definitions	The set of Type Definition components corresponding to all the type definitions defined as descendants of the `types` *element information item*, if any, plus any (via `xs:include`) or imported (via `xs:import`) Type Definition components. At a minimum this will include all the global type definitions defined by XML Schema `simpleType` and `complexType` *element information item*s. It MAY also include any definitions from some other type system which describes the [attributes] and [children] properties of an *element information item*. Each XML Schema type definition MUST have a unique QName.

2.2 Interface

2.2.1 The Interface Component

An Interface component describes sequences of messages that a service sends and/or receives. It does this by grouping related messages into operations. An operation is a sequence of input and output messages, and an interface is a set of operations.

An interface can optionally extend one or more other interfaces.

To avoid circular definitions, an interface MUST NOT appear as an element of the set of interfaces it extends, either directly or indirectly.

The set of operations available in an interface includes all the operations defined by the interfaces it extends, along with any operations it directly defines. The operations directly defined on an interface are referred to as the *declared* operations of the interface. In the process, operation components that are equivalent per **2.17 Equivalence of Components** are treated as one. The interface extension mechanism behaves in a similar way for all other components that can be defined inside an interface, namely Interface Fault, Feature and Property components.

Interfaces are named constructs and can be referred to by QName (see **2.19 QName resolution**). For instance, Binding components refer to interfaces in this way.

The properties of the Interface component are as follows:

- name REQUIRED. An *xs:QName*.
- extended interfaces OPTIONAL. A set of declared Interface components which this interface extends.
- interface faults OPTIONAL. The set of declared Interface Fault components. The namespace name of the name property of each Interface Fault in this set MUST be the same as the namespace name of the name property of this Interface component.
- interface operations OPTIONAL. A set of declared Interface Operation components. The namespace name of the name property of each Interface Operation in this set MUST be the same as the namespace name of the name property of this Interface component.
- features OPTIONAL. A set of declared Feature components.
- properties OPTIONAL. A set of declared Property components.

Let *Interface* be the set of all Interface components:

- Let *allExtendedInterfaces* be the set off all interfaces that are extended directly or indirectly by this interface.
- Let *allInterfaceFaults* be the set of all faults that are directly or indirectly on this interface.

- Let *allInterfaceOperations* be the set of all operations that are directly or indirectly on this interface.

Interface

$$
\begin{array}{l}
Base \\
name : QName \\
extendedInterfaces : \mathbb{P}\ ID \\
interfaceFaults : \mathbb{P}\ ID \\
interfaceOperations : \mathbb{P}\ ID \\
\\
allExtendedInterfaces : \mathbb{P}\ ID \\
allInterfaceFaults : \mathbb{P}\ ID \\
allInterfaceOperations : \mathbb{P}\ ID \\
\hline
extendedInterfaces \subseteq allExtendedInterfaces \\
interfaceFaults \subseteq allInterfaceFaults \\
interfaceOperations \subseteq allInterfaceOperations
\end{array}
$$

See *Base, QName, ID.*

Each component referenced by an Interface component must exist in the component model.

Let *InterfaceRI* express the referential integrity constraints on the Interface component:

InterfaceRI

$$
\begin{array}{l}
ComponentModel2 \\
\hline
\forall\, Interface \mid \theta Interface \in interfaceComps \bullet \\
\quad BaseValid \land \\
\quad extendedInterfaces \subset interfaceIds \land \\
\quad interfaceFaults \subseteq interfaceFaultIds \land \\
\quad interfaceOperations \subseteq interfaceOpIds
\end{array}
$$

See *ComponentModel2, Interface, BaseValid.*

This Z schema introduces some additional notation. The universal quantifier $\forall\, Interface$ declares each field that is part of the *Interface* schema as an in-scope variable and constrains them to satify the rules for *Interface*. The expression $\theta Interface$ assembles these variables into *Interface* record or struct. The expression $\theta Interface \in interfaceComps$ constrains the *Interface* record to exist in the component model.

- Every Interface component satifies the base validity constraints.
- The Interface components extended by each Interface component are contained in the component model.

- The Interface Fault components of each Interface component are contained in the component model.
- The Interface Operation components of each Interface component are contained in the component model.

For each Interface component in the interfaces property of a Description component, the name property MUST be unique.

Let *InterfaceKey* express the QName uniqueness constraint on the Interface component:

InterfaceKey

$$\begin{array}{|l} ComponentModel2 \\ \hline \forall\, x, y : interfaceComps \mid \\ \quad x.name = y.name \bullet x = y \\ \hline \end{array}$$

See *ComponentModel2*.

- No two Interface components have the same name property.

An Interface component contains nested Interface Operation and Interface Fault components. These components MUST have the Interface component as their parent.

Let *InterfaceParent* express the constraints on the parent properties of the nested components of an Interface component:

InterfaceParent

$$\begin{array}{|l} ComponentModel2 \\ \hline \forall\, i : interfaceComps; \\ \quad if : interfaceFaultComps; \\ \quad io : interfaceOpComps \bullet \\ \quad if.id \in i.interfaceFaults \Leftrightarrow if.parent = i.id \land \\ \quad io.id \in i.interfaceOperations \Leftrightarrow io.parent = i.id \\ \hline \end{array}$$

See *ComponentModel2*.

- The set of Interface Fault components contained by an Interface component is exactly the set of Interface Fault components that have that Interface component as their parent.
- The set of Interface Operation components contained by an Interface component is exactly the set of Interface Operation components that have that Interface component as their parent.

The set of all extended interfaces that are available on an Interface component consist of those that are declared on the component and those that are available on its extended interfaces.

Let *InterfaceAllExtendedInterfaces* express this definition:

InterfaceAllExtendedInterfaces

ComponentModel2

$$\forall\, i : interfaceComps \bullet$$
$$\quad i.allExtendedInterfaces = i.extendedInterfaces \cup$$
$$\quad\quad \{\, x : interfaceComps;\ y : ID \mid$$
$$\quad\quad\quad x.id \in i.extendedInterfaces \land$$
$$\quad\quad\quad y \in x.allExtendedInterfaces \bullet y \,\}$$

See *ComponentModel2.*

- An Interface component directly or indirectly extends an Interface component if it directly extends it, or if an Interface component that it directly extends, directly or indirectly extends it.

An Interface component MUST NOT directly or indirectly extend itself.
Let *InterfaceExtendsAcyclic* express this constraint:

InterfaceExtendsAcyclic

ComponentModel2

$$\forall\, i : interfaceComps \bullet$$
$$\quad i.id \notin i.allExtendedInterfaces$$

See *ComponentModel2.*

The set of all Interface Operation components that are available on an Interface component consist of those that are contained by the Interface component and those that are available on Interface components that it directly or indirectly extends.

Let *InterfaceAllInterfaceOperations* express this definition:

InterfaceAllInterfaceOperations

ComponentModel2

$$\forall\, i : interfaceComps \bullet$$
$$\quad i.allInterfaceOperations = i.interfaceOperations \cup$$
$$\quad\quad \{\, x : interfaceComps;\ y : ID \mid$$
$$\quad\quad\quad x.id \in i.allExtendedInterfaces \land$$
$$\quad\quad\quad y \in x.interfaceOperations \bullet y \,\}$$

See *ComponentModel2.*

- An Interface Operation component is available on an Interface component if it is contained by the Interface component or it is available on an an Interface component that this Interface component directly or indirectly extends.

The set of all Interface Operation components that are available on an Interface component consist of those that are contained by the Interface component and those that are available on Interface components that it directly or indirectly extends.

Let *InterfaceAllInterfaceFaults* express this definition:

InterfaceAllInterfaceFaults

ComponentModel2

$$\forall i : interfaceComps \bullet$$
$$i.allInterfaceFaults = i.interfaceFaults \cup$$
$$\{ x : interfaceComps; y : ID \mid$$
$$x.id \in i.allExtendedInterfaces \land$$
$$y \in x.interfaceFaults \bullet y \}$$

See *ComponentModel2.*

- An Interface Fault component is available on an Interface component if it is contained by the Interface component or it is available on an an Interface component that this Interface component directly or indirectly extends.

Let *InterfaceCM* be the conjunction of all the component model constraints on Interface components.

$$InterfaceCM \mathrel{\widehat=}$$
$$InterfaceRI \land$$
$$InterfaceKey \land$$
$$InterfaceParent \land$$
$$InterfaceAllExtendedInterfaces \land$$
$$InterfaceExtendsAcyclic \land$$
$$InterfaceAllInterfaceOperations \land$$
$$InterfaceAllInterfaceFaults$$

See *InterfaceRI, InterfaceKey, InterfaceParent, InterfaceAllExtendedInterfaces, InterfaceExtendsAcyclic, InterfaceAllInterfaceOperations, InterfaceAllInterfaceFaults.*

2.2.2 XML Representation of Interface Component

```
<description>
  <interface
        name="xs:NCName"
        extends="list of xs:QName"?
        styleDefault="list of xs:anyURI"? >
    <documentation />*
    [ <fault /> | <operation /> | <feature /> | <property /> ]*
  </interface>
</description>
```

The XML representation for an Interface component is an *element information item* with the following Infoset properties:

- A [local name] of `interface`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`
- One or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `name` *attribute information item* as described below in **2.2.2** `name` ***attribute information item*** **with** `interface` **[owner element]**.
  - An OPTIONAL `extends` *attribute information item* as described below in **2.2.2** `extends` ***attribute information item***.
  - An OPTIONAL `styleDefault` *attribute information item* as described below in **2.2.2** `styleDefault` ***attribute information item***.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item*s amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. Zero or more *element information item*s from among the following, in any order:
     - Zero or more `fault` *element information item*s **2.3.2 XML Representation of Interface Fault Component**.
     - Zero or more `operation` *element information item*s **2.4.2 XML Representation of Interface Operation Component**.
     - Zero or more `feature` *element information item*s **2.7.2 XML Representation of Feature Component**.
     - Zero or more `property` *element information item*s **2.8.2 XML Representation of Property Component**.
     - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

`name` *attribute information item* with `interface` [owner element]

The `name` *attribute information item* together with the `targetNamespace` *attribute information item* of the [parent] `description` *element information item* forms the QName of the interface.

The `name` *attribute information item* has the following Infoset properties:

- A [local name] of `name`
- A [namespace name] which has no value

The type of the `name` *attribute information item* is *xs:NCName*.

`extends` ***attribute information item***

The `extends` *attribute information item* lists the interfaces that this interface derives from.

The `extends` *attribute information item* has the following Infoset properties:

- A [local name] of `extends`
- A [namespace name] which has no value

The type of the `extends` *attribute information item* is a list of *xs:QName*.

`styleDefault` ***attribute information item***

The `styleDefault` *attribute information item* indicates the default style (see **2.4.1 Operation Style**) used to construct the element declaration properties of interface message references of all operations contained within the [owner element] `interface`.

The `styleDefault` *attribute information item* has the following Infoset properties:

- A [local name] of `styleDefault`.
- A [namespace name] which has no value.

The type of the `styleDefault` *attribute information item* is *list of xs:anyURI*. Its value, if present, MUST contain absolute IRIs (see [*IETF RFC 3987*]).

2.2.3 Mapping Interface's XML Representation to Component Properties

The mapping from the XML Representation of the `interface` *element information item* (see **2.2.2 XML Representation of Interface Component**) to the properties of the Interface component is as described in Table 2.2 .

Table 2.2: Mapping from XML Representation to Interface Component Properties

Property	Value
name	The QName whose local name is actual value of the `name` *attribute information item* and whose namespace name is the actual value of the `targetNamespace` *attribute information item* of the [parent] `description` *element information item*
extended interfaces	The set of Interface components resolved to by the values in the `extends` *attribute information item*, if any (see **2.19 QName resolution**).

interface faults	The set of Interface Fault components corresponding to the `fault` *element information item*s in [children], if any.
interface operations	The set of Interface Operation components corresponding to the `operation` *element information item*s in [children], if any.
features	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
properties	The set of Property components corresponding to the `property` *element information item*s in [children], if any.

Recall that, per **2.2.1 The Interface Component**, the Interface components in the extended interfaces property of a given Interface component MUST NOT contain that Interface component in any of their extended interfaces properties, that is to say, recursive extension of interfaces is disallowed.

2.3 Interface Fault

2.3.1 The Interface Fault Component

A fault is an event that occurs during the execution of a message exchange that disrupts the normal flow of messages.

A fault is typically raised when a party is unable to communicate an error condition inside the normal message flow, or a party wishes to terminate a message exchange. A fault message may be used to communicate out of band information such as the reason for the error, the origin of the fault, as well as other informal diagnostics such as a program stack trace.

An Interface Fault component describes a fault that MAY occur during invocation of an operation of the interface. The Interface Fault component declares an abstract fault by naming it and indicating the contents of the fault message. When and how the fault message flows is indicated by the Interface Operation component.

The Interface Fault component provides a clear mechanism to name and describe the set of faults an interface may generate. This allows operations to easily identify the individual faults they may generate by name. This mechanism allows the ready identification of the same fault occurring across multiple operations and referenced in multiple bindings as well as reducing duplication of description for an individual fault.

Faults other than the ones described in the Interface component may also be generated at run-time, i.e. faults are an open set. The Interface component describes faults that have application level semantics, i.e. that the client or service is expected to handle, and potentially recover from, as part of the

application processing logic. For example, an Interface component that accepts a credit card number may describe faults that indicate the credit card number is invalid, has been reported stolen, or has expired. The Interface component does not describe general system faults such as network failures, out of memory conditions, out of disk space conditions, invalid message formats, etc., although these faults may be generated as part of the message exchange. Such general system faults can reasonably be expected to occur in any message exchange and explicitly describing them in an Interface component is therefore uninformative.

The properties of the Interface Fault component are as follows:

- name REQUIRED. An *xs:QName*.
- element declaration OPTIONAL. A reference to a Element Declaration component in the element declarations property of the Description component. This element represents the content or "payload" of the fault.
- features OPTIONAL. A set of Feature components.
- properties OPTIONAL. A set of Property components.
- parent REQUIRED. The Interface component that contains this component in its interface faults property.

Let *InterfaceFault* be the set of all Interface Fault components:

$$
\begin{array}{|l}
\hline
\textit{InterfaceFault} \\
\textit{NestedBase} \\
\textit{name} : \textit{QName} \\
\textit{elementDeclaration} : \textit{OPTIONAL}[\textit{ID}] \\
\hline
\end{array}
$$

See *NestedBase, QName, OPTIONAL, ID.*

Each component referenced by an Interface Fault component must exist in the component model.

Let *InterfaceFaultRI* express the referential integrity constraints on the Interface Fault component:

$$
\begin{array}{|l}
\hline
\textit{InterfaceFaultRI} \\
\textit{ComponentModel2} \\
\hline
\forall\, \textit{InterfaceFault} \mid \theta \textit{InterfaceFault} \in \textit{interfaceFaultComps} \bullet \\
\quad \textit{NestedBaseValid} \land \\
\quad \textit{elementDeclaration} \subseteq \textit{elementDeclIds} \\
\hline
\end{array}
$$

See *ComponentModel2, InterfaceFault, NestedBaseValid.*

- Every Interface Fault component satifies the base validity constraints.
- The Element Declaration component of each Interface Fault component is contained in the component model.

For each Interface Fault component in the interface faults property of an Interface component, the name property must be unique.

Interface Fault components are uniquely identified by the the QName of the enclosing Interface component and QName of the Interface Fault component itself.

Let *InterfaceFaultKey* express the QName uniqueness constraint on the Interface Fault component:

InterfaceFaultKey

*ComponentModel*2

$$\forall x, y : interfaceFaultComps \mid x.parent = y.parent \land x.name = y.name \bullet x = y$$

See *ComponentModel2*.

- No two Interface Fault components contained by the same Interface component have the same name property.

Despite having a name property, Interface Fault components cannot be identified solely by their QName. Indeed, two Interface components whose name property value has the same namespace name, but different local names, can contain Interface Fault components with the same name property value. Thus, the name property of Interface Fault component is not sufficient to form the unique identity of an Interface Fault component. A method for uniquely identifying components is defined in **A.2 Fragment Identifiers** . See **A.2.5 The Interface Fault Component** for the definition of the fragment identifier for the Interface Fault component.

In cases where, due to an interface extending one or more other interfaces, two or more Interface Fault components have the same value for their name property, then the component models of those Interface Fault components MUST be equivalent (see **2.17 Equivalence of Components**).

If the Interface Fault components are equivalent then they are considered to collapse into a single component. It is an error if two Interface Fault components that are available in the same Interface component have the same value for their name properties but are not equivalent.

Let *InterfaceFaultNameUnique* express the uniqueness constraint on the name property of an Interface Fault component among all the Interface Fault components available in an Interface component:

InterfaceFaultNameUnique

ComponentModel2

$$\forall i : interfaceComps;$$
$$x, y : interfaceFaultComps \mid$$
$$x.id \in i.allInterfaceFaults \land$$
$$y.id \in i.allInterfaceFaults \land$$
$$x.name = y.name \bullet x = y$$

See *ComponentModel2.*

- No two Interface Fault components among all those available in the same Interface component have the same name property.

Note that, due to the above rules, if two interfaces that have the same value for the namespace name of their name property also have one or more faults that have the same value for their name property then those two interfaces cannot both form part of the derivation chain of a derived interface unless those faults are the same fault.

For the above reason, it is considered good practice to ensure, where necessary, that the local name of the name property of Interface Fault components within a namespace are unique, thus allowing such derivation to occur without inadvertent error.

If a type system NOT based on the XML Infoset [*XML Information Set*] is in use (as considered in **3.2 Using Other Schema Languages**) then additional properties would need to be added to the Interface Fault component (along with extensibility attributes to its XML representation) to allow associating such message types with the message reference.

Let *InterfaceFaultCM* be the conjunction of all the component model constraints on Interface Fault components.

$$InterfaceFaultCM \mathrel{\widehat=}$$
$$InterfaceFaultRI \land$$
$$InterfaceFaultKey \land$$
$$InterfaceFaultNameUnique$$

See *InterfaceFaultRI, InterfaceFaultKey, InterfaceFaultNameUnique.*

2.3.2 XML Representation of Interface Fault Component

```
<description>
  <interface>
    <fault
          name="xs:NCName"
          element="xs:QName"? >
      <documentation />*
      [ <feature /> | <property /> ]*
```

```
    </fault>
  </interface>
</description>
```

The XML representation for an Interface Fault component is an *element information item* with the following Infoset properties:

- A [local name] of `fault`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`
- One or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `name` *attribute information item* as described below in **2.3.2 `name` *attribute information item* with `fault` [owner element]**.
  - An OPTIONAL `element` *attribute information item* as described below in **2.3.2 `element` *attribute information item* with `fault` [owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item* amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. Zero or more *element information item*s from among the following, in any order:
     - Zero or more `feature` *element information item*s **2.7.2 XML Representation of Feature Component**
     - Zero or more `property` *element information item*s **2.8.2 XML Representation of Property Component**
     - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

`name` *attribute information item* with `fault` [owner element]

The `name` *attribute information item* identifies a given `fault` *element information item* inside a given `interface` *element information item*.

The `name` *attribute information item* has the following Infoset properties:

- A [local name] of `name`
- A [namespace name] which has no value

The type of the `name` *attribute information item* is *xs:NCName*.

`element` ***attribute information item*** **with** `fault` **[owner element]**

The `element` *attribute information item* refers, by QName, to an Element Declaration component.

The `element` *attribute information item* has the following Infoset properties:

- A [local name] of `element`.
- A [namespace name] which has no value.

The type of the `element` *attribute information item* is *xs:QName*.

2.3.3 Mapping Interface Fault's XML Representation to Component Properties

The mapping from the XML Representation of the `fault` *element information item* (see **2.3.2 XML Representation of Interface Fault Component**) to the properties of the Interface Fault component is as described in Table 2.3 .

Table 2.3: Mapping from XML Representation to Interface Fault Component Properties

Property	Value
name	The QName whose local name is the actual value of the `name` *attribute information item*. and whose namespace name is the actual value of the `targetNamespace` *attribute information item* of the [parent] `description` *element information item* of the [parent] `interface` *element information item*.
element declaration	The Element Declaration component from the element declarations property of the Description component resolved to by the value of the `element` *attribute information item* if present (see **2.19 QName resolution**), otherwise empty. It is an error for the `element` *attribute information item* to have a value and for it to not resolve to an Element Declaration component from the element declarations property of the Description component.
features	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
properties	The set of Property components corresponding to the `property` *element information item*s in [children], if any.
parent	The Interface component corresponding to the `interface` *element information item* in [parent].

2.4 Interface Operation

2.4.1 The Interface Operation Component

An Interface Operation component describes an operation that a given interface supports. An operation is an interaction with the service consisting of a set of (ordinary and fault) messages exchanged between the service and the other parties involved in the interaction. The sequencing and cardinality of the messages involved in a particular interaction is governed by the *message exchange pattern* used by the operation (see message exchange pattern property).

A message exchange pattern defines placeholders for messages, the participants in the pattern (i.e., the sources and sinks of the messages), and the cardinality and sequencing of messages exchanged by the participants. The message placeholders are associated with specific message types by the operation that uses the pattern by means of message and fault references (see interface message references and interface fault references properties). The service whose operation is using the pattern becomes one of the participants of the pattern. This specification does not define a machine understandable language for defining message exchange patterns, nor does it define any specific patterns. The companion specification, [*WSDL 2.0 Adjuncts*] defines a set of such patterns and defines identifying IRIs any of which MAY be used as the value of the message exchange pattern property.

The properties of the Interface Operation component are as follows:

- name REQUIRED. An *xs:QName*.
- message exchange pattern REQUIRED. An *xs:anyURI* identifying the message exchange pattern used by the operation. This *xs:anyURI* MUST be an absolute IRI (see [*IETF RFC 3987*]).
- interface message references OPTIONAL. A set of Interface Message Reference components for the ordinary messages the operation accepts or sends.
- interface fault references OPTIONAL. A set of Interface Fault Reference components for the fault messages the operation accepts or sends.
- style OPTIONAL. A set of *xs:anyURI*s identifying the rules that were used to construct the element declaration properties of interface message references. (See **2.4.1 Operation Style**.) These *xs:anyURI*s MUST be absolute IRIs (see [*IETF RFC 3986*]).
- features OPTIONAL. A set of Feature components.
- properties OPTIONAL. A set of Property components.
- parent REQUIRED. The Interface component that contains this component in its interface operations property.

Let *InterfaceOperation* be the set of all Interface Operation components:

InterfaceOperation

$$
\begin{array}{l}
NestedBase \\
name : QName \\
messageExchangePattern : AbsoluteURI \\
interfaceMessageReferences : \mathbb{P}\ ID \\
interfaceFaultReferences : \mathbb{P}\ ID \\
style : \mathbb{P}\ AbsoluteURI
\end{array}
$$

See *NestedBase, QName, AbsoluteURI, ID, Boolean.*

Each component referenced by an Interface Operation component must exist in the component model.

Let *InterfaceOperationRI* express the referential integrity constraints on the Interface Operation component:

InterfaceOperationRI

$$
\begin{array}{l}
ComponentModel2 \\
\hline
\forall\, InterfaceOperation \mid \theta InterfaceOperation \in interfaceOpComps \bullet \\
\quad NestedBaseValid \land \\
\quad interfaceMessageReferences \subseteq interfaceMessageRefIds \land \\
\quad interfaceFaultReferences \subseteq interfaceFaultRefIds
\end{array}
$$

See *ComponentModel2, InterfaceOperation, NestedBaseValid.*

- Every Interface Operation component satifies the base validity constraints.
- The Interface Message Reference components of each Interface Operation component are contained in the component model.
- The Interface Fault Reference components of each Interface Operation component are contained in the component model.

For each Interface Operation component in the interface operations property of an Interface component, the name property MUST be unique.

Interface Operation components are uniquely identified by the the QName of the enclosing Interface component and QName of the Interface Operation component itself.

Let *InterfaceOperationKey* express the QName uniqueness constraint on the Interface Operation component:

InterfaceOperationKey

$$
\begin{array}{l}
ComponentModel2 \\
\hline
\forall\, x, y : interfaceOpComps \mid \\
\quad x.parent = y.parent \land \\
\quad x.name = y.name \bullet x = y
\end{array}
$$

See *ComponentModel2*.

- No two Interface Operation components contained by the same Interface component have the same name property.

Despite having a name property, Interface Operation components cannot be identified solely by their QName. Indeed, two Interface components whose name property value has the same namespace name, but different local names, can contain Interface Operation components with the same name property value. Thus, the name property of Interface Operation components is not sufficient to form the unique identity of an Interface Operation component. A method for uniquely identifying components is defined in **A.2 Fragment Identifiers** . See **A.2.6 The Interface Operation Component** for the definition of the fragment identifier for the Interface Operation component.

In cases where, due to an interface extending one or more other interfaces, two or more Interface Operation components have the same value for their name property, then the component models of those Interface Operation components MUST be equivalent (see **2.17 Equivalence of Components**). If the Interface Operation components are equivalent then they are considered to collapse into a single component. It is an error if two Interface Operation components have the same value for their name property but are not equivalent.

Let *InterfaceOperationNameUnique* express the uniqueness constraint on the name property of an Interface Operation component among all the Interface Operation components available in an Interface component:

InterfaceOperationNameUnique

$ComponentModel2$

$$\forall i : interfaceComps; \\ x, y : interfaceOpComps \mid \\ x.id \in i.allInterfaceOperations \land \\ y.id \in i.allInterfaceOperations \land \\ x.name = y.name \bullet x = y$$

See *ComponentModel2*.

- No two Interface Operation components among all those available in the same Interface component have the same name property.

Note that, due to the above rules, if two interfaces that have the same value for the namespace name of their name property also have one or more operations that have the same value for their name property then those two interfaces cannot both form part of the derivation chain of a derived interface unless those operations are the same operation.

For the above reason, it is considered good practice to ensure, where necessary, that the name property of Interface Operation components within a namespace are unique, thus allowing such derivation to occur without inadvertent error.

More than one Interface Fault Reference component in the interface fault references property of an Interface Operation component may refer to the same message label. In that case, the listed fault types define alternative fault messages. This allows one to indicate that there is more than one type of fault that is related to that message.

An Interface Operation component contains nested Interface Message Reference and Interface Fault Reference components. These components MUST have the Interface Operation component as their parent.

Let *InterfaceOperationParent* express the constraints on the parent properties of the nested components of an Interface Operation component:

$$
\begin{array}{|l}
\hline
\textit{InterfaceOperationParent} \\
\textit{ComponentModel2} \\
\hline
\forall\, io : \textit{interfaceOpComps}; \\
\quad ifr : \textit{interfaceFaultRefComps}; \\
\quad imr : \textit{interfaceMessageRefComps} \bullet \\
\quad ifr.id \in io.\textit{interfaceFaultReferences} \Leftrightarrow ifr.\textit{parent} = io.id \land \\
\quad imr.id \in io.\textit{interfaceMessageReferences} \Leftrightarrow imr.\textit{parent} = io.id \\
\hline
\end{array}
$$

See *ComponentModel2.*

- The set of Interface Fault Reference components contained by an Interface Operation component is exactly the set of Interface Fault Reference components that have that Interface Operation component as their parent.
- The set of Interface Message Reference components contained by an Interface Operation component is exactly the set of Interface Message Reference components that have that Interface Operation component as their parent.

Let *InterfaceOperationCM* be the conjunction of all the component model constraints on Interface Operation components.

$$
\begin{array}{l}
\textit{InterfaceOperationCM} \mathrel{\widehat{=}} \\
\quad \textit{InterfaceOperationRI} \land \\
\quad \textit{InterfaceOperationKey} \land \\
\quad \textit{InterfaceOperationParent} \land \\
\quad \textit{InterfaceOperationNameUnique}
\end{array}
$$

See *InterfaceOperationRI, InterfaceOperationKey, InterfaceOperationParent, InterfaceOperationNameUnique.*

Message Exchange Pattern

This section describes some aspects of message exchange patterns in more detail. Refer to the *WSDL Version 2.0 Part 2: Adjuncts* specification [*WSDL 2.0 Adjuncts*] for a complete discussion of the semantics of message exchange

patterns in general as well as the definitions of the message exchange patterns that are predefined by WSDL 2.0.

A *placeholder message* is a template for an actual message as described by an Interface Message Reference component. Although a placeholder message is not itself a component, it is useful to regard it as having both a

message label

and a direction property which define the values of the actual Interface Message Reference component that corresponds to it. A placeholder message is also associated with some node that exchanges the message with the service. Furthermore, a placeholder message may be designated as optional in the exchange.

Let *Node* be the set of all nodes that participate in message exchanges:

$$[Node]$$

Let *PlaceholderMessage* be the set of all placeholder messages:

PlaceholderMessage

$$messageLabel : NCName$$
$$direction : Direction$$
$$node : Node$$
$$optional : Boolean$$

See *NCName, Direction, Node, Boolean.*

A *fault propagation ruleset* specifies the relation between the Interface Fault Reference and Interface Message Reference components of an Interface Operation component. The *WSDL Version 2.0 Part 2: Adjuncts* specification [*WSDL 2.0 Adjuncts*] defines three fault propagation rulesets which we'll refer to as *fault-replaces-message* , *message-triggers-fault* , and *no-faults* . These fault propagation rulesets are used by the predefined message exchange patterns. Other message exchange patterns may define additional fault propagation rulesets.

Let *FaultPropagationRuleset* be the set of all fault propagation rulesets:

$$[FaultPropagationRuleset]$$

Let the predefined fault propation rulesets be as follows:

$$messageTriggersFault : FaultPropagationRuleset$$
$$faultReplacesMessage : FaultPropagationRuleset$$
$$noFaults : FaultPropagationRuleset$$

$$messageTriggersFault \neq faultReplacesMessage$$
$$faultReplacesMessage \neq noFaults$$
$$noFaults \neq messageTriggersFault$$

See *FaultPropagationRuleset.*

A *message exchange pattern* is a template for the exchange of one or more messages, and their associated faults, between the service and one or more other nodes as described by an Interface Operation component. The service and the other nodes are referred to as the *participants* in the exchange. A message exchange pattern consists of a sequence of one or more placeholder messages. Each placeholder message within this sequence is uniquely identified by its

message label

property. A message exchange pattern is uniquely identified by an absolute IRI which is used as the value of the

message exchange pattern property of the Interface Operation component, and it specifies the fault propagation ruleset that its faults obey.

Let *MessageExchangePattern* be the set of all message exchange patterns:

$$
\begin{array}{|l}
\hline
\textit{MessageExchangePattern} \\
\textit{messageExchangePattern} : \textit{AbsoluteURI} \\
\textit{placeholderMessages} : \operatorname{seq} \textit{PlaceholderMessage} \\
\textit{faultPropagationRuleset} : \textit{FaultPropagationRuleset} \\
\hline
\textit{placeholderMessages} \neq \varnothing \\
\forall\, i1, i2 : \mathbb{Z};\ p1, p2 : \textit{PlaceholderMessage} \mid \\
\qquad i1 \mapsto p1 \in \textit{placeholderMessages} \land \\
\qquad i2 \mapsto p2 \in \textit{placeholderMessages} \bullet \\
\qquad p1.\textit{messageLabel} = p2.\textit{messageLabel} \Rightarrow i1 = i2 \\
\hline
\end{array}
$$

- Each message exchange pattern has at least one placeholder message.
- Each placeholder message in a message exchange pattern is uniquely identified by its message label.

Operation Style

An operation style specifies additional information about an operation. For example, an operation style may define structural constraints on the element declarations of the interface message reference or interface fault components used by the operation. This additional information in no way affects the messages and faults exchanged with the service and it may therefore be safely ignored in that context. However, the additional information may be used for other purposes, for example, improved code generation. The style property of the Interface Operation component contains a set of zero or more IRIs that identify operation styles. An Interface Operation component MUST satisfy the specification defined by each operation style identified by its style property.

If no Interface Operation component can simultaneously satisfy all of the styles, the document is invalid.

If the style property of an Interface Operation component does have a value, then that value (a set of IRIs) specifies the rules that were used to define the element declarations (or other properties that define the message and fault contents; see **3.2 Using Other Schema Languages**) of the Interface Message

Reference or Interface Fault components used by the operation. Although a given operation style has the ability to constrain *all* input and output messages and faults of an operation, it MAY choose to constrain any combination thereof, e.g. only the messages, or only the inputs.

Please refer to the *WSDL Version 2.0 Part 2: Adjuncts* specification [*WSDL 2.0 Adjuncts*] for particular operation style definitions.

2.4.2 XML Representation of Interface Operation Component

```
<description>
  <interface>
    <operation
          name="xs:NCName"
          pattern="xs:anyURI"
          style="list of xs:anyURI"? >
      <documentation />*
      [ <feature /> | <property /> |
        [ <input /> | <output /> | <infault /> | <outfault /> ]+
      ]*
    </operation>
  </interface>
</description>
```

The XML representation for an Interface Operation component is an *element information item* with the following Infoset properties:

- A [local name] of `operation`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`
- Two or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `name` *attribute information item* as described below in **2.4.2** `name` ***attribute information item*** **with** `operation` **[owner element]**.
  - A REQUIRED `pattern` *attribute information item* as described below in **2.4.2** `pattern` ***attribute information item*** **with** `operation` **[owner element]**.
  - An OPTIONAL `style` *attribute information item* as described below in **2.4.2** `style` ***attribute information item*** **with** `operation` **[owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

- One or more *element information item* amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. One or more *element information item*s from among the following, in any order:
     - One or more *element information item*s from among the following, in any order:
       * Zero or more `input` *element information item*s (see **2.5.2 XML Representation of Interface Message Reference Component**).
       * Zero or more `output` *element information item*s (see **2.5.2 XML Representation of Interface Message Reference Component**).
       * Zero or more `infault` *element information item*s (see **2.6.2 XML Representation of Interface Fault Reference**).
       * Zero or more `outfault` *element information item*s (see **2.6.2 XML Representation of Interface Fault Reference**).
     - Zero or more *element information item*s from among the following, in any order:
       * A `feature` *element information item* (see **2.7.2 XML Representation of Feature Component**).
       * A `property` *element information item* (see **2.8.2 XML Representation of Property Component**).
       * Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

`name` *attribute information item* with `operation` [owner element]

The `name` *attribute information item* identifies a given `operation` *element information item* inside a given `interface` *element information item*.

The `name` *attribute information item* has the following Infoset properties:

- A [local name] of `name`
- A [namespace name] which has no value

The type of the `name` *attribute information item* is *xs:NCName*.

`pattern` *attribute information item* with `operation` [owner element]

The `pattern` *attribute information item* identifies the message exchange pattern a given operation uses.

The `pattern` *attribute information item* has the following Infoset properties:

- A [local name] of `pattern`
- A [namespace name] which has no value

The type of the `pattern` *attribute information item* is *xs:anyURI*. Its value MUST be an absolute IRI (see [*IETF RFC 3987*]).

`style` ***attribute information item*** **with** `operation` **[owner element]**

The `style` *attribute information item* indicates the rules that were used to construct the element declaration properties of the Interface Message Reference components which are members of the interface message references property of the [owner element] operation.

The `style` *attribute information item* has the following Infoset properties:

- A [local name] of `style`
- A [namespace name] which has no value

The type of the `style` *attribute information item* is *list of xs:anyURI*. Its value MUST be an absolute IRI (see [*IETF RFC 3987*]).

2.4.3 Mapping Interface Operation's XML Representation to Component Properties

The mapping from the XML Representation of the `operation` *element information item* (see **2.4.2 XML Representation of Interface Operation Component**) to the properties of the Interface Operation component (see **2.4.1 The Interface Operation Component**) is as described in Table 2.4 .

Table 2.4: Mapping from XML Representation to Interface Operation Component Properties

Property	Value
name	The QName whose local name is the actual value of the `name` *attribute information item* and whose namespace name is the actual value of the `targetNamespace` *attribute information item* of the [parent] `description` *element information item* of the [parent] `interface` *element information item*.
message exchange pattern	The actual value of the `pattern` *attribute information item*; otherwise 'http://www.w3.org/2006/01/wsdl/in-out'.
interface message references	The set of message references corresponding to the `input` and `output` *element information item*s in [children], if any.
interface fault references	The set of interface fault references corresponding to the `infault` and `outfault` *element information item*s in [children], if any.

style	The set containing the IRIs in the actual value of the `style` *attribute information item*, if present; otherwise the set containing the IRIs in the actual value of the `styleDefault` *attribute information item* of the [parent] `interface` *element information item*, if present; otherwise empty.
features	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
properties	The set of Property components corresponding to the `property` *element information item*s in [children], if any.
parent	The Interface component corresponding to the `interface` *element information item* in [parent].

2.5 Interface Message Reference

2.5.1 The Interface Message Reference Component

An Interface Message Reference component associates a defined element with a message exchanged in an operation. By default, the element is defined in the XML Infoset [*XML Information Set*].

A message exchange pattern defines a set of placeholder messages that participate in the pattern and assigns them unique message labels within the pattern (e.g. 'In', 'Out'). The purpose of an Interface Message Reference component is to associate an actual message element (XML element declaration or some other declaration (see **3.2 Using Other Schema Languages**)) with a message in the pattern, as identified by its message label. Later, when the message exchange pattern is instantiated, messages corresponding to that particular label will follow the element assignment made by the Interface Message Reference component.

The properties of the Interface Message Reference component are as follows:

- message label REQUIRED. An *xs:NCName*. This property identifies the role this message plays in the message exchange pattern of the Interface Operation component this message is contained within. The value of this property MUST match the name of a placeholder message defined by the message exchange pattern.
- direction REQUIRED. An *xs:token* with one of the values *in* or *out*, indicating whether the message is coming to the service or going from the service, respectively. The direction MUST be the same as the direction of the message identified by the message label property in the message exchange pattern of the Interface Operation component this is contained within.

- message content model REQUIRED. An *xs:token* with one of the values *#any*, *#none*, *#other*, or *#element*. A value of *#any* indicates that the message content is any single element. A value of *#none* indicates there is no message content. A value of *#other* indicates that the message content is described by some other extension property that references a declaration in a non-XML extension type system. A value of *#element* indicates that the message consists of a single element described by the global element declaration referenced by the element declaration property. This property is used only when the message is described using an XML based data model.

- element declaration OPTIONAL. A reference to an XML element declaration in the element declarations property of the Description component. This element represents the content or "payload" of the message. When the message content model property has the value *#any* or *#none* the element declaration property MUST be empty.

- features OPTIONAL. A set of Feature components.

- properties OPTIONAL. A set of Property components.

- parent REQUIRED. The Interface Operation component that contains this component in its interface message references property.

Let *Direction* be a message direction of either *in* or *out*:

$$Direction ::= inToken \mid outToken$$

Let *MessageContentModel* be a message content model of either *any*, *none*, *other*, or *element*:

$$MessageContentModel ::= anyToken \mid noneToken \mid otherToken \mid elementToken$$

Let *InterfaceMessageReference* be the set of all Interface Message Reference components:

InterfaceMessageReference

$$NestedBase$$
$$messageLabel : NCName$$
$$direction : Direction$$
$$messageContentModel : MessageContentModel$$
$$elementDeclaration : OPTIONAL[ID]$$

$$messageContentModel = elementToken \Leftrightarrow elementDeclaration \neq \varnothing$$

See *NestedBase, NCName, Direction, OPTIONAL, MessageContentModel, ID.*

- The message content model is *element* exactly when the element declaration property is defined.

Each component referenced by an Interface Message Reference component must exist in the component model.

Let *InterfaceMessageReferenceRI* express the referential integrity constraints on the Interface Message Reference component:

InterfaceMessageReferenceRI

$$
\begin{array}{|l}
\hline
ComponentModel2 \\
\hline
\forall\, InterfaceMessageReference \mid \theta InterfaceMessageReference \in interfaceMessageRefComps \bullet \\
\quad NestedBaseValid \land \\
\quad elementDeclaration \subseteq elementDeclIds \\
\hline
\end{array}
$$

See *ComponentModel2, InterfaceMessageReference, NestedBaseValid.*

- Every Interface Message Reference component satifies the base validity constraints.
- The Element Declaration components of each Interface Message Reference component are contained in the component model.

For each Interface Message Reference component in the interface message references property of an Interface Operation component, its message label property MUST be unique.

Let *InterfaceMessageReferenceKey* express this uniqueness constraint on the Interface Message Reference component:

InterfaceMessageReferenceKey

$$
\begin{array}{|l}
\hline
ComponentModel2 \\
\hline
\forall\, x, y : interfaceMessageRefComps \mid \\
\quad x.parent = y.parent \land \\
\quad x.messageLabel = y.messageLabel \bullet x = y \\
\hline
\end{array}
$$

See *ComponentModel2.*

- No two Interface Message Reference components contained by the same Interface Operation component have the same message label property.

If a type system not based upon the XML Infoset is in use (as considered in **3.2 Using Other Schema Languages**) then additional properties would need to be added to the Interface Message Reference component (along with extensibility attributes to its XML representation) to allow associating such message types with the message reference.

Let *InterfaceMessageReferenceCM* be the conjunction of all the component model constraints on Interface Message Reference components.

$$
\begin{array}{l}
InterfaceMessageReferenceCM \mathrel{\widehat=} \\
\quad InterfaceMessageReferenceRI \land \\
\quad InterfaceMessageReferenceKey
\end{array}
$$

See *InterfaceMessageReferenceRI, InterfaceMessageReferenceKey.*

2.5.2 XML Representation of Interface Message Reference Component

```
<description>
  <interface>
    <operation>
      <input
            messageLabel="xs:NCName"?
            element="union of xs:QName, xs:token"? >
        <documentation />*
        [ <feature /> | <property /> ]*
      </input>
      <output
            messageLabel="xs:NCName"?
            element="union of xs:QName, xs:token"? >
        <documentation />*
        [ <feature /> | <property /> ]*
      </output>
    </operation>
  </interface>
</description>
```

The XML representation for an Interface Message Reference component is an *element information item* with the following Infoset properties:

- A [local name] of `input` or `output`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`
- Zero or more *attribute information item*s amongst its [attributes] as follows:
  - An OPTIONAL `messageLabel` *attribute information item* as described below in **2.5.2** `messageLabel` ***attribute information item*** **with** `input` **or** `output` [**owner element**].
  - An OPTIONAL `element` *attribute information item* as described below in **2.5.2** `element` ***attribute information item*** **with** `input` **or** `output` [**owner element**].
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item* amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).

2. Zero or more *element information item*s from among the following, in any order:
   - Zero or more `feature` *element information item*s **2.7.2 XML Representation of Feature Component**
   - Zero or more `property` *element information item*s **2.8.2 XML Representation of Property Component**
   - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

`messageLabel` ***attribute information item*** **with** `input` **or** `output` **[owner element]**

The `messageLabel` *attribute information item* identifies the role of this message in the message exchange pattern of the given `operation` *element information item*.

The `messageLabel` *attribute information item* has the following Infoset properties:

- A [local name] of `messageLabel`
- A [namespace name] which has no value

The type of the `messageLabel` *attribute information item* is *xs:NCName*.

`element` ***attribute information item*** **with** `input` **or** `output` **[owner element]**

The `element` *attribute information item* has the following Infoset properties:

- A [local name] of `element`.
- A [namespace name] which has no value.

The type of the `element` *attribute information item* is a union of *xs:QName* and *xs:token* where the allowed token values are *#any*, *#none*, or *#other*.

2.5.3 Mapping Interface Message Reference's XML Representation to Component Properties

The mapping from the XML Representation of the interface message reference *element information item* (see **2.5.2 XML Representation of Interface Message Reference Component**) to the properties of the Interface Message Reference component (see **2.5.1 The Interface Message Reference Component**) is as described in Table 2.5 .

Define the *message exchange pattern* of the *element information item* to be the message exchange pattern of the parent Interface Operation component.

Define the *message direction* of the *element information item* to be *in* if its local name is `input` and *out* if its local name is `output`.

The `messageLabel` *attribute information item* of an interface message reference *element information item* MUST be present if the message exchange pattern has more than one placeholder message with {direction} equal to the message direction.

If the `messageLabel` *attribute information item* of an interface message reference *element information item* is present then its actual value MUST match the {message label} of some placeholder message with {direction} equal to the message direction.

If the `messageLabel` *attribute information item* of an interface message reference *element information item* is absent then there MUST be a unique placeholder message with {direction} equal to the message direction.

Define the *effective message label* of an interface message reference *element information item* to be either the actual value of the `messageLabel` *attribute information item* if it is present, or the {message label} of the unique placeholder message with {direction} equal to the message direction if the *attribute information item* is absent.

Table 2.5: Mapping from XML Representation to Interface Message Reference Component Properties

Property	**Value**
message label	The effective message label.
direction	The message direction.
message content model	If the `element` *attribute information item* is present and its value is a QName, then *#element*: otherwise the actual value of the `element` *attribute information item*, if any; otherwise *#other*.
element declaration	If the `element` *attribute information item* is present and its value is a QName, then the Element Declaration component from the element declarations property of the Description component resolved to by the value of the `element` *attribute information item* (see **2.19 QName resolution**); otherwise empty. It is an error for the `element` *attribute information item* to have a value and for it to NOT resolve to an Element Declaration from the element declarations property of the Description.
features	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
properties	The set of Property components corresponding to the `property` *element information item*s in [children], if any.

parent	The Interface Operation component corresponding to the `interface` *element information item* in [parent].

2.6 Interface Fault Reference

2.6.1 The Interface Fault Reference Component

An Interface Fault Reference component associates a defined type, specified by an Interface Fault component, to a fault message exchanged in an operation.

A message exchange pattern defines a set of placeholder messages that participate in the pattern and assigns them unique message labels within the pattern (e.g. 'In', 'Out'). The purpose of an Interface Fault Reference component is to associate an actual message type (XML element declaration or some other declaration (see **3.2 Using Other Schema Languages**) for message content, as specified by an Interface Fault component) with a fault message occurring in the pattern. In order to identify the fault message it describes, the Interface Fault Reference component uses the message label of the message the fault is associated with as a key.

The companion specification [*WSDL 2.0 Adjuncts*] defines several *fault propagation rulesets* that a given message exchange pattern may use. For the ruleset *fault-replaces-message*, the message that the fault relates to identifies the message *in place of which* the declared fault message will occur. Thus, the fault message will travel in the *same* direction as the message it replaces in the pattern. For the ruleset *message-triggers-fault*, the message that the fault relates to identifies the message after which the indicated fault may occur, in the opposite direction of the referred to message. That is, the fault message will travel in the *opposite* direction of the message it comes after in the message exchange pattern.

The properties of the Interface Fault Reference component are as follows:

- interface fault REQUIRED. An Interface Fault component in the interface faults property of the [parent] Interface Operation component's [parent] Interface component, or an Interface component that it directly or indirectly extends. Identifying the Interface Fault component therefore indirectly defines the actual content or payload of the fault message.

- message label REQUIRED. An *xs:NCName*. This property identifies the message this fault relates to among those defined in the message exchange pattern property of the Interface Operation component it is contained within. The value of this property MUST match the name of a placeholder message defined by the message exchange pattern.

- direction REQUIRED. A *xs:token* with one of the values *in* or *out*, indicating whether the fault is coming to the service or going from the service, respectively. The direction MUST be consistent with the direction implied

by the fault propagation ruleset used in the message exchange pattern of the operation. For example, if the ruleset *fault-replaces-message* is used, then a fault that refers to an outgoing message would have a direction property value of *out*. On the other hand, if the ruleset *message-triggers-fault* is used, then a fault that refers to an outgoing message would have a direction property value of *in* as the fault travels in the opposite direction of the message.

- features OPTIONAL. A set of Feature components.
- properties OPTIONAL. A set of Property components.
- parent REQUIRED. The Interface Operation component that contains this component in its interface fault references property.

Let *InterfaceFaultReference* be the set of all Interface Fault Reference components:

$$
\begin{array}{|l}
\textit{InterfaceFaultReference} \\
\hline
\textit{NestedBase} \\
\textit{interfaceFault} : \textit{ID} \\
\textit{messageLabel} : \textit{NCName} \\
\textit{direction} : \textit{Direction} \\
\hline
\end{array}
$$

See *NestedBase, ID, NCName, Direction.*

Each component referenced by a Interface Fault Reference component must exist in the component model.

Let *InterfaceFaultReferenceRI* express the referential integrity constraints on the Interface Fault Reference component:

$$
\begin{array}{|l}
\textit{InterfaceFaultReferenceRI} \\
\hline
\textit{ComponentModel2} \\
\hline
\forall\, \textit{InterfaceFaultReference} \mid \theta \textit{InterfaceFaultReference} \in \textit{interfaceFaultRefComps} \bullet \\
\quad \textit{NestedBaseValid} \land \\
\quad \textit{interfaceFault} \in \textit{interfaceFaultIds} \\
\hline
\end{array}
$$

See *ComponentModel2, InterfaceFaultReference, NestedBaseValid.*

- Every Interface Fault Reference component satifies the base validity constraints.
- The Interface Fault component of each Interface Fault Reference component is contained in the component model.

For each Interface Fault Reference component in the interface fault references property of an Interface Operation component, the combination of its interface fault and message label properties MUST be unique.

Let *InterfaceFaultReferenceKey* express this uniqueness constraint on the Interface Fault Reference component:

InterfaceFaultReferenceKey

ComponentModel2

$$\forall x, y : interfaceFaultRefComps \mid x.parent = y.parent \land x.interfaceFault = y.interfaceFault \land x.messageLabel = y.messageLabel \bullet x = y$$

See *ComponentModel2.*

- No two Interface Fault Reference components contained by the same Interface Operation component have the same interface fault and message label properties.

An Interface Fault Reference component MUST refer to an Interface Fault component that is available in the associated Interface component. An Interface Fault component is available if it is contained in the Interface component or it is available in an Interface component that this Interface component extends.

Let *InterfaceFaultReferenceConsistent* express this consistency constraint on the Interface Fault Reference component:

InterfaceFaultReferenceConsistent

ComponentModel2

$$\forall ifr : interfaceFaultRefComps; io : interfaceOpComps; i : interfaceComps \mid ifr.parent = io.id \land io.parent = i.id \bullet ifr.interfaceFault \in i.allInterfaceFaults$$

See *ComponentModel2.*

- Every Interface Fault Reference component MUST refer to an Interface Fault component that is available in the Interface component that contains the Interface Operation component that contains the Interface Fault Reference component.

Let *InterfaceFaultReferenceCM* be the conjunction of all the component model constraints on Interface Fault Reference components.

$$InterfaceFaultReferenceCM \mathrel{\widehat=} InterfaceFaultReferenceRI \land InterfaceFaultReferenceKey \land InterfaceFaultReferenceConsistent$$

See *InterfaceFaultReferenceRI, InterfaceFaultReferenceKey, InterfaceFaultReferenceConsistent.*

2.6.2 XML Representation of Interface Fault Reference

```
<description>
  <interface>
    <operation>
      <infault
            ref="xs:QName"
            messageLabel="xs:NCName"? >
        <documentation />*
        [ <feature /> | <property /> ]*
      </infault>*
      <outfault
            ref="xs:QName"
            messageLabel="xs:NCName"? >
        <documentation />*
        [ <feature /> | <property /> ]*
      </outfault>*
    </operation>
  </interface>
</description>
```

The XML representation for a Interface Fault Reference component is an *element information item* with the following Infoset properties:

- A [local name] of `infault` or `outfault`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`
- One or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `ref` *attribute information item* as described below in **2.6.2** `ref` ***attribute information item*** **with** `infault`**, or** `outfault` **[owner element]**.
  - An OPTIONAL `messageLabel` *attribute information item* as described below in **2.6.2** `messageLabel` ***attribute information item*** **with** `infault`**, or** `outfault` **[owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item* amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. Zero or more *element information item*s from among the following, in any order:

- Zero or more `feature` *element information items* **2.7.2 XML Representation of Feature Component**
- Zero or more `property` *element information items* **2.8.2 XML Representation of Property Component**
- Zero or more namespace-qualified *element information items* whose [namespace name] is NOT "`http://www.w3.org/2006/01/wsdl`".

`ref` *attribute information item* with `infault`, or `outfault` [owner element]

The `ref` *attribute information item* refers to a fault component.

The `ref` *attribute information item* has the following Infoset properties:

- A [local name] of `ref`
- A [namespace name] which has no value

The type of the `ref` *attribute information item* is *xs:QName*.

`messageLabel` *attribute information item* with `infault`, or `outfault` [owner element]

The `messageLabel` *attribute information item* identifies the message in the message exchange pattern of the given `operation` *element information item* that is associated with this fault.

The `messageLabel` *attribute information item* has the following Infoset properties:

- A [local name] of `messageLabel`
- A [namespace name] which has no value

The type of the `messageLabel` *attribute information item* is *xs:NCName*.

The `messageLabel` *attribute information item* MUST be present in the XML representation of an Interface Fault Reference component with a given direction if the message exchange pattern of the parent Interface Operation component has more than one fault with that direction. Recall that the *fault propagation ruleset* of the message exchange pattern specifies the relation between faults and messages. For example, the *fault-replaces-message* ruleset specifies that the faults have the same direction as the messages, while the *message-triggers-fault* ruleset specifies that the faults have the opposite direction from the messages.

2.6.3 Mapping Interface Fault Reference's XML Representation to Component Properties

The mapping from the XML Representation of the message reference *element information item* (see **2.6.2 XML Representation of Interface Fault Reference**) to the properties of the Interface Fault Reference component (see **2.6.1 The Interface Fault Reference Component**) is as described in Table 2.6 .

Define the *message exchange pattern* of the *element information item* to be the message exchange pattern of the parent Interface Operation component.

Define the *fault direction* of the *element information item* to be *in* if its local name is `infault` and *out* if its local name is `outfault`.

Define the *message direction* of the *element information item* to be the {direction} of the placeholder message associated with the fault as specifed by the fault propagation ruleset of the message exchange pattern.

The `messageLabel` *attribute information item* of an interface fault reference *element information item* MUST be present if the message exchange pattern has more than one placeholder message with {direction} equal to the message direction.

If the `messageLabel` *attribute information item* of an interface fault reference *element information item* is present then its actual value MUST match the {message label} of some placeholder message with {direction} equal to the message direction.

If the `messageLabel` *attribute information item* of an interface fault reference *element information item* is absent then there MUST be a unique placeholder message with {direction} equal to the message direction.

Define the *effective message label* of an interface fault reference *element information item* to be either the actual value of the `messageLabel` *attribute information item* if it is present, or the {message label} of the unique placeholder message whose {direction} is equal to the message direction if the *attribute information item* is absent.

Table 2.6: Mapping from XML Representation to Interface Fault Reference Component Properties

Property	**Value**
interface fault	The Interface Fault component from interface faults property of the parent Interface component, or an Interface component that it directly or indirectly extends, with name equal to the actual value of the `ref` *attribute information item*.
message label	The effective message label.
direction	The fault direction.
features	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
properties	The set of Property components corresponding to the `property` *element information item*s in [children], if any.
parent	The Interface Operation component corresponding to the `interface` *element information item* in [parent].

2.7 Feature

2.7.1 The Feature Component

A Feature component describes an abstract piece of functionality typically associated with the exchange of messages between communicating parties. Although WSDL 2.0 imposes no constraints on the potential scope of such features, examples might include "reliability", "security", "correlation", and "routing". The presence of a Feature component in a WSDL 2.0 description indicates that the service supports the feature and may require that a client that interacts with the service use that feature. Each Feature is identified by its IRI.

WSDL 2.0's Feature concept is derived from SOAP 1.2's abstract feature concept ([*SOAP 1.2 Part 1: Messaging Framework*]). Every SOAP 1.2 abstract feature is therefore also a WSDL 2.0 Feature. There is no need to define a separate WSDL 2.0 Feature in order to use a particular SOAP 1.2 feature. The SOAP 1.2 feature can be used directly.

The properties of the Feature component are as follows:

- ref REQUIRED. An *xs:anyURI*. This *xs:anyURI* MUST be an absolute IRI as defined by [*IETF RFC 3987*]. This IRI SHOULD be dereferenceable to a document that directly or indirectly defines the meaning and use of the Feature that it identifies.
- required REQUIRED. An *xs:boolean*. If the value of this property is *true*, then the client MUST use the Feature that is identified by the ref IRI. Otherwise, the client MAY use the Feature that is identified by the ref IRI. In either case, if the client does use the Feature that is identified by the ref IRI, then the client MUST obey all semantics implied by the definition of that Feature.
- parent REQUIRED. The component that contains this component in its features property.

Let *Feature* be the set of all Feature components:

Feature

Identifier
ref : *AbsoluteURI*
required : *Boolean*
Parent

See *AbsoluteURI, Boolean, Parent.*

The parent of a Feature MUST be in the component model.

Let *FeatureRI* express this referential integrity constraint on the Feature component:

$$
\begin{array}{|l}
\hline
\textit{FeatureRI} \\
\textit{ComponentModel2} \\
\hline
\forall\, \textit{Feature} \mid \theta \textit{Feature} \in \textit{featureComps} \bullet \\
\quad \textit{ParentValid} \\
\hline
\end{array}
$$

See *ComponentModel2, Feature, ParentValid.*

The ref property of a Feature component MUST be unique within the features property of an Interface, Interface Fault, Interface Operation, Interface Message Reference, Interface Fault Reference, Binding, Binding Fault, Binding Operation, Binding Message Reference, Binding Fault Reference, Service, or Endpoint component.

Let *FeatureKey* express this uniqueness constraint on the Feature component:

$$
\begin{array}{|l}
\hline
\textit{FeatureKey} \\
\textit{ComponentModel2} \\
\hline
\forall\, x, y : \textit{featureComps} \mid \\
\quad x.\textit{parent} = y.\textit{parent} \land \\
\quad x.\textit{ref} = y.\textit{ref} \bullet x = y \\
\hline
\end{array}
$$

See *ComponentModel2.*

- No two Feature components contained by the same component have the same ref property.

Let *FeatureCM* be the conjunction of all the component model constraints on Feature components.

$$
\begin{array}{l}
\textit{FeatureCM} \mathrel{\widehat=} \\
\quad \textit{FeatureRI} \land \\
\quad \textit{FeatureKey}
\end{array}
$$

See *FeatureRI, FeatureKey.*

Feature Composition Model

The set of features which are required or available for a given component consists of the combined set of ALL feature declarations applicable to that component. A feature is applicable to a component if:

- it is asserted directly within that component, or
- it is asserted in a containing component, or
- it is asserted in a component referred to by the current component.

Many of the component types in the component model contain a features property, which is a set of Feature components. We refer to these as the *declared features* of the component. Furthermore, the features property is itself a subset of Feature components that are required or available for the given component as determined by the Feature Composition Model. We refer to these as the *in-scope features* of the component.

Let *Features* denote these sets of Feature components:

Features

$$
\begin{array}{l}
Identifier \\
features : \mathbb{P}\ ID \\
inScopeFeatures : \mathbb{P}\ ID \\
\hline
features \subseteq inScopeFeatures
\end{array}
$$

See *Identifier, ID.*

- The in-scope features for a component always include the declared features for that component.

The Feature components contained by a given component MUST exist in the component model and the given component MUST be their parent.

Let *FeaturesValid* express these validity constraints on the features property of a component:

FeaturesValid

$$
\begin{array}{l}
ComponentModel2 \\
Features \\
\hline
features \subseteq featureIds \\
\forall f : featureComps \bullet \\
\quad f.id \in features \Leftrightarrow f.parent = id
\end{array}
$$

See *ComponentModel2, Features.*

- Each Feature component contained by this component MUST exist in the component model.
- This component MUST be the parent of the Feature components it contains.

Following these rules, the set of features applicable at each component are as follows:

- Interface component: all features asserted within the Interface component and those with any extended Interface components.
- Interface Fault component: all features asserted within the Interface Fault component and those within the parent Interface component.

- Interface Operation component: all features asserted within the Interface Operation component and those within the parent Interface component.
- Interface Message Reference component: all features asserted within the Interface Message Reference component, those within the parent Interface Operation component and those within its parent Interface component.
- Interface Fault Reference component: all features asserted within the Interface Fault Reference component, those within the parent Interface Operation component and those within its parent Interface component.
- Binding component: all features asserted within the Binding component and those within the Interface component referred to by the Binding component (if any).
- Binding Fault component: all features asserted within the Binding Fault component, those within the parent Binding component, those within the corresponding Interface Fault component, and those within the Interface component referred to by the Binding component.
- Binding Operation component: all features asserted within the Binding Operation component, those within the parent Binding component, those within the corresponding Interface Operation component, and those within the Interface component referred to by the Binding component.
- Binding Message Reference component: all features asserted within the Binding Message Reference component, those within the parent Binding operation component, those within its parent Binding component, those within the corresponding Interface Message Reference component, and those within the Interface component referred to by the Binding component.
- Binding Fault Reference component: all features asserted within the Binding Fault Reference component, those within the parent Binding Operation component, those within its parent Binding component, those within the corresponding Interface Fault Reference component, and those within the Interface component referred to by the Binding component.
- Service component: all features asserted within the Service component and those within the Interface implemented by the Service component.
- Endpoint component: all features asserted within the Endpoint component, whose within the Binding component implemented by the Endpoint component, and those within the parent Service component.

If a given feature is asserted at multiple locations, then the value of that feature at a particular component is determined by the conjunction of all the constraints implied by its asserted values. If a feature is not required then it may or may not be engaged, but if a feature is required then it must be engaged.

Therefore, the conjunction of a required value and a non-required value is a required value. A composed feature is required if and only if at least one of its asserted values is required. This rule may be summarized as "true trumps".

In the following example, the `depositFunds` operation on the `BankService` has to be used with the `ISO9001`, the `notarization` and the `secure-channel` features; they are all in scope. The fact that the `notarization` feature is declared both in the operation and in the binding has no effect.

```
<description targetNamespace="http://example.com/bank"
     xmlns="http://www.w3.org/2006/01/wsdl"
     xmlns:ns1="http://example.com/bank">
  <interface name="ns1:Bank">
    <!-- All implementations of this interface must be secure -->
    <feature ref="http://example.com/secure-channel"
             required="true"/>
    <operation name="withdrawFunds">
      <!-- This operation must have ACID properties -->
      <feature ref="http://example.com/transaction"
               required="true"/>
      ...
    </operation>
    <operation name="depositFunds">
      <!-- This operation requires notarization -->
      <feature ref="http://example.com/notarization"
               required="true"/>
      ...
    </operation>
  </interface>

  <binding name="ns1:BankSOAPBinding">
    <!-- This particular binding requires ISO9001
         compliance to be verifiable -->
    <feature ref="http://example.com/ISO9001"
             required="true"/>
    <!-- This binding also requires notarization -->
    <feature ref="http://example.com/notarization"
             required="true"/>
  </binding>

  <service name="ns1:BankService"
           interface="tns:Bank">
    <endpoint binding="ns1:BankSOAPBinding">
      ...
    </endpoint>
  </service>
</description>
```

2.7.2 XML Representation of Feature Component

```
<feature
      ref="xs:anyURI"
      required="xs:boolean"? >
  <documentation />*
</feature>
```

The XML representation for a Feature component is an *element information item* with the following Infoset properties:

- A [local name] of `feature`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`
- One or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `ref` *attribute information item* as described below in **2.7.2** `ref` ***attribute information item*** **with** `feature` **[owner element]**.
  - An OPTIONAL `required` *attribute information item* as described below in **2.7.2** `required` ***attribute information item*** **with** `feature` **[owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item*s amongst its [children], in order as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

`ref` ***attribute information item*** **with** `feature` **[owner element]**

The `ref` *attribute information item* specifies the IRI of the feature.

The `ref` *attribute information item* has the following Infoset properties:

- A [local name] of `ref`
- A [namespace name] which has no value

The type of the `ref` *attribute information item* is `xs:anyURI`.

`required` ***attribute information item*** **with** `feature` **[owner element]**

The `required` *attribute information item* specifies whether the use of the feature is mandatory or optional.

The `required` *attribute information item* has the following Infoset properties:

- A [local name] of `required`
- A [namespace name] which has no value

The type of the `required` *attribute information item* is `xs:boolean`.

2.7.3 Mapping Feature's XML Representation to Component Properties

The mapping from the XML Representation of the `feature` *element information item* (see **2.7.2 XML Representation of Feature Component**) to the properties of the Feature component (see **2.7.1 The Feature Component**) is as described in Table 2.7 .

Table 2.7: Mapping from XML Representation to Feature Component Properties

Property	Value
ref	The actual value of the `ref` *attribute information item*.
required	The actual value of the `required` *attribute information item*, if present, otherwise `"false"`.
parent	The component corresponding to the *element information item* in [parent].

2.8 Property

2.8.1 The Property Component

A "property" in the Features and Properties architecture represents a named runtime value which affects the behavior of some aspect of a Web service interaction, much like an environment variable. For example, a reliable messaging SOAP module may specify a property to control the number of retries in the case of network failure. WSDL 2.0 documents may specify the value constraints for these properties by referring to a Schema type, or by specifying a particular value. Properties, and hence property values, can be shared amongst features/bindings/modules, and are named with IRIs precisely to allow this type of sharing.

The properties of the Property component are as follows:

- ref REQUIRED. An *xs:anyURI*. This *xs:anyURI* MUST be an absolute IRI as defined by [*IETF RFC 3987*]. This IRI SHOULD be dereferenceable to a document that directly or indirectly defines the meaning and use of the Property that it identifies.
- value constraint OPTIONAL. A reference to a Type Definition component in the type definitions property of the Description component constraining the value of the Property, or the token *#value* if the value property is not empty.
- value OPTIONAL. The value of the Property, an ordered list of child information items, as specified by the [children] property of *element information item*s in [*XML Information Set*].
- parent REQUIRED. The component that contains this component in its properties property.

Let *ValueConstraint* be the set of value constraints for Property components:

$$ValueConstraint ::= typeDefinitionId\langle\langle ID\rangle\rangle \mid valueToken$$

See *ID*.

- A value constraint is either a Type Definition component which defines the set of allowable values, or the token *#value* which indicates that the value is given by the contents of the value property of the Property component.

Let *ElementChildren* be the set of all allowable values of the [children] property of an XML Infoset *element information item*:

[*ElementChildren*]

Let *Property* be the set of all Property components:

Property

$$\begin{array}{l} Identifier \\ ref : AbsoluteURI \\ valueConstraint : OPTIONAL[ValueConstraint] \\ value : OPTIONAL[ElementChildren] \\ Parent \\ \hline valueConstraint = \{valueToken\} \Leftrightarrow value \neq \varnothing \end{array}$$

See *Identifier, AbsoluteURI, OPTIONAL, ValueConstraint, ElementChildren, Parent.*

- The value is constrained to be an explicitly given value exactly when the value property is defined.

Each component referenced by a Property component must exist in the component model.

Let *PropertyRI* express the referential integrity constraints on the Property component:

PropertyRI

$$ComponentModel2$$

$$\forall Property; y : ID \mid \theta Property \in propertyComps \bullet$$
$$valueConstraint = \{typeDefinitionId(y)\} \Rightarrow y \in typeDefIds \land$$
$$ParentValid$$

See *ComponentModel2, Property, ID, ParentValid.*

- If the value constraint of a Property component is a type definition, then the Type Definition component is contained in the component model.
- The parent of each Property component is contained in the component model.

The ref property of a Property component MUST be unique within the properties property of an Interface, Interface Fault, Interface Operation, Interface Message Reference, Interface Fault Reference, Binding, Binding Fault, Binding Operation, Binding Message Reference, Binding Fault Reference, Service, or Endpoint component.

Let *PropertyKey* express this uniqueness constraint on the Property component:

PropertyKey

$$ComponentModel2$$

$$\forall x, y : propertyComps \mid$$
$$x.parent = y.parent \land$$
$$x.ref = y.ref \bullet x = y$$

See *ComponentModel2.*

- No two Property components contained by the same component have the same ref property.

If a type system not based upon the XML Infoset is in use (as considered in **3.2 Using Other Schema Languages**) then additional properties would need to be added to the Property component (along with extensibility attributes to its XML representation) to allow using such a type system to describe values and constraints for properties.

Let *PropertyCM* be the conjunction of all the component model constraints on Property components.

$$PropertyCM \mathrel{\widehat=} PropertyRI \land PropertyKey$$

See *PropertyRI, PropertyKey.*

Property Composition Model

At runtime, the behavior of features, (SOAP) modules and bindings may be affected by the values of in-scope properties. Properties combine into a virtual "execution context" which maps property names (IRIs) to constraints. Each property IRI MAY therefore be associated with AT MOST one property constraint for a given interaction.

The set of properties which are required or available for a given component consists of the combined set of ALL property declarations applicable to that component. A property is applicable to a component if:

- it is asserted directly within that component, or
- it is asserted in a containing component, or
- it is asserted in a component referred to by the current component.

Many of the component types in the component model contain a properties property, which is a set of Property components. We refer to these as the *declared properties* of the component. Furthermore, the properties property is itself a subset of Property components that are required or available for the given component as determined by the Property Composition Model. We refer to these as the *in-scope properties* of the component.

Let *Properties* denote these sets of Property components:

Properties

$$Identifier$$
$$properties : \mathbb{P}\ ID$$
$$inScopeProperties : \mathbb{P}\ ID$$

$$properties \subseteq inScopeProperties$$

See *Identifier, ID.*

- The in-scope properties for a component always include the declared properties for that component.

The Property components contained by a given component MUST exist in the component model and the given component MUST be their parent.

Let *PropertiesValid* express these validity constraints on the properties property of a component:

$$
\begin{array}{|l}
\hline
\textit{PropertiesValid} \\
\textit{ComponentModel2} \\
\textit{Properties} \\
\hline
\textit{properties} \subseteq \textit{propertyIds} \\
\forall\, p : \textit{propertyComps} \bullet \\
\quad p.id \in \textit{properties} \Leftrightarrow p.\textit{parent} = \textit{id} \\
\hline
\end{array}
$$

See *ComponentModel2, Property.*

- Each Property component contained by this component MUST exist in the component model.
- This component MUST be the parent of the Property components it contains.

Following these rules, the set of properties applicable at each component are as follows:

- Interface component: all properties asserted within the Interface component and those with any extended Interface components.
- Interface Fault component: all properties asserted within the Interface Fault component and those within the parent Interface component.
- Interface Operation component: all properties asserted within the Interface Operation component and those within the parent Interface component.
- Interface Message Reference component: all properties asserted within the Interface Message Reference component, those within the parent Interface Operation component and those within its parent Interface component.
- Binding component: all properties asserted within the Binding component and those within the Interface component referred to by the Binding component (if any).
- Binding Fault component: all properties asserted within the Binding Fault component, those within the parent Binding component, those within the corresponding Interface Fault component, and those within the Interface component referred to by the Binding component.
- Binding Operation component: all properties asserted within the Binding Operation component, those within the parent Binding component, those within the corresponding Interface Operation component, and those within the Interface component referred to by the Binding component.

- Binding Message Reference component: all properties asserted within the Binding Message Reference component, those within the parent Binding Operation component, those within its parent Binding component, those within the corresponding Interface Message Reference component, and those within the Interface component referred to by the Binding component.

- Binding Fault Reference component: all properties asserted within the Binding Fault Reference component, those within the parent Binding Operation component, those within its parent Binding component, those within the corresponding Interface Fault Reference component, and those within the Interface component referred to by the Binding component.

- Service component: all properties asserted within the Service component and those within the Interface implemented by the Service component.

- Endpoint component: all properties asserted within the Endpoint component, whose within the Binding component implemented by the Endpoint component, and those within the parent Service component.

Note that, in the text above, "property constraint" (or, simply, "constraint") is used to mean EITHER a `constraint` inside a Property component OR a `value`, since `value` may be considered a special case of `constraint`.

If a given Property is asserted at multiple locations, then the value of that Property at a particular component is determined by the conjunction of all the constraints of its in-scope Property components. A Property constraint asserts that, for a given interaction, the value of a Property is either a specified value or belongs to a specified set of values. A specified value may be regarded as a singleton set, so in both cases a Property constraint corresponds to an assertion that the Property value belongs to some set. The conjunction of all the constraints associated with the in-scope properties is an assertion that the property value belongs to each of the associated sets, or equivalently, that the value belongs to the intersection of all the associated sets. If the intersection of the associated sets is empty, then the property constraints are mutually incompatible, and the composition is invalid. Therefore, the intersection of the associated sets SHOULD NOT be empty.

The reason that we phrase the requirement for a non-empty intersection as SHOULD rather than MUST, is that in general, it may be computationally difficult to determine by inspection of the type definitions that the intersection of two or more value sets is empty. Therefore, it is not a strict validity requirement that the intersection of the value sets be non-empty. An empty intersection will always result in failure of the service at run-time.

However, it is in general feasible to test specified values for either equality or membership in value sets. All specified values MUST be equal and belong to each specified value set.

2.8.2 XML Representation of Property Component

```
<property
      ref="xs:anyURI" >
  <documentation />*
  [ <value /> | <constraint /> ]?
</property>
```

The XML representation for a Property component is an *element information item* with the following Infoset properties:

- A [local name] of `property`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`
- One or more *attribute information items* amongst its [attributes] as follows:
  - A REQUIRED `ref` *attribute information item* as described below in **2.8.2** `ref` ***attribute information item*** **with** `property` **[owner element]**.
  - Zero or more namespace qualified *attribute information items* whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information items* amongst its [children], in order as follows:
  1. Zero or more `documentation` *element information items* (see **5 Documentation**).
  2. One OPTIONAL *element information item* from among the following:
     - A `value` *element information item* as described in **2.8.2** `value` ***element information item*** **with** `property` **[parent]**
     - A `constraint` *element information item* as described in **2.8.2** `constraint` ***element information item*** **with** `property` **[parent]**
  3. Zero or more namespace-qualified *element information items* whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

`ref` ***attribute information item*** **with** `property` **[owner element]**

The `ref` *attribute information item* specifies the IRI of the property. It has the following Infoset properties:

- A [local name] of `ref`
- A [namespace name] which has no value

The type of the `ref` *attribute information item* is `xs:anyURI`.

`value` ***element information item*** **with** `property` **[parent]**

```
<property>
  <value>
    xs:anyType
  </value>
</property>
```

The `value` *element information item* specifies the value of the property. It has the following Infoset properties:

- A [local name] of `value`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`

The type of the `value` *element information item* is `xs:anyType`.

`constraint` ***element information item*** **with** `property` **[parent]**

```
<property>
  <constraint>
    xs:QName
  </constraint>
</property>
```

The `constraint` *element information item* specifies a constraint on the value of the property. It has the following Infoset properties:

- A [local name] of `constraint`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`

The type of the `constraint` *attribute information item* is `xs:QName`.

2.8.3 Mapping Property's XML Representation to Component Properties

The mapping from the XML Representation of the `property` *element information item* (see **2.8.2 XML Representation of Property Component**) to the properties of the Property component (see **2.8.1 The Property Component**) is as described in Table 2.8 .

Table 2.8: Mapping from XML Representation to Property Component Properties

Property	Value
ref	The actual value of the `ref` *attribute information item.*

value constraint	If the `constraint` *element information item* is present, the Type Definition component from the type definitions property of the Description component resolved to by the value of the `constraint` *element information item* (see **2.19 QName resolution**); otherwise, if the `value` *element information item* is present, the token *#value*; otherwise empty.
value	The value of the [children] property of the `value` *element information item*, if that element is present, otherwise empty.
parent	The component corresponding to the *element information item* in [parent].

2.9 Binding

2.9.1 The Binding Component

A Binding component describes a concrete message format and transmission protocol which may be used to define an endpoint (see **2.15 Endpoint**). That is, a Binding component defines the implementation details necessary to access the service.

Binding components can be used to describe such information in a reusable manner for any interface or specifically for a given interface. Furthermore, binding information MAY be specified on a per-operation basis (see **2.11.1 The Binding Operation Component**) within an interface in addition to across all operations of an interface.

If a Binding component specifies any operation-specific binding details (by including Binding Operation components) or any fault binding details (by including Binding Fault components) then it MUST specify an interface the Binding component applies to, so as to indicate which interface the operations come from.

Conversely, a Binding component which omits any operation-specific binding details and any fault binding details MAY omit specifying an interface. Binding components that do not specify an interface MAY be used to specify operation-independent binding details for Service components with different interfaces. That is, such Binding components are reusable across one or more interfaces.

No concrete binding details are given in this specification. The companion specification, *WSDL (Version 2.0): Adjuncts* [*WSDL 2.0 Adjuncts*] defines such bindings for SOAP 1.2 [*SOAP 1.2 Part 1: Messaging Framework*] and HTTP [*IETF RFC 2616*]. Other specifications MAY define additional binding details. Such specifications are expected to annotate the Binding component (and its sub-components) with additional properties and specify the mapping from the XML representation to those properties.

A Binding component that defines bindings for an Interface component

MUST define bindings for all the operations of that Interface component. The bindings may occur via defaulting rules which allow one to specify default bindings for all operations (see, for example [*WSDL 2.0 Adjuncts*]) or by directly listing each Interface Operation component of the Interface component and defining bindings for them. Thus, it is an error for a Binding component to not define bindings for all the Interface Operation components of the Interface component for which the Binding component purportedly defines bindings for.

Bindings are named constructs and can be referred to by QName (see **2.19 QName resolution**). For instance, Endpoint components refer to bindings in this way.

The properties of the Binding component are as follows:

- name REQUIRED. An *xs:QName*.
- interface OPTIONAL. An Interface component indicating the interface for which binding information is being specified.
- type REQUIRED. An *xs:anyURI*. This *xs:anyURI* MUST be an absolute IRI as defined by [*IETF RFC 3987*]. The value of this IRI indicates what kind of concrete binding details are contained within this Binding component. Specifications (such as [*WSDL 2.0 Adjuncts*]) that define such concrete binding details MUST specify appropriate values for this property. The value of this property MAY be the namespace name of the extension elements or attributes which define those concrete binding details.
- binding faults OPTIONAL. A set of Binding Fault components.
- binding operations OPTIONAL. A set of Binding Operation components.
- features OPTIONAL. A set of Feature components.
- properties OPTIONAL. A set of Property components.

Let *Binding* be the set of all Binding components:

$$
\begin{array}{|l}
\hline
\textit{Binding} \\
\textit{Base} \\
\textit{name} : \textit{QName} \\
\textit{interface} : \textit{OPTIONAL}[\textit{ID}] \\
\textit{type} : \textit{AbsoluteURI} \\
\textit{bindingFaults} : \mathbb{P}\ \textit{ID} \\
\textit{bindingOperations} : \mathbb{P}\ \textit{ID} \\
\hline
\textit{interface} = \varnothing \Rightarrow \\
\quad \textit{bindingFaults} = \varnothing \land \\
\quad \textit{bindingOperations} = \varnothing \\
\hline
\end{array}
$$

See *Base, QName, OPTIONAL, ID, AbsoluteURI.*

- If no Interface component is specified then there MUST NOT be any faults or operations defined.

Each component referenced by a Binding component must exist in the component model.

Let *BindingRI* express the referential integrity constraints on the Binding component:

BindingRI

$$
\begin{array}{|l}
\hline
ComponentModel2 \\
\hline
\forall\, Binding \mid \theta Binding \in bindingComps \bullet \\
\quad BaseValid \land \\
\quad interface \subseteq interfaceIds \land \\
\quad bindingFaults \subseteq bindingFaultIds \land \\
\quad bindingOperations \subseteq bindingOpIds \\
\hline
\end{array}
$$

See *ComponentModel2, Binding, BaseValid.*

- Every Binding component satifies the base validity constraints.
- The Interface component of each Binding component is contained in the component model.
- The Binding Fault components of each Binding component are contained in the component model.
- The Binding Operation components of each Binding component are contained in the component model.

For each Binding component in the bindings property of a Description component, the name property MUST be unique.

Let *BindingKey* express the QName uniqueness constraint on the Binding component:

BindingKey

$$
\begin{array}{|l}
\hline
ComponentModel2 \\
\hline
\forall\, x, y : bindingComps \mid \\
\quad x.name = y.name \bullet x = y \\
\hline
\end{array}
$$

See *ComponentModel2.*

- No two Binding components have the same QName.

A Binding component contains nested Binding Operation and Binding Fault components. These components MUST have the Binding component as their parent.

Let *BindingParent* express the constraints on the parent properties of the nested components of a Binding component:

BindingParent

$$
\begin{array}{l}
ComponentModel2 \\
\hline
\forall\, b : bindingComps; \\
\quad bf : bindingFaultComps; \\
\quad bo : bindingOpComps \bullet \\
\quad bf.id \in b.bindingFaults \Leftrightarrow bf.parent = b.id \land \\
\quad bo.id \in b.bindingOperations \Leftrightarrow bo.parent = b.id
\end{array}
$$

See *ComponentModel2*.

- The set of Binding Fault components contained by a Binding component is exactly the set of Binding Fault components that have that Binding component as their parent.
- The set of Binding Operation components contained by a Binding component is exactly the set of Binding Operation components that have that Binding component as their parent.

Let *BindingCM* be the conjunction of all the component model constraints on Binding components.

$$
\begin{array}{l}
BindingCM \mathrel{\widehat{=}} \\
\quad BindingRI \land \\
\quad BindingKey \land \\
\quad BindingParent
\end{array}
$$

See *BindingRI, BindingKey, BindingParent*.

2.9.2 XML Representation of Binding Component

```
<description>
  <binding
        name="xs:NCName"
        interface="xs:QName"?
        type="xs:anyURI" >
    <documentation />*
    [ <fault /> | <operation /> | <feature /> | <property /> ]*
  </binding>
</description>
```

The XML representation for a Binding component is an *element information item* with the following Infoset properties:

- A [local name] of `binding`

- A [namespace name] of "http://www.w3.org/2006/01/wsdl"
- Two or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED name *attribute information item* as described below in **2.9.2 name *attribute information item* with binding [owner element]**.
  - An OPTIONAL interface *attribute information item* as described below in **2.9.2 interface *attribute information item* with binding [owner element]**.
  - An REQUIRED type *attribute information item* as described below in **2.9.2 type *attribute information item* with binding [owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT "http://www.w3.org/2006/01/wsdl".
- Zero or more *element information item*s amongst its [children], in order, as follows:
  1. Zero or more documentation *element information item*s (see **5 Documentation**).
  2. Zero or more *element information item*s from among the following, in any order:
     - Zero or more fault *element information item*s (see **2.10.2 XML Representation of Binding Fault Component**).
     - Zero or more operation *element information item*s (see **2.11.2 XML Representation of Binding Operation Component**).
     - Zero or more feature *element information item*s (see **2.7.2 XML Representation of Feature Component**).
     - Zero or more property *element information item*s (see **2.8.2 XML Representation of Property Component**).
     - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT "http://www.w3.org/2006/01/wsdl". Such *element information item*s are considered to be binding extension elements(see **2.9.2 Binding extension elements**).

name *attribute information item* with binding [owner element]

The name *attribute information item* together with the targetNamespace *attribute information item* of the description *element information item* forms the QName of the binding.

The name *attribute information item* has the following Infoset properties:

- A [local name] of name
- A [namespace name] which has no value

The type of the name *attribute information item* is *xs:NCName*.

`interface` ***attribute information item*** **with** `binding` **[owner element]**

The `interface` *attribute information item* refers, by QName, to an Interface component.

The `interface` *attribute information item* has the following Infoset properties:

- A [local name] of `interface`
- A [namespace name] which has no value

The type of the `interface` *attribute information item* is *xs:QName*.

`type` ***attribute information item*** **with** `binding` **[owner element]**

The `type` *attribute information item* identifies the kind of binding details contained in the Binding component.

The `type` *attribute information item* has the following Infoset properties:

- A [local name] of `type`
- A [namespace name] which has no value

The type of the `type` *attribute information item* is *xs:anyURI*.

Binding extension elements

Binding extension elements are used to provide information specific to a particular binding. The semantics of such *element information item*s are defined by the specification for those *element information item*s. Such specifications are expected to annotate the Binding component with additional properties and specify the mapping from the XML representation to those properties.

2.9.3 Mapping Binding's XML Representation to Component Properties

The mapping from the XML Representation of the `binding` *element information item* (see **2.9.2 XML Representation of Binding Component**) to the properties of the Binding component (see **2.9.1 The Binding Component**) is as described in Table 2.9 .

Table 2.9: Mapping from XML Representation to Binding Component Properties

Property	Value
name	The QName whose local name is the actual value of the `name` *attribute information item* and whose namespace name is the actual value of the `targetNamespace` *attribute information item* of the [parent] `description` *element information item*.

interface	The Interface component resolved to by the actual value of the `interface` *attribute information item* (see **2.19 QName resolution**), if any.
type	The actual value of the `type` *attribute information item*.
binding faults	The set of Binding Fault components corresponding to the `fault` *element information item*s in [children], if any.
binding operations	The set of Binding Operation components corresponding to the `operation` *element information item*s in [children], if any.
features	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
properties	The set of Property components corresponding to the `property` *element information item*s in [children], if any.

2.10 Binding Fault

2.10.1 The Binding Fault Component

A Binding Fault component describes a concrete binding of a particular fault within an interface to a particular concrete message format. A particular fault of an interface is uniquely identified by its name property.

Note that the fault does not occur by itself - it occurs as part of a message exchange as defined by an Interface Operation component (and its binding counterpart the Binding Operation component). Thus, the fault binding information specified in a Binding Fault component describes how faults that occur within a message exchange of an operation will be formatted and carried in the transport.

The properties of the Binding Fault component are as follows:

- interface fault

  REQUIRED. An Interface Fault component in the interface faults property of the Interface component identified by the interface property of the parent Binding component, or an Interface component that that Interface component directly or indirectly extends. This is the Interface Fault component for which binding information is being specified.

- features OPTIONAL. A set of Feature components.

- properties OPTIONAL. A set of Property components.

- parent REQUIRED. The Binding component that contains this component in its binding faults property.

Let *BindingFault* be the set of all Binding Fault components:

BindingFault

NestedBase

$interfaceFault : ID$

See *NestedBase, ID.*

Each component referenced by a Binding Fault component must exist in the component model.

Let *BindingFaultRI* express the referential integrity constraints on the Binding Fault component:

BindingFaultRI

*ComponentModel*2

$$\forall BindingFault \mid \theta BindingFault \in bindingFaultComps \bullet \\ NestedBaseValid \land \\ interfaceFault \in interfaceFaultIds$$

See *ComponentModel2, BindingFault, NestedBaseValid.*

- Every Binding Fault component satifies the base validity constraints.
- The Interface Fault component of each Binding Fault component is contained in the component model.

For each Binding Fault component in the binding faults property of a Binding component, the interface fault property MUST be unique. That is, one cannot define multiple bindings for the same fault within a given Binding component.

Let *BindingFaultKey* express this uniqueness constraint on the Binding Fault component:

BindingFaultKey

*ComponentModel*2

$$\forall x, y : bindingFaultComps \mid \\ x.parent = y.parent \land \\ x.interfaceFault = y.interfaceFault \bullet x = y$$

See *ComponentModel2.*

- No two Binding Fault components contained by the same Binding component have the same interface fault property.

A Binding Fault component MUST bind an Interface Fault component that is available in the Interface component associated with the Binding component. An Interface Fault component is available if it is contained in the Interface component or is available in an extended Interface component.

Let *BindingFaultConsistent* express this consistency contraint on Binding Fault components:

$$
\begin{array}{|l}
\hline
\textit{BindingFaultConsistent} \\
\textit{ComponentModel2} \\
\hline
\forall\, bf : bindingFaultComps; \\
\quad b : bindingComps; \\
\quad i : interfaceComps \mid \\
\quad bf.parent = b.id \land \\
\quad b.interface = \{i.id\} \bullet \\
\quad bf.interfaceFault \in i.allInterfaceFaults \\
\hline
\end{array}
$$

See *ComponentModel2.*

- Each Binding Fault component MUST bind an Interface Fault component that is available in the Interface component that is associated with its parent Binding component.

Let *BindingFaultCM* be the conjunction of all the component model constraints on Binding Fault components.

$$
\begin{array}{l}
\textit{BindingFaultCM} \mathrel{\widehat=} \\
\quad \textit{BindingFaultRI} \land \\
\quad \textit{BindingFaultKey} \land \\
\quad \textit{BindingFaultConsistent}
\end{array}
$$

See *BindingFaultRI, BindingFaultKey, BindingFaultConsistent.*

2.10.2 XML Representation of Binding Fault Component

```
<description>
  <binding>
    <fault
          ref="xs:QName" >
      <documentation />*
      [ <feature /> | <property /> ]*
    </fault>
  </binding>
</description>
```

The XML representation for a Binding Fault component is an *element information item* with the following Infoset properties:

- A [local name] of `fault`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`

- One or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `ref` *attribute information item* as described below in **2.10.2 `ref` *attribute information item* with `fault` [owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item* amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. Zero or more *element information item*s from among the following, in any order:
     - Zero or more `feature` *element information item*s **2.7.2 XML Representation of Feature Component**
     - Zero or more `property` *element information item*s **2.8.2 XML Representation of Property Component**
     - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`. Such *element information item*s are considered to be binding fault extension elements as described below (see **2.10.2 Binding Fault extension elements**).

`ref` *attribute information item* with `fault` [owner element]

The `ref` *attribute information item* has the following Infoset properties:

- A [local name] of `ref`
- A [namespace name] which has no value

The type of the `ref` *attribute information item* is *xs:QName*.

Binding Fault extension elements

Binding Fault extension elements are used to provide information specific to a particular fault in a binding. The semantics of such *element information item*s are defined by the specification for those *element information item*s. Such specifications are expected to annotate the Binding Fault component with additional properties and specify the mapping from the XML representation to those properties.

2.10.3 Mapping Binding Fault's XML Representation to Component Properties

The mapping from the XML Representation of the `fault` *element information item* (see **2.10.2 XML Representation of Binding Fault Component**) to the properties of the Binding Fault component (see **2.10.1 The Binding Fault Component**) is as described in Table 2.10 .

Table 2.10: Mapping from XML Representation to Binding Fault Component Properties

Property	Value
interface fault	The Interface Fault Component corresponding to the actual value of the `ref` *attribute information item*.
features	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
properties	The set of Property components corresponding to the `property` *element information item*s in [children], if any.
parent	The Binding component corresponding to the `binding` *element information item* in [parent].

2.11 Binding Operation

2.11.1 The Binding Operation Component

The Binding Operation component describes the concrete message format(s) and protocol interaction(s) associated with a particular interface operation for a given endpoint. A particular operation of an interface is uniquely identified by its name property.

The properties of the Binding Operation component are as follows:

- interface operation

  REQUIRED. An Interface Operation component in the interface operations property of the Interface component identified by the interface property of the [parent] Binding component, or an Interface component that that Interface component directly or indirectly extends. This is the Interface Operation component for which binding information is being specified.

- binding message references

  OPTIONAL. A set of Binding Message Reference components.

- binding fault references

  OPTIONAL. A set of Binding Fault Reference components.

- features OPTIONAL. A set of Feature components.
- properties OPTIONAL. A set of Property components.
- parent REQUIRED. The Binding component that contains this component in its binding operations property.

Let *BindingOperation* be the set of all Binding Operation components:

$$
\begin{array}{|l}
\hline
\textit{BindingOperation} \\
\textit{NestedBase} \\
\textit{interfaceOperation} : \textit{ID} \\
\textit{bindingMessageReferences} : \mathbb{P}\ \textit{ID} \\
\textit{bindingFaultReferences} : \mathbb{P}\ \textit{ID} \\
\hline
\end{array}
$$

See *NestedBase, ID.*

Each component referenced by a Binding Operation component must exist in the component model.

Let *BindingOperationRI* express the referential integrity constraints on the Binding Operation component:

$$
\begin{array}{|l}
\hline
\textit{BindingOperationRI} \\
\textit{ComponentModel2} \\
\hline
\forall\, \textit{BindingOperation} \mid \theta\, \textit{BindingOperation} \in \textit{bindingOpComps} \bullet \\
\quad \textit{NestedBaseValid} \land \\
\quad \textit{interfaceOperation} \in \textit{interfaceOpIds} \land \\
\quad \textit{bindingMessageReferences} \subseteq \textit{bindingMessageRefIds} \land \\
\quad \textit{bindingFaultReferences} \subseteq \textit{bindingFaultRefIds} \\
\hline
\end{array}
$$

See *ComponentModel2, BindingOperation, NestedBaseValid.*

- Every Binding Operation component satifies the base validity constraints.
- The Interface Operation component of each Binding Operation component is contained in the component model.
- The Binding Message Reference components of each Binding Operation component are contained in the component model.
- The Binding Fault Reference components of each Binding Operation component are contained in the component model.

For each Binding Operation component in the binding operations property of a Binding component, the interface operation property MUST be unique. That is, one cannot define multiple bindings for the same operation within a given Binding component.

Let *BindingOperationKey* express this uniqueness constraint on the Binding Operation component:

BindingOperationKey

ComponentModel2

$$\forall x, y : bindingOpComps \mid x.parent = y.parent \land x.interfaceOperation = y.interfaceOperation \bullet x = y$$

See *ComponentModel2*.

- No two Binding Operation components contained by the same Binding component have the same interface operation property.

A Binding Operation component contains nested Binding Message Reference and Binding Fault Reference components. These components MUST have the Binding Operation component as their parent.

Let *BindingOperationParent* express the constraints on the parent properties of the nested components of a Binding Operation component:

BindingOperationParent

ComponentModel2

$$\forall bo : bindingOpComps; bfr : bindingFaultRefComps; bmr : bindingMessageRefComps \bullet bfr.id \in bo.bindingFaultReferences \Leftrightarrow bfr.parent = bo.id \land bmr.id \in bo.bindingMessageReferences \Leftrightarrow bmr.parent = bo.id$$

See *ComponentModel2*.

- The set of Binding Fault Reference components contained by a Binding Operation component is exactly the set of Binding Fault Reference components that have that Binding Operation as their parent.
- The set of Binding Message Reference components contained by a Binding Operation component is exactly the set of Binding Message Reference components that have that Binding Operation as their parent.

A Binding Operation component MUST bind an Interface Operation component that is available in the Interface component associated with the Binding component. An Interface Operation component is available if it is contained in the Interface component or is available in an extended Interface component.

Let *BindingOperationConsistent* express this consistency contraint on Binding Operation components:

BindingOperationConsistent

ComponentModel2

$$\forall\, bo : bindingOpComps;\ b : bindingComps;\ i : interfaceComps \mid bo.parent = b.id \land b.interface = \{i.id\} \bullet bo.interfaceOperation \in i.allInterfaceOperations$$

See *ComponentModel2*.

- Each Binding Operation component MUST bind an Interface Operation component that is available in the Interface component that is associated with its parent Binding component.

Let *BindingOperationCM* be the conjunction of all the component model constraints on Binding Operation components.

$$BindingOperationCM \mathrel{\widehat=} BindingOperationRI \land BindingOperationKey \land BindingOperationParent \land BindingOperationConsistent$$

See *BindingOperationRI, BindingOperationKey, BindingOperationParent, BindingOperationConsistent.*

2.11.2 XML Representation of Binding Operation Component

```
<description>
  <binding>
    <operation
          ref="xs:QName" >
      <documentation />*
      [ <input /> | <output /> | <infault /> | <outfault /> | <feature /> | <property /> ]*
    </operation>
  </binding>
</description>
```

The XML representation for a Binding Operation component is an *element information item* with the following Infoset properties:

- A [local name] of `operation`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`

- One or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `ref` *attribute information item* as described below in **2.11.2 `ref` *attribute information item* with `operation` [owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item*s amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. Zero or more *element information item*s from among the following, in any order:
     - Zero or more `input` *element information item*s (see **2.12 Binding Message Reference**)
     - Zero or more `output` *element information item*s (see **2.12 Binding Message Reference**)
     - Zero or more `infault` *element information item*s (see **2.13 Binding Fault Reference**)
     - Zero or more `outfault` *element information item*s (see **2.13 Binding Fault Reference**)
     - Zero or more `feature` *element information item*s (see **2.7.2 XML Representation of Feature Component**)
     - Zero or more `property` *element information item*s (see **2.7.2 XML Representation of Feature Component**)
     - Zero or more namespace-qualified *element information item* whose [namespace name] is NOT `" http://www.w3.org/2006/01/wsdl "`. Such *element information item*s are considered to be binding operation extension elements as described below (see **2.11.2 Binding Operation extension elements**).

`ref` *attribute information item* with `operation` [owner element]

The `ref` *attribute information item* has the following Infoset properties:

- A [local name] of `ref`
- A [namespace name] which has no value

The type of the `ref` *attribute information item* is *xs:QName*.

Binding Operation extension elements

Binding Operation extension elements are used to provide information specific to a particular operation in a binding. The semantics of such *element information item*s are defined by the specification for those *element information item*s. Such specifications are expected to annotate the Binding Operation component with additional properties and specify the mapping from the XML representation to those properties.

2.11.3 Mapping Binding Operation's XML Representation to Component Properties

The mapping from the XML Representation of the `operation` *element information item* (see **2.11.2 XML Representation of Binding Operation Component**) to the properties of the Binding Operation component is as described in Table 2.11 .

Table 2.11: Mapping from XML Representation to Binding Operation Component Properties

Property	Value
interface operation	The Interface Operation component corresponding to the actual value of the `ref` *attribute information item*.
binding message references	The set of Binding Message Reference components corresponding to the `input` and `output` *element information item*s in [children], if any.
binding fault references	The set of Binding Fault Reference components corresponding to the `infault` and `outfault` *element information item*s in [children], if any.
features	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
properties	The set of Property components corresponding to the `property` *element information item*s in [children], if any.
parent	The Binding component corresponding to the `binding` *element information item* in [parent].

2.12 Binding Message Reference

2.12.1 The Binding Message Reference Component

A Binding Message Reference component describes a concrete binding of a particular message participating in an operation to a particular concrete message format.

The properties of the Binding Message Reference component are as follows:

- interface message reference

  REQUIRED. An Interface Message Reference component among those in the

  interface message references

  property of the Interface Operation component being bound by the containing Binding Operation component.

- features

  OPTIONAL. A set of Feature components.

- properties

  OPTIONAL. A set of Property components.

- parent

  REQUIRED. The Binding Operation component that contains this component in its

  binding message references

  property.

Let *BindingMessageReference* be the set of all Binding Message Reference components:

BindingMessageReference

NestedBase

interfaceMessageReference : *ID*

See *NestedBase*.

Each component referenced by a Binding Message Reference component must exist in the component model.

Let *BindingMessageReferenceRI* express the referential integrity constraints on the Binding Message Reference component:

$$
\begin{array}{|l}
\textit{BindingMessageReferenceRI} \\
\textit{ComponentModel2} \\
\hline
\forall\, \textit{BindingMessageReference} \mid \\
\quad \theta\, \textit{BindingMessageReference} \in \textit{bindingMessageRefComps} \bullet \\
\qquad \textit{NestedBaseValid} \land \\
\qquad \textit{interfaceMessageReference} \in \textit{interfaceMessageRefIds} \\
\hline
\end{array}
$$

See *ComponentModel2, BindingMessageReference, NestedBaseValid.*

- Every Binding Message Reference component satifies the base validity constraints.
- The Interface Message Reference component refered to by a Binding Message Reference component MUST exist in the component model.

For each Binding Message Reference component in the
binding message references
property of a Binding Operation component, the
interface message reference
property MUST be unique. That is, the same message cannot be bound twice within the same operation.

Let *BindingMessageReferenceKey* express this uniqueness constraint on the Binding Message Reference component:

$$
\begin{array}{|l}
\textit{BindingMessageReferenceKey} \\
\textit{ComponentModel2} \\
\hline
\forall\, x, y : \textit{bindingMessageRefComps} \mid \\
\quad x.\textit{parent} = y.\textit{parent} \land \\
\quad x.\textit{interfaceMessageReference} = y.\textit{interfaceMessageReference} \bullet \\
\quad x = y \\
\hline
\end{array}
$$

See *ComponentModel2.*

- No two Binding Message Reference components contained by the same Binding Operation component have the same interface message reference property.

The Interface Message Reference component bound by a Binding Message Reference component MUST be contained in the Interface Operation component that is being bound by the Binding Operation that contains this Binding Message Reference component.

Let *BindingMessageReferenceConsistent* express this consistency constraint:

BindingMessageReferenceConsistent

ComponentModel2

$$\forall\, bmr : bindingMessageRefComps;\ bo : bindingOpComps;\ imr : interfaceMessageRefComps \mid bmr.parent = bo.id \land bmr.interfaceMessageReference = imr.id \bullet bo.interfaceOperation = imr.parent$$

See *ComponentModel2.*

- For each Binding Message Reference component, the parent Interface Operation component of its Interface Message Reference component is the Interface Operation component of its parent Binding Operation component.

Let *BindingMessageReferenceCM* be the conjunction of all the component model constraints on Binding Message Reference components.

$$BindingMessageReferenceCM \mathrel{\widehat=} BindingMessageReferenceRI \land BindingMessageReferenceKey \land BindingMessageReferenceConsistent$$

See *BindingMessageReferenceRI, BindingMessageReferenceKey, BindingMessageReferenceConsistent.*

2.12.2 XML Representation of Binding Message Reference Component

```
<description>
  <binding>
    <operation>
      <input
            messageLabel="xs:NCName"? >
        <documentation />*
        [ <feature /> | <property /> ]*
      </input>
      <output
            messageLabel="xs:NCName"? >
        <documentation />*
        [ <feature /> | <property /> ]*
      </output>
    </operation>
  </binding>
</description>
```

The XML representation for a Binding Message Reference component is an *element information item* with the following Infoset properties:

- A [local name] of `input` or `output`.
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *attribute information item*s amongst its [attributes] as follows:
  - An OPTIONAL `messageLabel` *attribute information item* as described below in **2.12.2** `messageLabel` ***attribute information item*** **with** `input` **or** `output` **[owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item* amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. Zero or more *element information item*s from among the following, in any order:
     - Zero or more `feature` *element information item*s **2.7.2 XML Representation of Feature Component**
     - Zero or more `property` *element information item*s **2.8.2 XML Representation of Property Component**
     - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`. Such *element information item*s are considered to be binding message reference extension elements as described below (see **2.12.2 Binding Message Reference extension elements**).

`messageLabel` ***attribute information item*** **with** `input` **or** `output` **[owner element]**

The `messageLabel` *attribute information item* has the following Infoset properties:

- A [local name] of `messageLabel`.
- A [namespace name] which has no value.

The type of the `messageLabel` *attribute information item* is *xs:NCName*.

Binding Message Reference extension elements

Binding Message Reference extension elements are used to provide information specific to a particular message in an operation. The semantics of such *element information item*s are defined by the specification for those *element information item*s. Such specifications are expected to annotate the Binding Message Reference component with additional properties and specify the mapping from the XML representation to those properties..

2.12.3 Mapping Binding Message Reference's XML Representation to Component Properties

The mapping from the XML Representation of the `binding` *element information item* (see **2.12.2 XML Representation of Binding Message Reference Component**) to the properties of the Binding Message Reference component is as described in Table 2.12 .

Define the *message exchange pattern* of the *element information item* to be the message exchange pattern of the Interface Operation component being bound.

Define the *message direction* of the *element information item* to be *in* if its local name is `input` and *out* if its local name is `output`.

The `messageLabel` *attribute information item* of a binding message reference *element information item* MUST be present if the message exchange pattern has more than one placeholder message with {direction} equal to the message direction.

If the `messageLabel` *attribute information item* of a binding message reference *element information item* is present then its actual value MUST match the {message label} of some placeholder message with {direction} equal to the message direction.

If the `messageLabel` *attribute information item* of a binding message reference *element information item* is absent then there MUST be a unique placeholder message with {direction} equal to the message direction.

Define the *effective message label* of a binding message reference *element information item* to be either the actual value of the `messageLabel` *attribute information item* if it is present, or the {message label} of the unique placeholder message with {direction} equal to the message direction if the *attribute information item* is absent.

Table 2.12: Mapping from XML Representation to Binding Message Reference Component Properties

Property	Value
interface message reference	The Interface Message Reference component in the interface message references of the Interface Operation component being bound with message label equal to the effective message label.

{features}	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
{properties}	The set of Property components corresponding to the `property` *element information item*s in [children], if any.
{parent}	The Binding Operation component corresponding to the `operation` *element information item* in [parent].

2.13 Binding Fault Reference

2.13.1 The Binding Fault Reference Component

A Binding Fault Reference component describes a concrete binding of a particular fault participating in an operation to a particular concrete message format.

The properties of the Binding Fault Reference component are as follows:

- interface fault reference

  REQUIRED. An Interface Fault Reference component among those in the

  interface fault references

  property of the Interface Operation component being bound by the parent Binding Operation component.

- features

  OPTIONAL. A set of Feature components.

- properties

  OPTIONAL. A set of Property components.

- parent

  REQUIRED. The Binding Operation component that contains this component in its

  binding fault references

  property.

Let *BindingFaultReference* be the set of all Binding Fault Reference components:

BindingFaultReference

NestedBase

interfaceFaultReference : *ID*

See *NestedBase.*

Each component referenced by a Binding Fault Reference component must exist in the component model.

Let *BindingFaultReferenceRI* express the referential integrity constraints on the Binding Fault Reference component:

$$
\begin{array}{|l}
\textit{BindingFaultReferenceRI} \\
\textit{ComponentModel2} \\
\hline
\forall\, \textit{BindingFaultReference} \mid \\
\quad \theta\, \textit{BindingFaultReference} \in \textit{bindingFaultRefComps} \bullet \\
\qquad \textit{NestedBaseValid} \land \\
\qquad \textit{interfaceFaultReference} \in \textit{interfaceFaultRefIds} \\
\hline
\end{array}
$$

See *ComponentModel2, BindingFaultReference, NestedBaseValid.*

- Every Binding Fault Reference component satifies the base validity constraints.
- The Interface Fault Reference component refered to by a Binding Fault Reference component MUST exist in the component model.

For each Binding Fault Reference component in the binding fault references property of a Binding Operation component, the

interface fault reference

property MUST be unique. That is, the same fault cannot be bound twice within the same operation.

Let *BindingFaultReferenceKey* express this uniqueness constraint on the Binding Fault Reference component:

$$
\begin{array}{|l}
\textit{BindingFaultReferenceKey} \\
\textit{ComponentModel2} \\
\hline
\forall\, x, y : \textit{bindingFaultRefComps} \mid \\
\quad x.\textit{parent} = y.\textit{parent} \land \\
\quad x.\textit{interfaceFaultReference} = y.\textit{interfaceFaultReference} \bullet \\
\quad x = y \\
\hline
\end{array}
$$

See *ComponentModel2.*

- No two Binding Fault Reference components contained by the same Binding Operation component have the same interface fault reference property.

The Interface Fault Reference component bound by a Binding Fault Reference component MUST be contained in the Interface Operation component that is being bound by the Binding Operation that contains this Binding Fault Reference component.

Let *BindingFaultReferenceConsistent* express this consistency constraint:

BindingFaultReferenceConsistent

ComponentModel2

$$\forall\, bfr : bindingFaultRefComps;\ bo : bindingOpComps;\ ifr : interfaceFaultRefComps \mid bfr.parent = bo.id \land bfr.interfaceFaultReference = ifr.id \bullet bo.interfaceOperation = ifr.parent$$

See *ComponentModel2.*

- For each Binding Fault Reference component, the parent Interface Operation component of its Interface Fault Reference component is the Interface Operation component bound by its parent Binding Operation component.

Let *BindingFaultReferenceCM* be the conjunction of all the component model constraints on Binding Fault Reference components.

$$BindingFaultReferenceCM \mathrel{\widehat=} BindingFaultReferenceRI \land BindingFaultReferenceKey \land BindingFaultReferenceConsistent$$

See *BindingFaultReferenceRI, BindingFaultReferenceKey, BindingFaultReferenceConsistent.*

2.13.2 XML Representation of Binding Fault Reference Component

```
<description>
  <binding>
    <operation>
      <infault
            ref="xs:QName"
            messageLabel="xs:NCName"?>
        <documentation />*
        [ <feature /> | <property /> ]*
      </infault>
      <outfault
            ref="xs:QName"
            messageLabel="xs:NCName"?>
        <documentation />*
        [ <feature /> | <property /> ]*
      </outfault>
    </operation>
  </binding>
</description>
```

The XML representation for a Binding Fault Reference component is an *element information item* with the following Infoset properties:

- A [local name] of `infault` or `outfault`.
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`.
- One or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `ref` *attribute information item* as described below in **2.13.2 `ref` *attribute information item* with `infault` or `outfault` [owner element]**.

    An OPTIONAL `messageLabel` *attribute information item* as described below in **2.13.2 `messageLabel` *attribute information item* with `infault` or `outfault` [owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item* amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. Zero or more *element information item*s from among the following, in any order:
     - Zero or more `feature` *element information item*s **2.7.2 XML Representation of Feature Component**
     - Zero or more `property` *element information item*s **2.8.2 XML Representation of Property Component**
     - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`. Such *element information item*s are considered to be binding fault reference extension elements as described below (see **2.13.2 Binding Fault Reference extension elements**).

`ref` *attribute information item* with `infault` or `outfault` [owner element]

The `ref` *attribute information item* has the following Infoset properties:

- A [local name] of `ref`.
- A [namespace name] which has no value.

The type of the `ref` *attribute information item* is *xs:QName*.

`messageLabel` *attribute information item* with `infault` or `outfault` [owner element]

The `messageLabel` *attribute information item* has the following Infoset properties:

- A [local name] of `messageLabel`.
- A [namespace name] which has no value.

The type of the `messageLabel` *attribute information item* is *xs:NCName*.

Binding Fault Reference extension elements

Binding Fault Reference extension elements are used to provide information specific to a particular fault in an operation. The semantics of such *element information item*s are defined by the specification for those *element information item*s. Such specifications are expected to annotate the Binding Fault Reference component with additional properties and specify the mapping from the XML representation to those properties..

2.13.3 Mapping Binding Fault Reference's XML Representation to Component Properties

The mapping from the XML Representation of the `binding` *element information item* (see **2.13.2 XML Representation of Binding Fault Reference Component**) to the properties of the Binding Fault Reference component is as described in Table 2.13 .

Define the *message exchange pattern* of the *element information item* to be the message exchange pattern of the Interface Operation component being bound.

Define the *fault direction* of the *element information item* to be *in* if its local name is `infault` and *out* if its local name is `outfault`.

Define the *message direction* of the *element information item* to be the {direction} of the placeholder message associated with the fault as specifed by the fault propagation ruleset of the message exchange pattern.

The `messageLabel` *attribute information item* of a binding fault reference *element information item* MUST be present if the message exchange pattern has more than one placeholder message with {direction} equal to the message direction.

If the `messageLabel` *attribute information item* of a binding fault reference *element information item* is present then its actual value MUST match the {message label} of some placeholder message with {direction} equal to the message direction.

If the `messageLabel` *attribute information item* of a binding fault reference *element information item* is absent then there MUST be a unique placeholder message with {direction} equal to the message direction.

Define the *effective message label* of a binding fault reference *element information item* to be either the actual value of the `messageLabel` *attribute information item* if it is present, or the {message label} of the unique placeholder message with {direction} equal to the message direction if the *attribute information item* is absent.

There MUST be an Interface Fault Reference component in the interface fault references of the Interface Operation being bound with message label equal to the effective message label and with interface fault equal to an Interface Fault component with name equal to the actual value of the `ref` *attribute information item*.

Table 2.13: Mapping from XML Representation to Binding Fault Reference Component Properties

Property	Value
interface fault reference	The Interface Fault Reference component in the interface fault references of the Interface Operation being bound with message label equal to the effective message label and with interface fault equal to an Interface Fault component with name equal to the actual value of the `ref` *attribute information item*.
{features}	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
{properties}	The set of Property components corresponding to the `property` *element information item*s in [children], if any.
{parent}	The Binding Operation component corresponding to the `operation` *element information item* in [parent].

2.14 Service

2.14.1 The Service Component

A Service component describes a set of endpoints (see **2.15 Endpoint**) at which a particular deployed implementation of the service is provided. The endpoints thus are in effect alternate places at which the service is provided.

Services are named constructs and can be referred to by QName (see **2.19 QName resolution**).

The properties of the Service component are as follows:

- name REQUIRED. An *xs:QName*.
- interface REQUIRED. An Interface component.
- endpoints REQUIRED. A non-empty set of Endpoint components.

- features OPTIONAL. A set of Feature components.
- properties OPTIONAL. A set of Property components.

Let *Service* be the set of all Service components:

Service

$$Base$$
$$name : QName$$
$$interface : ID$$
$$endpoints : \mathbb{P}_1\ ID$$

See *Base, QName, ID.*

Each component referenced by a Service component must exist in the component model.

Let *ServiceRI* express the referential integrity constraints on the Service component:

ServiceRI

$$ComponentModel2$$

$$\forall\, Service \mid \theta Service \in serviceComps \bullet$$
$$\quad BaseValid \land$$
$$\quad interface \in interfaceIds \land$$
$$\quad endpoints \subseteq endpointIds$$

See *ComponentModel2, Service, BaseValid.*

- Every Service component satifies the base validity constraints.
- The Interface component of each Service component is contained in the component model.
- The Endpoint components of each Service component are contained in the component model.

For each Service component in the services property of a Description component, the name property MUST be unique.

Let *ServiceKey* express the QName uniqueness constraint on the Service component:

ServiceKey

$$ComponentModel2$$

$$\forall\, x, y : serviceComps \mid$$
$$\quad x.name = y.name \bullet x = y$$

See *ComponentModel2.*

- No two Service components have the same QName.

A Service component contains nested Endpoint components. These components MUST have the Service component as their parent.

Let *ServiceParent* express the constraints on the parent properties of the nested components of a Service component:

ServiceParent

$$
\begin{array}{|l}
\hline
ComponentModel2 \\
\hline
\forall\, s : serviceComps; \\
\quad e : endpointComps \bullet \\
\quad e.id \in s.endpoints \Leftrightarrow e.parent = s.id \\
\hline
\end{array}
$$

See *ComponentModel2.*

- The set of Endpoint components contained by a Service component is exactly the set of Endpoint components that have that Service component as their parent.

Let *ServiceCM* be the conjunction of all the component model constraints on Service components.

$$
\begin{aligned}
&ServiceCM \mathrel{\widehat=} \\
&\quad ServiceRI \land \\
&\quad ServiceKey \land \\
&\quad ServiceParent
\end{aligned}
$$

See *ServiceRI, ServiceKey, ServiceParent.*

2.14.2 XML Representation of Service Component

```
<description>
  <service
        name="xs:NCName"
        interface="xs:QName" >
    <documentation />*
    <endpoint />+
    [ <feature /> | <property /> ]*
  </service>
</description>
```

The XML representation for a Service component is an *element information item* with the following Infoset properties:

- A [local name] of `service`
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`

- Two or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `name` *attribute information item* as described below in **2.14.2 `name` *attribute information item* with `service` [owner element]**.
  - A REQUIRED `interface` *attribute information item* as described below in **2.14.2 `interface` *attribute information item* with `service` [owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- One or more *element information item* amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).
  2. One or more *element information item*s from among the following, in any order:
     - One or more `endpoint` *element information item*s (see **2.15.2 XML Representation of Endpoint Component**
     - Zero or more `feature` and/or `property` *element information item*s (see **2.7.2 XML Representation of Feature Component** and **2.8.2 XML Representation of Property Component**, respectively).
     - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

`name` *attribute information item* with `service` [owner element]

The `name` *attribute information item* together with the `targetNamespace` *attribute information item* of the `description` *element information item* forms the QName of the service.

The `name` *attribute information item* has the following Infoset properties:

- A [local name] of `name`
- A [namespace name] which has no value

The type of the `name` *attribute information item* is *xs:NCName*.

`interface` *attribute information item* with `service` [owner element]

The `interface` *attribute information item* identifies the interface that the service is an instance of. The `interface` *attribute information item* has the following Infoset properties:

- A [local name] of `interface`
- A [namespace name] which has no value

The type of the `interface` *attribute information item* is *xs:QName.*.

2.14.3 Mapping Service's XML Representation to Component Properties

The mapping from the XML Representation of the `service` *element information item* (see **2.14.2 XML Representation of Service Component**) to the properties of the Service component is as described in Table 2.14 .

Table 2.14: Mapping from XML Representation to Service Component Properties

Property	Value
name	The QName whose local name is the actual value of the `name` *attribute information item* and whose namespace name is the actual value of the `targetNamespace` *attribute information item* of the [parent] `description` *element information item*.
interface	The Interface component resolved to by the actual value of the `interface` *attribute information item* (see **2.19 QName resolution**).
endpoints	The Endpoint components corresponding to the `endpoint` *element information item*s in [children].
features	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
properties	The set of Property components corresponding to the `property` *element information item*s in [children], if any.

2.15 Endpoint

2.15.1 The Endpoint Component

An Endpoint component defines the particulars of a specific endpoint at which a given service is available.

Endpoint components are local to a given Service component; they cannot be referred to by QName (see **A.2 Fragment Identifiers**).

The address property is optional to allow for means other than IRIs to be used, e.g. a WS-Addressing Endpoint Reference [*WSA 1.0 Core*]. It is also

possible that in certain scenarios an address will not be required, in which case this property may not be present.

The properties of the Endpoint component are as follows:

- name REQUIRED. An *xs:NCName*.
- binding REQUIRED. A Binding component.
- address OPTIONAL. An *xs:anyURI*. This *xs:anyURI* MUST be an absolute IRI as defined by [*IETF RFC 3987*]. If present, the value of this attribute represents the network address at which the service indicated by the parent Service component's interface property is offered via the binding referred to by the binding property.
- features OPTIONAL. A set of Feature components.
- properties OPTIONAL. A set of Property components.
- parent REQUIRED. The Service component that contains this component in its endpoints property.

Let *Endpoint* be the set of all Endpoint components:

$$
\begin{array}{|l}
\hline
\textit{Endpoint} \\
\hline
\textit{NestedBase} \\
\textit{name} : \textit{NCName} \\
\textit{binding} : \textit{ID} \\
\textit{address} : \textit{OPTIONAL}[\textit{AbsoluteURI}] \\
\hline
\end{array}
$$

See *NestedBase, NCName, ID, OPTIONAL, AbsoluteURI.*

Each component referenced by a Endpoint component must exist in the component model.

Let *EndpointRI* express the referential integrity constraints on the Endpoint component:

$$
\begin{array}{|l}
\hline
\textit{EndpointRI} \\
\hline
\textit{ComponentModel2} \\
\hline
\forall\, \textit{Endpoint} \mid \theta \textit{Endpoint} \in \textit{endpointComps} \bullet \\
\quad \textit{NestedBaseValid} \land \\
\quad \textit{binding} \in \textit{bindingIds} \\
\hline
\end{array}
$$

See *ComponentModel2, Endpoint, NestedBaseValid.*

- Every Service component satifies the base validity constraints.
- The Binding component of each Endpoint component is contained in the component model.

- The Feature components of each Endpoint component are contained in the component model.
- The Property components of each Endpoint component are contained in the component model.

For each Endpoint component in the endpoints property of a Service component, the name property MUST be unique.

Let *EndpointKey* express this uniqueness constraint on the Endpoint component:

EndpointKey

$ComponentModel2$

$$\forall x, y : endpointComps \mid x.parent = y.parent \land x.name = y.name \bullet x = y$$

See *ComponentModel2*.

- No two Endpoint components contained by the same Service component have the same name property.

For each Endpoint component in the endpoints property of a Service component, the binding property MUST either be a Binding component with an unspecified interface property or a Binding component with an interface property equal to the interface property of the Service component.

Let *EndpointConsistent* express this consistency constraint:

EndpointConsistent

$ComponentModel2$

$$\forall s : serviceComps; e : endpointComps; b : bindingComps \mid e.parent = s.id \land e.binding = b.id \bullet b.interface \subseteq \{s.interface\}$$

See *ComponentModel2*.

- The Interface component of the Endpoint component's Service component MUST be the same as the Interface component of the Endpoint component's Binding component, if one is specified.

Let *EndpointCM* be the conjunction of all the component model constraints on Endpoint components.

$$EndpointCM \mathrel{\widehat{=}} EndpointRI \land EndpointKey \land EndpointConsistent$$

See *EndpointRI, EndpointKey, EndpointConsistent.*

2.15.2 XML Representation of Endpoint Component

```
<description>
  <service>
    <endpoint
          name="xs:NCName"
          binding="xs:QName"
          address="xs:anyURI"? >
      <documentation />*
      [ <feature /> | <property /> ]*
    </endpoint>+
  </service>
</description>
```

The XML representation for a Endpoint component is an *element information item* with the following Infoset properties:

- A [local name] of `endpoint`.
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`.
- Two or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `name` *attribute information item* as described below in **2.15.2** `name` ***attribute information item*** **with** `endpoint` **[owner element]**.
  - A REQUIRED `binding` *attribute information item* as described below in **2.15.2** `binding` ***attribute information item*** **with** `endpoint` **[owner element]**.
  - An OPTIONAL `address` *attribute information item* as described below in **2.15.2** `address` ***attribute information item*** **with** `endpoint` **[owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item* amongst its [children], in order, as follows:
  1. Zero or more `documentation` *element information item*s (see **5 Documentation**).

2. Zero or more *element information item*s from among the following, in any order:
   - Zero or more `feature` *element information item*s **2.7.2 XML Representation of Feature Component**
   - Zero or more `property` *element information item*s **2.8.2 XML Representation of Property Component**
   - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`. Such *element information item*s are considered to be endpoint extension elements as described below (see **2.15.2 Endpoint extension elements**).

`name` ***attribute information item*** **with** `endpoint` **[owner element]**

The `name` *attribute information item* together with the `targetNamespace` *attribute information item* of the `description` *element information item* forms the QName of the endpoint.

The `name` *attribute information item* has the following Infoset properties:

- A [local name] of `name`.
- A [namespace name] which has no value.

The type of the `name` *attribute information item* is *xs:NCName*.

`binding` ***attribute information item*** **with** `endpoint` **[owner element]**

The `binding` *attribute information item* refers, by QName, to a Binding component

The `binding` *attribute information item* has the following Infoset properties:

- A [local name] of `binding`
- A [namespace name] which has no value

The type of the `binding` *attribute information item* is *xs:QName*.

`address` ***attribute information item*** **with** `endpoint` **[owner element]**

The `address` *attribute information item* specifies the address of the endpoint.

The `address` *attribute information item* has the following Infoset properties:

- A [local name] of `address`
- A [namespace name] which has no value

The type of the `address` *attribute information item* is *xs:anyURI*.

Endpoint extension elements

Endpoint extension elements are used to provide information specific to a particular endpoint in a server. The semantics of such *element information item*s are defined by the specification for those *element information item*s. Such specifications are expected to annotate the Endpoint component with additional properties and specify the mapping from the XML representation to those properties.

2.15.3 Mapping Endpoint's XML Representation to Component Properties

The mapping from the XML Representation of the `endpoint` *element information item* (see **2.15.2 XML Representation of Endpoint Component**) to the properties of the Endpoint component is as described in Table 2.15 .

Table 2.15: Mapping from XML Representation to Endpoint Component Properties

Property	Value
name	The actual value of the `name` *attribute information item*.
binding	The Binding component resolved to by the actual value of the `binding` *attribute information item* (see **2.19 QName resolution**).
address	The actual value of the `address` *attribute information item* if present, otherwise empty.
features	The set of Feature components corresponding to the `feature` *element information item*s in [children], if any.
properties	The set of Property components corresponding to the `property` *element information item*s in [children], if any.
parent	The Service component corresponding to the `service` *element information item* in [parent].

2.16 XML Schema 1.0 Simple Types Used in the Component Model

The XML Schema 1.0 simple types [*XML Schema: Datatypes*] used in this specification are:

- *xs:token*
- *xs:NCName*
- *xs:anyURI*
- *xs:QName*
- *xs:boolean*

Let *NCName* be set of actual values of *xs:NCName*:

$[NCName]$

Let *URI* be the set of actual values of *xs:anyURI*:

$[URI]$

Let *AbsoluteURI* be the subset of absolute URIs (see [*IETF RFC 3986*]):

$$AbsoluteURI : \mathbb{P}\ URI$$

See *URI*.

Let *QName* be the set of actual values of *xs:QName*:

- Let *namespaceName* be the namespace name.
- Let *localName* be the local name.

QName

$namespaceName : AbsoluteURI$
$localName : NCName$

See *AbsoluteURI, NCName*.

Let *Boolean* be the set of actual values of *xs:boolean*:

$Boolean ::= True \mid False$

2.17 Equivalence of Components

Two component instances of the same type are considered equivalent if, for each property of the first component, there is a corresponding property with an equivalent value on the second component, and vice versa.

Instances of properties of the same type are considered equivalent if their values are equivalent.

- For values of a simple type (see **2.16 XML Schema 1.0 Simple Types Used in the Component Model**) this means that they contain the same values. For instance, two string values are equivalent if they contain the same sequence of Unicode characters, as described in [*Character Model for the WWW*]
- Values which are references to other components are considered equivalent when they refer to equivalent components (as determined above).
- List-based values are considered equivalent if they have the same length and their elements at corresponding positions are equivalent.
- Finally, set-based values are considered equivalent if for each value in the first, there is an equivalent value in the second, and vice versa.

Extension properties which are not string values, sets of strings or references MUST describe their values' equivalence rules.

Because different top-level components (e.g., Interface, Binding, and Service) are required to have different names, it is possible to determine whether two top-level components of a given type are equivalent by examining their {name} property.

2.18 Symbol Spaces

This specification defines three symbol spaces, one for each top-level component type (Interface, Binding and Service).

Within a symbol space, all qualified names (that is, the name property) are unique. Between symbol spaces, the names need not be unique. Thus it is perfectly coherent to have, for example, a binding and an interface that have the same name.

When XML Schema is being used as one of the type systems for a WSDL 2.0 description, then six other symbol spaces also exist, one for each of: global element declarations, global attribute declarations, named model groups, named attribute groups, type definitions and key constraints, as defined by [*XML Schema: Structures*]. Other type systems may define additional symbol spaces.

2.19 QName resolution

In its serialized form WSDL 2.0 makes significant use of references between components. Such references are made using the Qualified Name, or QName, of the component being referred to. QNames are a tuple, consisting of two parts; a namespace name and a local name. The namespace name for a component is represented by the value of the `targetNamespace` *attribute information item* of the [parent] `description` *element information item* and the local name is represented by the name property of the component.

QName references are resolved by looking in the appropriate property of the Description component. For example, to resolve a QName of an interface (as referred to by the `interface` *attribute information item* on a binding), the interfaces property of the Description component would be inspected.

If the appropriate property of the Description component does not contain a component with the required QName then the reference is a broken reference. It is an error for a Description component to have such broken references.

2.20 Comparing URIs and IRIs

This specification uses absolute URIs and IRIs to identify several components (for example, features and properties) and components characteristics (for example, operation message exchange patterns and styles). When such absolute URIs and IRIs are being compared to determine equivalence (see **2.17 Equivalence of Components**) they MUST be compared character-by-character as indicated in [*IETF RFC 3987*].

Chapter 3

Types

```
<description>
  <types>
    <documentation />*
    [ <xs:import namespace="xs:anyURI" schemaLocation="xs:anyURI"? /> |
      <xs:schema targetNamespace="xs:anyURI" /> |
      other extension elements ]*
  </types>
</description>
```

The content of messages and faults may be constrained using type system components. These constraints are based upon a specific data model, and expressed using a particular schema language.

Although a variety of data models can be accommodated (through WSDL 2.0 extensions), this specification only defines a means of expressing constraints based upon the XML Infoset [*XML Information Set*]. Furthermore, although a number of alternate schema languages can be used to constrain the XML Infoset (as long as they support the semantics of either inlining or importing schema), this specification only defines the use of XML Schema [*XML Schema: Structures*], [*XML Schema: Datatypes*].

Specifically, the element declarations and type definitions properties of the Description component are collections of imported and inlined schema components that describe Infoset *element information item*s.

When extensions are used to enable the use of a non-Infoset data model, or a non-Schema constraint language, the `wsdl:required` attribute information item MAY be used to require support for that extension.

Support for the W3C XML Schema [*XML Schema: Structures*], [*XML Schema: Datatypes*] is included in the conformance criteria for WSDL 2.0 documents (see **3.1 Using W3C XML Schema Description Language**).

The schema components contained in the element declarations property of the Description component provide the type system used for Interface Message Reference and Interface Fault components. Interface Message Reference com-

ponents indicate their structure and content by using the standard *attribute information item*s `element`, or for alternate schema languages in which these concepts do not map well, by using alternative *attribute information item* extensions. Interface Fault components behave similarly. Such extensions should define how they reference type system components. Such type system components MAY appear in additional collection properties on the Description component.

The schema components contained in the type definitions property of the Description component provide the type system used for constraining the values of properties described by Property components. Extensions in the form of *attribute information item*s can be used to refer to constraints (type definitions or analogous constructs) described using other schema languages or type systems. Such components MAY appear in additional collection properties on the Description component.

The `types` *element information item* encloses data type definitions, based upon the XML Infoset, used to define messages and has the following Infoset properties:

- A [local name] of `types`.
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT http://www.w3.org/2006/01/wsdl
- Zero or more *element information item*s amongst its [children] as follows:
  - Zero or more `documentation` *element information item*s (see **5 Documentation**) in its [children] property.
  - Zero or more *element information item*s from among the following, in any order:
    - `xs:import` *element information item*s
    - `xs:schema` *element information item*s
    - Other namespace qualified *element information item*s whose namespace is NOT http://www.w3.org/2006/01/wsdl

3.1 Using W3C XML Schema Description Language

XML Schema MAY be used as the schema language via import or inlining.

A WSDL 2.0 document MUST NOT refer to XML Schema components in a given namespace unless an `xs:import` or `xs:schema` *element information item* for that namespace is present or the namespace is the XML Schema namespace which contains built-in types as defined in XML Schema Part 2: Datatypes Second Edition [*XML Schema: Datatypes*]. That is, using the `xs:import` or `xs:schema` *element information item* is a necessary condition for making XML

Schema components, other than the built-in components, referenceable within a WSDL 2.0 document. The built-in XML Schema datatypes are built-in to the WSDL 2.0 component model and are contained in the type definitions property of the Description component.

Table 3.1 summarizes the referenceability of schema components.

Table 3.1: Referenceability of schema components

	XML Representation	**Referenceability of XML Schema Components**
Including description	description/include	XML Schema components in the included Description component's element declarations and type definitions properties are referenceable.
Importing description	description/import	None of the XML Schema Components in the imported Description component are referenceable.
Importing XML Schema	description/types/xs:import	Element Declaration and Type Definition components in the imported namespace are referenceable.
Inlined XML Schema	description/types/xs:schema	Element Declaration and Type Definition components in the inlined XML Schema are referenceable.

3.1.1 Importing XML Schema

Importing an XML Schema uses the syntax and semantics of the `xs:import` mechanism defined by XML Schema [*XML Schema: Structures*], [*XML Schema: Datatypes*], with the differences defined in this and the following section. The schema components defined in the imported namespace are referenceable by QName (see **2.19 QName resolution**). Only components in the imported namespace are referenceable in the WSDL 2.0 document.

A child *element information item* of the `types` *element information item* is defined with the Infoset properties as follows:

- A [local name] of `"import"`.
- A [namespace name] of `"http://www.w3.org/2001/XMLSchema"`.
- One or two *attribute information item*s as follows:

– A REQUIRED `namespace` *attribute information item* as described below.

– An OPTIONAL `schemaLocation` *attribute information item* as described below.

`namespace` *attribute information item*

The `namespace` *attribute information item* defines the namespace of the element declarations and type definitions imported from the referenced schema. The referenced schema MUST contain a `targetNamespace` *attribute information item* on its `xs:schema` *element information item*. The value of the `targetNamespace` *attribute information item* of the `xs:schema` *element information item* of an imported schema MUST equal the value of the `namespace` of the `import` *element information item* in the importing WSDL 2.0 document. Note that a WSDL 2.0 document must not import a schema that does not have a `targetNamespace` *attribute information item* on its `xs:schema` *element information item*. Such schemas must first be included (using `xs:include`) in a schema that contains a `targetNamespace` *attribute information item* on its `xs:schema` *element information item*, which can then be either imported or inlined in the WSDL 2.0 document.

The `namespace` *attribute information item* has the following Infoset properties:

- A [local name] of namespace
- A [namespace name] which has no value.

The type of the `namespace` *attribute information item* is *xs:anyURI*.

`schemaLocation` *attribute information item*

The `schemaLocation` *attribute information item*, if present, provides a hint to the XML Schema processor as to where the schema may be located. Caching and cataloging technologies may provide better information than this hint. The `schemaLocation` *attribute information item* has the following Infoset properties:

- A [local name] of schemaLocation.
- A [namespace name] which has no value.

The type of the `schemaLocation` *attribute information item* is *xs:anyURI*.

It is an error if a QName is not resolved (see **2.19 QName resolution**). When resolving QNames references for schema definitions, the namespace MUST be imported by the referring WSDL 2.0 document. If the namespace so referenced is contained in an inline schema, it MAY be imported without a `schemaLocation` attribute, so long as the inline schema has been resolved in the current component model.

3.1.2 Inlining XML Schema

Inlining an XML schema uses the existing top-level `xs:schema` *element information item* defined by XML Schema [*XML Schema: Structures*]. It may be viewed as simply cutting and pasting an existing schema document to a location inside the types *element information item*.

The schema components defined and declared in the inlined schema document are referenceable by QName (see **2.19 QName resolution**). Only components defined and declared in the schema itself and components included by it via xs:include are referenceable. Specifically components that the schema imports via xs:import are NOT referenceable.

Similarly, components defined in an inlined XML schema are NOT automatically referenceable within WSDL 2.0 document that imported (using `wsdl:import`) the WSDL 2.0 document that inlines the schema (see **4.2 Importing Descriptions** for more details). For this reason, it is recommended that XML schema documents intended to be shared across several WSDL 2.0 documents be placed in separate XML schema documents and imported using `xs:import`, rather than inlined inside a WSDL 2.0 document.

Inside an inlined XML schema, the `xs:import` and `xs:include` *element information item*s MAY be used to refer to other XML schemas inlined in the same or other WSDL 2.0 document, provided that an appropriate value, such as a fragment identifier (see [*XML Schema: Structures*] 4.3.1) is specified for their `schemaLocation` *attribute information item*s. For `xs:import`, the `schemaLocation` attribute is not required so long as the namespace has been resolved in the current component model. The semantics of such *element information item*s are governed solely by the XML Schema specification [*XML Schema: Structures*].

A WSDL 2.0 document MAY inline two or more schemas from the same `targetNamespace`. For example, two or more inlined schemas may have the same `targetNamespace` provided that they do not define the same elements or types. A WSDL 2.0 document MUST NOT define the same element or type in more than one inlined schema. Note that it is the responsibility of the underlying XML Schema processor to sort out a coherent set of schema components.

The `xs:schema` *element information item* has the following Infoset properties:

- A [local name] of schema.
- A [namespace name] of `"http://www.w3.org/2001/XMLSchema"`.
- A REQUIRED `targetNamespace` *attribute information item*, amongst its [attributes] as described below.
- Additional OPTIONAL *attribute information item*s as specified for the `xs:schema` *element information item* by the XML Schema specification.
- Zero or more child *element information item*s as specified for the `xs:schema` *element information item* by the XML Schema specification.

`targetNamespace` ***attribute information item***

The `targetNamespace` *attribute information item* defines the namespace of the element declarations and type definitions inlined in its [owner element] `xs:schema` *element information item*. WSDL 2.0 modifies the XML Schema definition of the `xs:schema` *element information item* to make this *attribute information item* required. The `xs:schema` *element information item* MUST contain a `targetNamespace` *attribute information item*. The `targetNamespace` *attribute information item* has the following Infoset properties:

- A [local name] of targetNamespace.
- A [namespace name] which has no value.

The type of the `targetNamespace` *attribute information item* is *xs:anyURI*.

3.1.3 References to Element Declarations and Type Definitions

Whether inlined or imported, the element declarations present in a schema are referenceable from an Interface Message Reference or Interface Fault component. Similarly, regardless of whether they are inlined or imported, the type definitions present in a schema are referenceable from a Property component.

A named, global `xs:element` declaration is referenceable from the `element` *attribute information item* of an `input`, `output` or `fault` *element information item*. The QName is constructed from the `targetNamespace` of the schema and the value of the `name` *attribute information item* of the `xs:element` *element information item*. An `element` *attribute information item* MUST NOT refer to a global `xs:simpleType` or `xs:complexType` definition.

A named, global `xs:simpleType` or `xs:complexType`declaration is referenceable from the `constraint` *attribute information item* of `property` *element information item*. The QName is constructed from the `targetNamespace` of the schema and the value of the `name` *attribute information item* of the `xs:simpleType` or `xs:complexType` *element information item*. A `constraint` *attribute information item* MUST NOT refer to a global `xs:element` definition.

3.2 Using Other Schema Languages

Since it is unreasonable to expect that a single schema language can be used to describe all possible Interface Message Reference, Interface Fault and Property component contents and their constraints, WSDL 2.0 allows alternate schema languages to be specified via extensibility elements. An extensibility *element information item* MAY appear under the `types` *element information item* to identify the schema language employed, and to locate the schema instance defining the grammar for Interface Message Reference and Interface Fault components or the constraint for Property components. Depending upon the schema

language used, an *element information item* MAY be defined to allow inlining, if and only if the schema language can be expressed in XML.

A specification of extension syntax for an alternative schema language MUST include the declaration of an *element information item*, intended to appear as a child of the `wsdl:types` *element information item*, which references, names, and locates the schema instance (an "import" *element information item*). The extension specification SHOULD, if necessary, define additional properties of the Description component (and extensibility attributes) to hold the components of the referenced type system. It is expected that additional extensibility attributes for Interface Message Reference, Interface Fault and Property components will also be defined, along with a mechanism for resolving the values of those attributes to a particular imported type system component.

A specification of extension syntax for an alternative schema language MUST use a namespace that is different than the namespace of XML Schema. The namespace of the alternative schema language is used for *element information item*s that are children of the `wsdl:types` *element information item* and for any extensibility *attribute information item*s that appear on other components. The namespace used for an alternate schema language MUST be an absolute IRI.

See [*Alternative Schema Languages Support*] for examples of using other schema languages. These examples reuse the element declarations property of the Description component and the `element` *attribute information item*s of the `wsdl:input`, `wsdl:output` and `wsdl:fault` *element information item*s.

This specification does not define the behavior of a WSDL 2.0 document that uses multiple schema languages for describing type system components simultaneously.

3.3 Describing Messages that Refer to Services and Endpoints

Web services may exchange messages that refer to other Web services or Web service endpoints. If the interface or binding of these referenced services or endpoints are known at description time, then it may be useful to include this information in the WSDL 2.0 document that describes the Web service. WSDL 2.0 provides two global *attribute information item*s, `wsdlx:interface` and `wsdlx:binding` that may be used to annotate XML Schema components or components from other type description languages.

WSDL 2.0 defines the use of these global *attribute information item*s to annotate XML Schema components that use the `xs:anyURI` simple type in an *element information item* or *attribute information item* for endpoint addresses that correspond to the address property of the Endpoint component. However, the use of these global *attribute information item*s is not limited to simple types based on `xs:anyURI`. They may be used for any other types that are used to refer to Web services or Web service endpoints, e.g. a WS-Addressing

Endpoint Reference [*WSA 1.0 Core*]. See the primer [*WSDL 2.0 Primer*] for more information and examples.

3.3.1 `wsdlx:interface` *attribute information item*

WSDL 2.0 provides a global *attribute information item* with the following Infoset properties:

- A [local name] of `interface`.
- A [namespace name] of `" http://www.w3.org/2006/01/wsdl-extensions "`.

The type of the `wsdlx:interface` *attribute information item* is an *xs:QName* that specifies the name property of an Interface component.

3.3.2 `wsdlx:binding` *attribute information item*

WSDL 2.0 provides a global *attribute information item* with the following Infoset properties:

- A [local name] of `binding`.
- A [namespace name] of `" http://www.w3.org/2006/01/wsdl-extensions "`.

The type of the `wsdlx:binding` *attribute information item* is an *xs:QName* that specifies the name property of a Binding component.

3.3.3 `wsdlx:interface` and `wsdlx:binding` Consistency

The `wsdlx:interface` and `wsdlx:binding` attributes may be used either independently or together. If `wsdlx:interface` and `wsdlx:binding` are used together then they MUST satisfy the same consistency rules that apply to the interface property of a Service component and the binding property of a nested Endpoint component, that is either the binding refers the interface of the service or the binding refers to no interface.

3.3.4 Use of `wsdlx:interface` and `wsdlx:binding` with `xs:anyURI`

`wsdlx:interface` and `wsdlx:binding` may be used to describe *element information item*s and *attribute information item*s whose type is `xs:anyURI` or a restriction of it, to describe messages that contain the address property of an Endpoint. This is accomplished by including the `wsdlx:interface` and/or `wsdlx:binding` *attribute information item* in the `xs:element`, `xs:simpleType`, or `xs:attribute` *element information item* of the corresponding XML Schema component.

Chapter 4

Modularizing WSDL 2.0 descriptions

This specification provides two mechanisms, described in this section, for modularizing WSDL 2.0 descriptions. These mechanisms help to make WSDL 2.0 descriptions clearer by allowing separation of the various components of a description. Such separation could be performed according to the level of abstraction of a given set of components, or according to the namespace affiliation required of a given set of components or according to some other grouping such as application applicability.

Both mechanisms work at the level of WSDL 2.0 components and NOT at the level of XML Information Sets or XML 1.0 serializations.

4.1 Including Descriptions

```
<description>
  <include
        location="xs:anyURI" >
    <documentation />*
  </include>
</description>
```

The WSDL 2.0 `include` *element information item* allows for the separation of different components of a service definition, belonging to the same target namespace, into independent WSDL 2.0 documents.

The WSDL 2.0 `include` *element information item* is modeled after the XML Schema `include` *element information item* (see [*XML Schema: Structures*], section 4.2.3 "References to schema components in the same namespace"). Specifically, it can be used to include components from WSDL 2.0 descriptions that share a target namespace with the including description. Components in the transitive closure of the included WSDL 2.0 documents become part of the

Description component of the including WSDL 2.0 document. The included components can be referenced by QName. Note that because all WSDL 2.0 descriptions have a target namespace, no-namespace includes (sometimes known as "chameleon includes") never occur in WSDL 2.0.

A mutual include is direct inclusion by one WSDL 2.0 document of another WSDL 2.0 document which includes the first. A circular include achieves the same effect with greater indirection (A s B includes C includes A, for instance). Multiple inclusion of a single WSDL 2.0 document resolves to a single set of components. Mutual, multiple, and circular includes are explicitly permitted, and do not represent multiple redefinitions of the same components. Multiple inclusion of a single WSDL 2.0 document has the same meaning as including it only once.

The `include` *element information item* has:

- A [local name] of `include`.
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`.
- One or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `location` *attribute information item* as described below in **4.1.1** `location` ***attribute information item*** **with** `include` **[owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item* amongst its [children], as follows:
  - Zero or more `documentation` *element information item*s (see **5 Documentation**).
  - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

4.1.1 `location` *attribute information item* with `include` [owner element]

The `location` *attribute information item* has the following Infoset properties:

- A [local name] of `location`.
- A [namespace name] which has no value.

A `location` *attribute information item* is of type `xs:anyURI`. Its actual value is the location of some information about the namespace identified by the `targetNamespace` *attribute information item* of the containing `description` *element information item*.

The IRI indicated by `location` MUST resolve to a WSDL 2.0 document.

The actual value of the `targetNamespace` *attribute information item* of the included WSDL 2.0 document MUST match the actual value of the `targetNamespace` *attribute information item* of the `description` *element information item* which is the [parent] of the `include` *element information item*.

4.2 Importing Descriptions

```
<description>
  <import
        namespace="xs:anyURI" location="xs:anyURI"? >
    <documentation />*
  </import>
</description>
```

Every top-level WSDL 2.0 component is associated with a namespace. Every WSDL 2.0 document carries a `targetNamespace` *attribute information item* on its `wsdl:description` *element information item* that associates the document with a target namespace which becomes the namespace of each top-level WSDL 2.0 component defined in the document. Any namespace other than the document's target namespace is referred to as a *foreign namespace* and any component associated with a foreign namespace is referred to as a *foreign component*. This section describes the syntax and mechanisms by which references may be made from within a WSDL 2.0 document to foreign components. In addition to this syntax, there is an optional facility for suggesting the IRI of a WSDL 2.0 document that contains definitions of foreign components.

The WSDL 2.0 `import` *element information item* is modeled after the XML Schema `import` *element information item* (see [*XML Schema: Structures*], section 4.2.3 "References to schema components across namespaces"). Specifically, it can be used to import WSDL 2.0 components from a foreign namespace. The WSDL 2.0 `import` *element information item* identifies a foreign namespace. The presence of a WSDL 2.0 `import` *element information item* signals that the WSDL 2.0 document may contain references to foreign components. The `wsdl:import` *element information item* is therefore like a forward declaration for foreign namespaces.

As with XML schema, any WSDL 2.0 document that references a foreign component MUST have a `wsdl:import` *element information item* for the associated foreign namespace (but which does not necessarily provide a `location` *attribute information item* that identifies the WSDL 2.0 document in which the referenced component is defined). In other respects, the visibility of components is pervasive; if two WSDL 2.0 documents import the same namespace then they will have access to the same components from the imported namespace (i.e. regardless of which, if any, `location` *attribute information item* values are provided on the respective `wsdl:import` *element information item*s.)

Using the `wsdl:import` *element information item* is a necessary condition for making foreign components available to a WSDL 2.0 document. That is,

a WSDL 2.0 document can only refer to foreign components if it contains an `wsdl:import` *element information item* for the associated foreign namespace.

If a WSDL 2.0 document contains more than one `wsdl:import` *element information item* for a given value of the `namespace` *attribute information item* then they MUST provide different values for the `location` *attribute information item*. Repeating the `wsdl:import` *element information item* for the same `namespace` value MAY be used as a way to provide alternate locations to find information about a given namespace.

Furthermore, this specification DOES NOT require the `location` *attribute information item* to be dereferenceable. If it is not dereferenceable then no information about the imported namespace is provided by that `wsdl:import` *element information item*. It is possible that such lack of information can cause QNames in other parts of a WSDL 2.0 Description component to become broken references (see **2.19 QName resolution**). Such broken references are not errors of the `wsdl:import` *element information item* but rather QName resolution errors which must be detected as described in **2.19 QName resolution**.

The `import` *element information item* has the following Infoset properties:

- A [local name] of `import`.
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`.
- One or more *attribute information item*s amongst its [attributes] as follows:
  - A REQUIRED `namespace` *attribute information item* as described below in **4.2.1** `namespace` ***attribute information item***.
  - An OPTIONAL `location` *attribute information item* as described below in **4.2.2** `location` ***attribute information item*** **with** `import` **[owner element]**.
  - Zero or more namespace qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *element information item*s amongst its [children], as follows:
  - Zero or more `documentation` *element information item*s (see **5 Documentation**).
  - Zero or more namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"`.

4.2.1 `namespace` *attribute information item*

The `namespace` *attribute information item* has the following Infoset properties:

- A [local name] of `namespace`.
- A [namespace name] which has no value.

The `namespace` *attribute information item* is of type `xs:anyURI`. Its actual value indicates that the containing WSDL 2.0 document MAY contain qualified references to WSDL 2.0 definitions in that namespace (via one or more prefixes declared with namespace declarations in the normal way). This value MUST NOT match the actual value of `targetNamespace` *attribute information item* in the enclosing WSDL 2.0 document. If the location attribute in the `import` *element information item* is dereferencible then it MUST reference a WSDL 2.0 document and the actual value of the `namespace` *attribute information item* MUST be identical to the actual value of the `targetNamespace` *attribute information item* of the referenced WSDL 2.0 document.

4.2.2 `location` *attribute information item* with `import` [owner element]

The `location` *attribute information item* has the following Infoset properties:

- A [local name] of `location`.
- A [namespace name] which has no value.

The `location` *attribute information item* is of type `xs:anyURI`. Its actual value, if present, gives a hint as to where a serialization of a WSDL 2.0 document with definitions for the imported namespace can be found.

The `location` *attribute information item* is optional. This allows WSDL 2.0 components to be constructed from information other than an XML 1.0 serialization of a WSDL 2.0 document. It also allows the development of WSDL 2.0 processors that have *a prior* (i.e., built-in) knowledge of certain namespaces.

Chapter 5

Documentation

```
<documentation>
  [extension elements]*
</documentation>
```

WSDL 2.0 uses the optional `documentation` *element information item* as a container for human readable or machine processable documentation. The content of the *element information item* is arbitrary *character information items* and *element information item*s ("mixed" content in XML Schema[*XML Schema: Structures*]). The `documentation` *element information item* is allowed inside any WSDL 2.0 *element information item*.

Like other *element information item*s in the `"http://www.w3.org/2006/01/wsdl"` namespace, the `documentation` *element information item* allows qualified *attribute information item*s whose [namespace name] is not `"http://www.w3.org/2006/01/wsdl"`. The `xml:lang` attribute (see [*XML 1.0*]) MAY be used to indicate the language used in the contents of the `documentation` *element information item*.

The `documentation` *element information item* has:

- A [local name] of `documentation`.
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`.
- Zero or more *attribute information item*s in its [attributes] property.
- Zero or more child *element information item*s in its [children] property.
- Zero or more *character information item*s in its [children] property.

Chapter 6

Language Extensibility

In addition to extensibility implied by the Feature and Property components described above, the schema for WSDL 2.0 has a two-part extensibility model based on namespace-qualified elements and attributes. An extension is identified by the QName consisting of its namespace IRI and its element name. The meaning of an extension SHOULD be defined (directly or indirectly) in a document that is available at its namespace IRI.

6.1 Element based Extensibility

WSDL 2.0 allows extensions to be defined in terms of *element information item*s. Where indicated herein, WSDL 2.0 allows namespace-qualified *element information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"` to appear among the [children] of specific *element information item*s whose [namespace name] is `"http://www.w3.org/2006/01/wsdl"`. Such *element information item*s MAY be used to annotate WSDL 2.0 constructs such as interface, operation, etc.

It is expected that extensions will add to the existing properties of components in the component model. The specification for an extension *element information item* should include definitions of any such properties and the mapping from the XML representation of the extension to the properties in the component model.

The WSDL 2.0 schema defines a base type for use by extensibility elements. Example **??** shows the type definition. The use of this type as a base type is optional.

Extensibility elements are commonly used to specify some technology-specific binding. They allow innovation in the area of network and message protocols without having to revise the base WSDL 2.0 specification. WSDL 2.0 recommends that specifications defining such protocols also define any necessary WSDL 2.0 extensions used to describe those protocols or formats.

```
<xs:complexType name='ExtensibilityElement' abstract='true' >
```

```
  <xs:attribute ref='wsdl:required' use='optional' />
</xs:complexType>
```

6.1.1 Mandatory extensions

Extension elements can be marked as mandatory by annotating them with a `wsdl:required` *attribute information item* (see **6.1.2** `required` ***attribute information item***) with a value of `"true"`. A mandatory extension is an extension that MAY change the meaning of the element to which it is attached, such that the meaning of that element is no longer governed by this specification. Instead, the meaning of an element containing a mandatory extension is governed by the meaning of that extension. Thus, the definition of the element's meaning is *delegated* to the specification that defines the extension.

An extension that is NOT marked as mandatory MUST NOT invalidate the meaning of any part of the WSDL 2.0 document. Thus, a NON-mandatory extension merely provides additional description of capabilities of the service. This specification does not provide a mechanism to mark extension attributes as being required. Therefore, all extension attributes are NON-mandatory.

A mandatory extension is considered mandatory because it has the ability to change the meaning of the element to which it is attached. Thus, the meaning of the element may not be fully understood without understanding the attached extension. A NON-mandatory extension, on the other hand, can be safely ignored without danger of misunderstanding the rest of the WSDL 2.0 document.

If a WSDL 2.0 document declares an extension, Feature or Property as optional (i.e., NON-mandatory), then the Web service MUST NOT assume that the client supports that extension, Feature or Property, *unless* the Web service knows (through some other means) that the client has in fact elected to engage and support that extension, Feature or Property.

A key purpose of an extension is to formally indicate (i.e., in a machine-processable way) that a particular feature or convention is supported or required. This enables toolkits that understand the extension to engage it automatically, while toolkits that do not yet understand a required extension may be able to flag it to an operator for manual support.

If a Web service requires the client to follow a particular convention that is likely to be automatable in WSDL 2.0 toolkits, then that convention SHOULD be indicated in the WSDL 2.0 document as a `wsdl:required` extension, rather than just being conveyed out of band, even if that convention is not currently implemented in WSDL 2.0 toolkits.

This practice will help prevent interoperability problems that could arise if one toolkit requires a particular convention that is not indicated in the WSDL 2.0 document, while another toolkit does not realize that that convention is required. It will also help facilitate future automatic processing by WSDL 2.0 toolkits.

On the other hand, a client MAY engage an extension, Feature or Property that is declared as optional in the WSDL 2.0 document. Therefore, the Web service MUST support every extension, Feature or Property that is declared as optional in the WSDL 2.0 document, in addition to supporting every extension, Feature or Property that is declared as mandatory.

If finer-grain, direction-sensitive control of extensions, Features or Properties is desired, then such extensions, Features or Properties may be designed in a direction-sensitive manner (from the client or from the Web service) so that either direction may be separately marked required or optional. For example, instead of defining a single extension that governs both directions, two extensions could be defined – one for each direction.

6.1.2 `required` *attribute information item*

WSDL 2.0 provides a global *attribute information item* with the following Infoset properties:

- A [local name] of `required`.
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl"`.

The type of the `required` *attribute information item* is *xs:boolean*. Its default value is `"false"` (hence extensions are NOT required by default).

6.2 Attribute-based Extensibility

WSDL 2.0 allows qualified *attribute information item*s whose [namespace name] is NOT `"http://www.w3.org/2006/01/wsdl"` to appear on any *element information item* whose namespace name IS `"http://www.w3.org/2006/01/wsdl"`. Such *attribute information item*s can be used to annotate WSDL 2.0 constructs such as interfaces, bindings, etc.

WSDL 2.0 does not provide a mechanism for marking extension *attribute information item*s as mandatory.

6.3 Extensibility Semantics

As indicated above, it is expected that the presence of extensibility elements and attributes will result in additional properties appearing in the component model.

The presence of an optional extensibility element or attribute MAY therefore augment the semantics of a WSDL 2.0 document in ways that do not invalidate the existing semantics. However, the presence of a mandatory extensibility element MAY alter the semantics of a WSDL 2.0 document in ways that invalidate the existing semantics.

Extensibility elements SHOULD NOT alter the existing semantics in ways that are likely to confuse users.

However, once the client and service both know that an optional feature has been engaged (because the service has received a message explicitly engaging that feature, for example), then the semantics of that feature supersede what the WSDL 2.0 document indicated. For example, the WSDL 2.0 document may have specified an XML message schema to be used, but also indicated an optional security feature that encrypts the messages. If the security feature is engaged, then the encrypted messages will no longer conform to the specified message schema (until they are decrypted).

Authors of extensibility elements should make sure to include in the specification for such elements a clear statement of the requirements for document conformance (see **1.2 Document Conformance**).

Authors of extensibility elements that may manifest as properties of the Description component should be alert to the impact of imports on their extensions, or their extensions on imports. It is not possible, within the component model, to define extensions that have an effective scope equal to the scope of a containing file. Extensions that modify the behavior of the components contained in a description may therefore unexpectedly modify the behavior of components in imported descriptions as well, unless proper care is taken. Users of such extension elements should also be aware of the potential pitfalls.

Chapter 7

Locating WSDL 2.0 Documents

As an XML vocabulary, WSDL 2.0 documents, WSDL2.0 document fragments or QName references to WSDL 2.0 components MAY appear within other XML documents. This specification defines a global attribute, `wsdlLocation`, to help with QName resolution (see **2.19 QName resolution**). This attribute allows an element that contains such references to be annotated to indicate where the WSDL 2.0 documents fo one or more namespaces can be found. In particular, this attribute is expected to be useful when using service references in message exchanges.

The `wsdlLocation` global attribute is defined in the namespace `"http://www.w3.org/2006/01/wsdl-insta` (hereafter referred to as `"wsdli:wsdlLocation"`, for brevity). This attribute MAY appear on any XML element which allows attributes from other namespaces to occur. It MUST NOT appear on a `wsdl:description` element or any of its children/descendants.

A normative XML Schema [*XML Schema: Structures*], [*XML Schema: Datatypes*] document for the `"http://www.w3.org/2006/01/wsdl-instance"` namespace can be found at http://www.w3.org/2006/01/wsdl-instance.

7.1 `wsdli:wsdlLocation` *attribute information item*

WSDL 2.0 provides a global *attribute information item* with the following Infoset properties:

- A [local name] of `wsdlLocation`.
- A [namespace name] of `"http://www.w3.org/2006/01/wsdl-instance"`.

The type of the `wsdlLocation` *attribute information item* is a list *xs:anyURI*. Its actual value MUST be a list of pairs of IRIs; where the first IRI of a pair, which MUST be an absolute IRI as defined in [*IETF RFC 3987*], indicates a

WSDL 2.0 (or 1.1) namespace name, and, the second a hint as to the location of a WSDL 2.0 document defining WSDL 2.0 components (or WSDL 1.1 elements [*WSDL 1.1*]) for that namespace name. The second IRI of a pair MAY be absolute or relative. For each pair of IRIs, if the location IRI of the pair is dereferencible then it MUST reference a WSDL 2.0 (or 1.1) document whose target namespace is the namespace IRI of the pair.

Chapter 8

Conformance

This sections describes how this specification conforms to other specifications. At present, only one other specification, XML Information Set, is included here. Refer to **1.2 Document Conformance** for a description of the criteria that Web service description documents must satisfy in order to conform to this specification.

8.1 XML Information Set Conformance

This specification conforms to the [*XML Information Set*]. The following information items MUST be present in the input Infosets to enable correct processing of WSDL 2.0 documents:

- *Document Information Items* with [*children*] and [*base URI*] properties.
- *Element Information Items* with [*namespace name*], [*local name*], [*children*], [*attributes*], [*base URI*] and [*parent*] properties.
- *Attribute Information Items* with [*namespace name*], [*local name*] and [*normalized value*] properties.
- *Character Information Items* with [*character code*], [*element content whitespace*] and [*parent*] properties.

Chapter 9

XML Syntax Summary (Non-Normative)

```
<description targetNamespace="xs:anyURI" >
  <documentation />?

  <import namespace="xs:anyURI" location="xs:anyURI"? >
    <documentation />*
  </import>*

  <include location="xs:anyURI" >
    <documentation />*
  </include>*

  <types>
    <documentation />*

      [ <xs:import namespace="xs:anyURI" schemaLocation="xs:anyURI"? /> |
        <xs:schema targetNamespace="xs:anyURI" /> |
        other extension elements ]*
  </types>

  <interface name="xs:NCName" extends="list of xs:QName"? styleDefault="list of xs:anyURI"?
    <documentation />*

    <fault name="xs:NCName" element="xs:QName"? >
      <documentation />*

      <feature ... />*

      <property ... />*
```

```
</fault>*

<operation name="xs:NCName" pattern="xs:anyURI" style="list of xs:anyURI"? >
  <documentation />*

  <input messageLabel="xs:NCName"? element="union of xs:QName, xs:token"? >
    <documentation />*

    <feature ... />*

    <property ... />*
  </input>*

  <output messageLabel="xs:NCName"? element="union of xs:QName, xs:token"? >
    <documentation />*

    <feature ... />*

    <property ... />*
  </output>*

  <infault ref="xs:QName" messageLabel="xs:NCName"? >
    <documentation />*

    <feature ... />*

    <property ... />*
  </infault>*

  <outfault ref="xs:QName" messageLabel="xs:NCName"? >
    <documentation />*

    <feature ... />*

    <property ... />*
  </outfault>*

  <feature ... />*

  <property ... />*
</operation>*

<feature ref="xs:anyURI" required="xs:boolean"? >
  <documentation />*
</feature>*
```

```
  <property ref="xs:anyURI" >
    <documentation />*

    <value> xs:anyType </value>?

    <constraint> xs:QName </constraint>?
  </property>*
</interface>*

<binding name="xs:NCName" interface="xs:QName"? type="xs:anyURI" >
  <documentation />*

  <fault ref="xs:QName" >
    <documentation />*

    <feature ... />*

    <property ... />*
  </fault>*

  <operation ref="xs:QName" >
    <documentation />*

    <input messageLabel="xs:NCName"? >
      <documentation />*

      <feature ... />*

      <property ... />*
    </input>*

    <output messageLabel="xs:NCName"? >
      <documentation />*

      <feature ... />*

      <property ... />*
    </output>*

    <infault ref="xs:QName" messageLabel="xs:NCName"? >
      <documentation />*

      <feature ... />*

      <property ... />*
    </infault>*
```

```
      <outfault ref="xs:QName" messageLabel="xs:NCName"? >
        <documentation />*

        <feature ... />*

        <property ... />*
      </outfault>*

      <feature ... />*

      <property ... />*
    </operation>*

    <feature ... />*

    <property ... />*
  </binding>*

  <service name="xs:NCName" interface="xs:QName" >
    <documentation />*

    <endpoint name="xs:NCName" binding="xs:QName" address="xs:anyURI"? >
      <documentation />*

      <feature ... />*

      <property ... />*
    </endpoint>*

    <feature ... />*

    <property ... />*
  </service>*
</description>
```

Chapter 10

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Appendix A

The application/wsdl+xml Media Type

This appendix defines the `"application/wsdl+xml"` media type which can be used to describe WSDL 2.0 documents serialized as XML.

A.1 Registration

MIME media type name: application

MIME subtype name: wsdl+xml

Required parameters: none

Optional parameters: charset This parameter has identical semantics to the charset parameter of the `"application/xml"` media type as specified in [*RFC 3023*].

Encoding considerations: Identical to those of `"application/xml"` as described in [*RFC 3023*], section 3.2, as applied to the WSDL document Infoset.

Security considerations: See section **A.3 Security considerations**.

Interoperability considerations: There are no known interoperability issues.

Published specifications: This document and [*WSDL 2.0 Adjuncts*].

Applications which use this media type: No known applications currently use this media type.

Additional information: File extension: wsdl

Fragment identifiers: Either a syntax identical to that of `"application/xml"` as described in [*RFC 3023*], section 5 or the syntax defined in **A.2 Fragment Identifiers**.

Base URI: As specified in [*RFC 3023*], section 6.

Macintosh File Type code: WSDL

Person and email address to contact for further information: World Wide Web Consortium ¡web-human@w3.org¿

Intended usage: COMMON

Author/Change controller: The WSDL 2.0 specification set is a work product of the World Wide Web Consortium's Web Service Description Working Group. The W3C has change control over these specifications.

A.2 Fragment Identifiers

This section defines a fragment identifier syntax for identifying components of a WSDL 2.0 document. This fragment identifier syntax is compliant with the [*XPointer Framework*].

A WSDL 2.0 fragment identifier consists of zero or more xmlns pointer parts followed by a WSDL 2.0 pointer part as defined below. The pointer parts have a scheme name that corresponds to one of the standard WSDL 2.0 component types, and scheme data that is a path composed of names that identify the components. The scheme names all begin with the prefix "wsdl." to avoid name conflicts with other schemes. The names in the path are of type either QName, NCName, IRI, URI, or Pointer Part depending on the context. The scheme data for extension components is defined by the corresponding extension specification.

For QNames, any prefix MUST be defined by a preceding xmlns pointer part. If a QName does not have a prefix then its namespace name is the target namespace of the WSDL 2.0 document.

The fragment identifier is typically constructed from the name property of the component and the name properties of its ancestors as a path according to Table A.1 . The first column of this table gives the name of the WSDL 2.0 component. Columns labeled 1 through 4 specify the identifiers that uniquely identify the component within its context. Identifiers are typically formed from the name property, although in several cases references to other components are used. These identifiers are then used to construct the pointer part in the last column. The fragment identifier in a WSDL 2.0 component IRI-reference MUST resolve to some component as defined by the construction rules in Table A.1 .

Table A.1: Rules for determining pointer parts for WSDL 2.0 components

Component	**1**	**2**	**3**	**4**	**Pointer Part**
Description	n/a	n/a	n/a	n/a	wsdl.description()
Element Declaration	*element* QName	n/a	n/a	n/a	wsdl.elementDeclaration(*element*)
Element Declaration	*element* QName	*system* IRI	n/a	n/a	wsdl.elementDeclaration(*element*,*system*)
Type Definition	*type* QName	n/a	n/a	n/a	wsdl.typeDefinition(*type*)
Type Definition	*type* QName	*system* IRI	n/a	n/a	wsdl.typeDefinition(*type*,*system*)
Interface	*interface* NCName	n/a	n/a	n/a	wsdl.interface(*interface*)
Interface Fault	*interface* NCName	*fault* NCName	n/a	n/a	wsdl.interfaceFault(*interface*/*fault*)
Interface Operation	*interface* NCName	*operation* NCName	n/a	n/a	wsdl.interfaceOperation(*interface*/*operation*)
Interface Message Reference	*interface* NCName	*operation* NCName	*message* NCName	n/a	wsdl.interfaceMessageReference(*interface*/*operat*
Interface Fault Reference	*interface* NCName	*operation* NCName	*message* NCName	*fault* QName	wsdl.interfaceFaultReference(*interface*/*operation*
Binding	*binding* NCName	n/a	n/a	n/a	wsdl.binding(*binding*)
Binding Fault	*binding* NCName	*fault* QName	n/a	n/a	wsdl.bindingFault(*binding*/*fault*)
Binding Operation	*binding* NCName	*operation* QName	n/a	n/a	wsdl.bindingOperation(*binding*/*operation*)
Binding Message Reference	*binding* NCName	*operation* QName	*message* NCName	n/a	wsdl.bindingMessageReference(*binding*/*operatio*
Binding Fault Reference	*binding* NCName	*operation* QName	*message* NCName	*fault* QName	wsdl.bindingFaultReference(*binding*/*operation*/*n*
Service	*service* NCName	n/a	n/a	n/a	wsdl.service(*service*)

Endpoint	*service* NC-Name	*endpoint* NC-Name	n/a	n/a	wsdl.endpoint(*service*/*endpoint*)
Feature	*parent* Pointer Part	*feature* IRI	n/a	n/a	wsdl.feature(*parent*/*feature*)
Property	*parent* Pointer Part	*property* IRI	n/a	n/a	wsdl.property(*parent*/*property*)
Extensions	*namespace* URI	*identifier* extension-specific-syntax	n/a	n/a	wsdl.extension(*namespace*,*identifier*)

Note that the above rules are defined in terms of component properties rather than the XML Infoset representation of the component model. The following sections specify in detail how the pointer parts are constructed from the component model.

Let *ComponentID* be the set of all component identifiers and component models that contain that identifier:

ComponentID

$$\begin{array}{l} componentModel \\ id : ID \\ \hline id \in componentIds \end{array}$$

See *ComponentModel, ID.*

An IRI-reference consists of an IRI and a fragment identifier. IRI-references for WSDL 2.0 documents consist of an IRI that dereferences to a resource whose media type is application/wsdl+xml and a fragment identifier that conforms to XPointer syntax including the WSDL 2.0 pointer part schemes defined here. The interpretation of the WSDL 2.0 pointer parts is defined in terms of *component designators* which are themselves IRI-references. The component designator for a WSDL 2.0 document IRI-reference is formed by replacing the WSDL 2.0 document IRI by the target namespace IRI of the WSDL 2.0 document. The WSDL 2.0 pointer parts are interpretted in the context of the component model instance defined by the WSDL 2.0 document.

Let *ComponentDesignator* be the set of WSDL 2.0 component designators:

ComponentDesignator

$$\begin{array}{l} iri : AbsoluteURI \\ fragId : wsdlPointerPart \end{array}$$

See *AbsoluteURI, wsdlPointerPart.*

We refer to the namespace of the WSDL 2.0 document as the *context namespace*. The Description, Element Declaration, and Type Definition components are not associated with any WSDL 2.0 namespace, however, for the purpose of constructing component designator IRI-references, we assign them the context namespace. In general, a WSDL 2.0 document may import other WSDL 2.0 namespaces, and the IRI of component designators for WSDL 2.0 components from the imported namespace is that namespace. Finally, the component model may contain extension components, in which case the specification for the extension must define the IRI used for extension component designators.

Let *ComponentContext* be the set of all component identifiers, component models that contain that identifier, and context namespaces:

$$
\begin{array}{|l}
\hline
ComponentContext \\
ComponentID \\
contextNamespace : AbsoluteURI \\
\hline
\end{array}
$$

See *ComponentID, AbsoluteURI.*

Let *componentNamespace* map a component within a given context to its component designator namespace IRI:

$$componentNamespace : ComponentContext \longrightarrow AbsoluteURI$$

See *ComponentContext, AbsoluteURI.*

The namespace of a Description, Element Declaration, or Type Definition component is the context namespace:

$$
\begin{array}{l}
\forall\, ComponentContext \mid \\
\quad id \in descriptionIds \cup \\
\qquad elementDeclIds \cup \\
\qquad typeDefIds \bullet \\
\quad componentNamespace(\theta\, ComponentContext) = \\
\qquad contextNamespace
\end{array}
$$

See *ComponentContext, componentNamespace.*

The namespace of an Interface, Binding, or Service component is the namespace of its name property:

$$
\begin{array}{l}
\forall\, ComponentContext; \\
\quad c : Component \mid \\
\quad c \in components \land \\
\quad id = Id(c) \land \\
\quad id \in interfaceIds \cup \\
\qquad bindingIds \cup \\
\qquad serviceIds \bullet \\
\quad componentNamespace(\theta\, ComponentContext) = \\
\qquad (Name(c)).namespaceName
\end{array}
$$

See *ComponentContext, Component, Id, componentNamespace, Name.*

The namespace of a nested component is equal to the namespace of its parent:

$$
\begin{array}{l}
\forall\, ComponentContext; \\
\quad c : NestedComponent \mid \\
\quad c \in components \bullet \\
\quad componentNamespace(\theta\, ComponentContext) = \\
\qquad componentNamespace(\mu\, id : ID \mid \\
\qquad id = ParentId(c) \bullet \theta\, ComponentContext)
\end{array}
$$

See *ComponentContext, NestedComponent, componentNamespace, ID, ParentId.*

The syntax of extension component identifiers is defined by the corresponding extension specification.

Let *ExtensionIdentifier* be the set of all identifiers for extension components:

$$[ExtensionIdentifier]$$

Let *wsdlPointerPart* be the set of all WSDL 2.0 component pointer parts:

$$
\begin{array}{l}
wsdlPointerPart ::= \\
\quad wsdlDescription \mid \\
\quad wsdlElementDeclaration\langle\!\langle QName \times OPTIONAL[AbsoluteURI]\rangle\!\rangle \mid \\
\quad wsdlTypeDefinition\langle\!\langle QName \times OPTIONAL[AbsoluteURI]\rangle\!\rangle \mid \\
\quad wsdlInterface\langle\!\langle NCName\rangle\!\rangle \mid \\
\quad wsdlInterfaceFault\langle\!\langle NCName \times NCName\rangle\!\rangle \mid \\
\quad wsdlInterfaceOperation\langle\!\langle NCName \times NCName\rangle\!\rangle \mid \\
\quad wsdlInterfaceMessageReference\langle\!\langle NCName \times NCName \times NCName\rangle\!\rangle \mid \\
\quad wsdlInterfaceFaultReference\langle\!\langle NCName \times NCName \times NCName \times QName\rangle\!\rangle \mid \\
\quad wsdlBinding\langle\!\langle NCName\rangle\!\rangle \mid \\
\quad wsdlBindingFault\langle\!\langle NCName \times QName\rangle\!\rangle \mid \\
\quad wsdlBindingOperation\langle\!\langle NCName \times QName\rangle\!\rangle \mid \\
\quad wsdlBindingMessageReference\langle\!\langle NCName \times QName \times NCName\rangle\!\rangle \mid \\
\quad wsdlBindingFaultReference\langle\!\langle NCName \times QName \times NCName \times QName\rangle\!\rangle \mid \\
\quad wsdlService\langle\!\langle NCName\rangle\!\rangle \mid \\
\quad wsdlEndpoint\langle\!\langle NCName \times NCName\rangle\!\rangle \mid \\
\quad wsdlFeature\langle\!\langle wsdlPointerPart \times AbsoluteURI\rangle\!\rangle \mid \\
\quad wsdlProperty\langle\!\langle wsdlPointerPart \times AbsoluteURI\rangle\!\rangle \mid \\
\quad wsdlExtension\langle\!\langle AbsoluteURI \times ExtensionIdentifier\rangle\!\rangle
\end{array}
$$

Let *pointerPart* map a component identifier within the context of some component model to its WSDL 2.0 pointer part:

$$\mid \quad pointerPart : ComponentID \longrightarrow wsdlPointerPart$$

See *ComponentID, wsdlPointerPart.*

This map will be defined for each component in the following sections.

Let *ComponentToDesignator* map a WSDL 2.0 component to its component designator:

$$
\begin{array}{|l}
\textit{ComponentToDesignator} \\
\textit{ComponentContext} \\
\textit{ComponentDesignator} \\
\hline
\textit{iri} = \textit{componentNamespace}(\theta\, \textit{ComponentContext}) \\
\textit{fragId} = \textit{pointerPart}(\theta\, \textit{ComponentID}) \\
\hline
\end{array}
$$

See *ComponentContext, ComponentDesignator, componentNamespace, pointerPart.*

A.2.1 The Description Component

wsdl.description()

The description fragment identifier has no arguments and designates the unique Description component in the component model.

The pointer part defined by a Description component is *wsdlDescription*:

$$
\begin{array}{l}
\forall\, \textit{ComponentID} \mid \\
\quad \textit{id} \in \textit{descriptionIds} \bullet \\
\quad \textit{pointerPart}(\theta\, \textit{ComponentID}) = \\
\qquad \textit{wsdlDescription}
\end{array}
$$

See *ComponentID, pointerPart, wsdlPointerPart.*

A.2.2 The Element Declaration Component

wsdl.elementDeclaration(*element*) wsdl.elementDeclaration(*element*,*system*)

1. *element*

   is the name property of the Element Declaration component.

2. *system*

   is the namespace absolute IRI of the extension type system used for the Element Declaration component (see **3.2 Using Other Schema Languages**). This parameter is absent if XML Schema is the type system.

Let *xmlSchemaNamespaceURI* be the namespace IRI for XML Schema:

$$
\begin{array}{|l}
\textit{xmlSchemaNamespaceURI} : \textit{AbsoluteURI}
\end{array}
$$

See *AbsoluteURI.*

Let *ElementDeclArgs* represent the arguments for the Element Declaration component pointer part:

ElementDeclArgs

$element : QName$
$system : OPTIONAL[AbsoluteURI]$

$system \neq \{xmlSchemaNamespaceURI\}$

See *QName, OPTIONAL, AbsoluteURI, xmlSchemaNamespaceURI.*

Let *ElementDeclDesignator* express the association between an Element Declaration component its pointer part arguments:

ElementDeclDesignator

ComponentModel
$elementDeclComp : ElementDeclaration$

ElementDeclArgs

$elementDeclComp \in elementDeclComps$
$elementDeclComp.name = element$
$elementDeclComp.system \in \{xmlSchemaNamespaceURI\} \cup system$

See *ComponentModel, ElementDeclaration, ElementDeclArgs, xmlSchemaNamespaceURI.*

The pointer part defined by an Element Declaration component is *wsdlElementDeclaration*:

$\forall$ *ElementDeclDesignator*;
$id : ID \mid$
$id = elementDeclComp.id \bullet$
$pointerPart(\theta ComponentID) =$
$wsdlElementDeclaration(element, system)$

See *ElementDeclDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.3 The Type Definition Component

wsdl.typeDefinition(*type*) wsdl.typeDefinition(*type*,*system*)

1. *type*

   is the name property of the Type Definition component.

2. *system*

   is the namespace absolute IRI of the extension type system used for the Type Definition component (see **3.2 Using Other Schema Languages**). This parameter is absent if XML Schema is the type system.

Let *TypeDefArgs* represent the arguments for the Type Definition component pointer part:

TypeDefArgs

$type : QName$
$system : OPTIONAL[AbsoluteURI]$

$system \neq \{xmlSchemaNamespaceURI\}$

See *QName, OPTIONAL, AbsoluteURI, xmlSchemaNamespaceURI.*

Let *TypeDefDesignator* express the association between a Type Definition component and its pointer part arguments:

TypeDefDesignator

ComponentModel
$typeDefComp : TypeDefinition$

TypeDefArgs

$typeDefComp \in typeDefComps$
$typeDefComp.name = type$
$typeDefComp.system \in \{xmlSchemaNamespaceURI\} \cup system$

See *ComponentModel, TypeDefinition, TypeDefArgs, xmlSchemaNamespaceURI.*

The pointer part defined by a Type Definition component is *wsdlTypeDefinition*:

$$\forall\, TypeDefDesignator;\ id : ID \mid$$
$$id = typeDefComp.id \bullet$$
$$pointerPart(\theta ComponentID) =$$
$$wsdlTypeDefinition(type, system)$$

See *TypeDefDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.4 The Interface Component

wsdl.interface(*interface*)

1. *interface*

   is the local name of the name property of the Interface component.

Let *InterfaceArgs* represent the arguments for the Interface component pointer part:

InterfaceArgs

$interface : NCName$

See *NCName*.

Let *InterfaceDesignator* express the association between an Interface component and its pointer part arguments:

InterfaceDesignator

$$
\begin{array}{l}
ComponentModel \\
interfaceComp : Interface \\
\\
InterfaceArgs \\
\hline
interfaceComp \in interfaceComps \\
interfaceComp.name.localName = interface
\end{array}
$$

See *ComponentModel, Interface, InterfaceArgs.*

The pointer part defined by an Interface component is *wsdlInterface*:

$$
\begin{array}{l}
\forall\, InterfaceDesignator; \\
\quad id : ID \mid \\
\quad id = interfaceComp.id \bullet \\
\quad pointerPart(\theta ComponentID) = \\
\qquad wsdlInterface(interface)
\end{array}
$$

See *InterfaceDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.5 The Interface Fault Component

wsdl.interfaceFault(*interface*/*fault*)

1. *interface*

   is the local name of the name property of the parent Interface component.

2. *fault*

   is the local name of the name property of the Interface Fault component.

Let *InterfaceFaultArgs* represent the arguments for the Interface Fault component pointer part:

InterfaceFaultArgs

$$
\begin{array}{l}
InterfaceArgs \\
fault : NCName
\end{array}
$$

See *InterfaceArgs, NCName.*

Let *InterfaceFaultDesignator* express the association between an Interface Fault component and its pointer part arguments:

InterfaceFaultDesignator

InterfaceDesignator
$interfaceFaultComp : InterfaceFault$

InterfaceFaultArgs

$interfaceFaultComp \in interfaceFaultComps$
$interfaceFaultComp.parent = interfaceComp.id$
$interfaceFaultComp.name.localName = fault$

See *InterfaceDesignator, InterfaceFault, InterfaceFaultArgs.*

The pointer part defined by an Interface Fault component is *wsdlInterfaceFault*:

$\forall\, InterfaceFaultDesignator;$
$id : ID \mid$
$id = interfaceFaultComp.id \bullet$
$pointerPart(\theta ComponentID) =$
$wsdlInterfaceFault(interface, fault)$

See *InterfaceFaultDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.6 The Interface Operation Component

wsdl.interfaceOperation(*interface*/*operation*)

1. *interface*

   is the local name of the name property of the parent Interface component.

2. *operation*

   is the local name of the name property of the Interface Operation component.

Let *InterfaceOpArgs* represent the arguments for the Interface Operation component pointer part:

InterfaceOpArgs

InterfaceArgs
$operation : NCName$

See *InterfaceArgs, NCName.*

Let *InterfaceOpDesignator* express the association between an Interface Operation component and its pointer part arguments:

InterfaceOpDesignator

InterfaceDesignator
interfaceOpComp : *InterfaceOperation*

InterfaceOpArgs

---

interfaceOpComp ∈ *interfaceOpComps*
interfaceOpComp.parent = *interfaceComp.id*
interfaceOpComp.name.localName = *operation*

See *InterfaceDesignator, InterfaceOperation, InterfaceOpArgs.*

The pointer part defined by an Interface Operation component is *wsdlInterfaceOperation*:

∀ *InterfaceOpDesignator*;
id : *ID* |
id = *interfaceOpComp.id* •
pointerPart(θ *ComponentID*) =
wsdlInterfaceOperation(*interface*, *operation*)

See *InterfaceOpDesignator, ID, ComponentID, wsdlPointerPart.*

A.2.7 The Interface Message Reference Component

wsdl.interfaceMessageReference(*interface*/*operation*/*message*)

1. *interface*

   is the local name of the name property of the grandparent Interface component.

2. *operation*

   is the local name of the name property of the parent Interface Operation component.

3. *message*

   is the

   message label

   property of the Interface Message Reference component.

Let *InterfaceMessageRefArgs* represent the arguments for the Interface Message Reference pointer part:

InterfaceMessageRefArgs

InterfaceOpArgs
message : *NCName*

See *NCName.*

Let *InterfaceMessageRefDesignator* express the association between an Interface Message Reference component and its pointer part arguments:

InterfaceMessageRefDesignator

$$
\begin{array}{l}
InterfaceOpDesignator \\
interfaceMessageRefComp : InterfaceMessageReference \\
InterfaceMessageRefArgs \\
\hline
interfaceMessageRefComp \in interfaceMessageRefComps \\
interfaceMessageRefComp.parent = interfaceOpComp.id \\
interfaceMessageRefComp.messageLabel = message
\end{array}
$$

See *InterfaceOpDesignator, InterfaceMessageReference, InterfaceMessageRefArgs.*

The pointer part defined by an Interface Message Reference component is *wsdlInterfaceMessageReference*:

$$
\begin{array}{l}
\forall\, InterfaceMessageRefDesignator; \\
\quad id : ID \mid \\
\quad id = interfaceMessageRefComp.id \bullet \\
\quad pointerPart(\theta ComponentID) = \\
\qquad wsdlInterfaceMessageReference(interface, operation, message)
\end{array}
$$

See *InterfaceMessageRefDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.8 The Interface Fault Reference Component

wsdl.interfaceFaultReference(*interface*/*operation*/*message*/*fault*)

1. *interface*

   is the local name of the name property of the grandparent Interface component.

2. *operation*

   is the local name of the name property of the parent Interface Operation component.

3. *message*

   is the

   message label

   property of the Interface Fault Reference component.

4. *fault*

   is the name property of the Interface Fault component referred to by the

interface fault

property of the Interface Fault Reference component.

Let *InterfaceFaultRefArgs* represent the arguments for the Interface Fault Reference component pointer part:

InterfaceFaultRefArgs

$$
\begin{array}{l}
InterfaceOpArgs \\
message : NCName \\
fault : QName
\end{array}
$$

See *InterfaceOpArgs, NCName, QName.*

Let *InterfaceFaultRefDesignator* express the association between an Interface Fault Reference component and its pointer part arguments:

InterfaceFaultRefDesignator

$$
\begin{array}{l}
InterfaceOpDesignator \\
interfaceFaultComp : InterfaceFault \\
interfaceFaultRefComp : InterfaceFaultReference \\
\\
InterfaceFaultRefArgs \\
\hline
interfaceFaultComp \in interfaceFaultComps \\
interfaceFaultComp.id \in interfaceComp.allInterfaceFaults \\
interfaceFaultComp.name = fault \\
\\
interfaceFaultRefComp \in interfaceFaultRefComps \\
interfaceFaultRefComp.interfaceFault = interfaceFaultComp.id \\
interfaceFaultRefComp.messageLabel = message
\end{array}
$$

See *InterfaceOpDesignator, InterfaceFault, InterfaceFaultReference, InterfaceFaultRefArgs.*

The pointer part defined by an Interface Fault Reference component is *wsdlInterfaceFaultReference*:

$$
\begin{array}{l}
\forall\, InterfaceFaultRefDesignator; \\
\quad id : ID \mid \\
\quad id = interfaceFaultRefComp.id \bullet \\
\quad pointerPart(\theta\, ComponentID) = \\
\qquad wsdlInterfaceFaultReference(interface, operation, message, fault)
\end{array}
$$

See *InterfaceFaultRefDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.9 The Binding Component

wsdl.binding(*binding*)

1. *binding*

   is the local name of the name property of the Binding component.

Let *BindingArgs* represent the arguments for the Binding component pointer part:

BindingArgs

$$binding : NCName$$

See *NCName*.

Let *BindingDesignator* express the association between a Binding component and its pointer part arguments:

BindingDesignator

$$ComponentModel$$
$$bindingComp : Binding$$
$$BindingArgs$$

$$bindingComp \in bindingComps$$
$$bindingComp.name.localName = binding$$

See *ComponentModel, Binding, BindingArgs.*

Note that the above definition applies to all Binding components, whether or not they bind a specific Interface component.

The pointer part defined by a Binding component is *wsdlBinding*:

$$\forall BindingDesignator;$$
$$\quad id : ID \mid$$
$$\quad id = bindingComp.id \bullet$$
$$\quad pointerPart(\theta ComponentID) =$$
$$\qquad wsdlBinding(binding)$$

See *BindingDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

Let *BindingInterfaceDesignator* express the association between an Interface component and the pointer part arguments in the case that the associated Binding component binds a specific Interface component.

BindingInterfaceDesignator

$$BindingDesignator$$
$$interfaceComp : Interface$$

$$interfaceComp \in interfaceComps$$
$$bindingComp.interface = \{interfaceComp.id\}$$

See *BindingDesignator, Interface.*

A.2.10 The Binding Fault Component

wsdl.bindingFault(*binding*/*fault*)

1. *binding*

   is the local name of the name property of the parent Binding component.

2. *fault*

   is the name property of the Interface Fault component referred to by the interface fault property of the Binding Fault component.

Let *BindingFaultArgs* represent the arguments for the Binding Fault pointer part:

BindingFaultArgs

$$
\begin{array}{l}
BindingArgs \\
fault : QName
\end{array}
$$

See *BindingArgs, QName.*

Let *BindingFaultDesignator* express the association between a Binding Fault component and its pointer part arguments:

BindingFaultDesignator

$$
\begin{array}{l}
BindingInterfaceDesignator \\
interfaceFaultComp : InterfaceFault \\
bindingFaultComp : BindingFault \\
\\
BindingFaultArgs \\
\hline
interfaceFaultComp \in interfaceFaultComps \\
interfaceFaultComp.id \in interfaceComp.allInterfaceFaults \\
interfaceFaultComp.name = fault \\
\\
bindingFaultComp \in bindingFaultComps \\
bindingFaultComp.parent = bindingComp.id \\
bindingFaultComp.interfaceFault = interfaceFaultComp.id
\end{array}
$$

See *BindingInterfaceDesignator, InterfaceFault, BindingFault, BindingFaultArgs.*

The pointer part defined by a Binding Fault component is *wsdlBindingFault*:

$$
\begin{array}{l}
\forall\, BindingFaultDesignator; \\
\quad id : ID \mid \\
\quad id = bindingFaultComp.id \bullet \\
\quad pointerPart(\theta\, ComponentID) = \\
\qquad wsdlBindingFault(binding, fault)
\end{array}
$$

See *BindingFaultDesignator, ID, ComponentID, pointerPart, wsdlPointerPart.*

A.2.11 The Binding Operation Component

wsdl.bindingOperation(*binding*/*operation*)

1. *binding*

   is the local name of the name property of the parent Binding component.

2. *operation*

   is the name property of the Interface Operation component referred to by the

   interface operation

   property of the Binding Operation component.

Let *BindingOpArgs* represent the arguments for the Binding Operation component:

BindingOpArgs

$$\begin{array}{l} BindingArgs \\ operation : QName \end{array}$$

See *BindingArgs, QName.*

Let *BindingOpDesignator* express the association between a Binding Operation component and its pointer part arguments:

BindingOpDesignator

$$\begin{array}{l} BindingInterfaceDesignator \\ interfaceOpComp : InterfaceOperation \\ bindingOpComp : BindingOperation \\ \\ BindingOpArgs \\ \hline interfaceOpComp \in interfaceOpComps \\ interfaceOpComp.id \in interfaceComp.allInterfaceOperations \\ interfaceOpComp.name = operation \\ \\ bindingOpComp \in bindingOpComps \\ bindingOpComp.parent = bindingComp.id \\ bindingOpComp.interfaceOperation = interfaceOpComp.id \end{array}$$

See *BindingInterfaceDesignator, InterfaceOperation, BindingOperation, BindingOpArgs.*

The pointer part defined by a Binding Operation component is *wsdlBindingOperation*:

$$\forall\, BindingOpDesignator;\ id : ID \mid$$
$$id = bindingOpComp.id \bullet$$
$$pointerPart(\theta ComponentID) =$$
$$wsdlBindingOperation(binding, operation)$$

See *BindingOpDesignator, ComponentModel, wsdlPointerPart.*

A.2.12 The Binding Message Reference Component

wsdl.bindingMessageReference(*binding*/*operation*/*message*)

1. *binding*

   is the local name of the name property of the grandparent Binding component.

2. *operation*

   is the name property of the Interface Operation component referred to by the

   interface operation

   property of the parent Binding Operation component.

3. *message*

   is the

   message label

   property of the Interface Message Reference component referred to by the

   interface message reference

   property of the Binding Message Reference component.

Let *BindingMessageRefArgs* represent the arguments for the Binding Message Reference pointer part:

BindingMessageRefArgs

$$BindingOpArgs$$
$$message : NCName$$

See *BindingOpArgs, QName.*

Let *BindingMessageRefDesignator* express the association between a Binding Message Reference component and its pointer part arguments:

BindingMessageRefDesignator

BindingOpDesignator
interfaceMessageRefComp : *InterfaceMessageReference*
bindingMessageRefComp : *BindingMessageReference*

BindingMessageRefArgs

---

interfaceMessageRefComp ∈ *interfaceMessageRefComps*
interfaceMessageRefComp.parent = *interfaceOpComp.id*
interfaceMessageRefComp.messageLabel = *message*

bindingMessageRefComp ∈ *bindingMessageRefComps*
bindingMessageRefComp.parent = *bindingOpComp.id*
bindingMessageRefComp.interfaceMessageReference = *interfaceMessageRefComp.id*

See *BindingOpDesignator, InterfaceMessageReference, BindingMessageReference, BindingMessageRefArgs.*

The pointer part defined by a Binding Message Reference component is *wsdlBindingMessageReference*:

∀ *BindingMessageRefDesignator*;
id : *ID* |
id = *bindingMessageRefComp.id* •
pointerPart(θ*ComponentID*) =
wsdlBindingMessageReference(*binding*, *operation*, *message*)

See *BindingMessageRefDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.13 The Binding Fault Reference Component

wsdl.bindingFaultReference(*binding*/*operation*/*message*/*fault*)

1. *binding*

   is the local name of the name property of the grandparent Binding component.

2. *operation*

   is the name property of the Interface Operation component referred to by the

   interface operation

   property of the parent Binding Operation component.

3. *message*

   is the

   message label

property of the Interface Fault Reference component referred to by the interface fault reference
property of the Binding Fault Reference component.

4. *fault*
   is the name property of the Interface Fault component referred to by the interface fault
   property of the Interface Fault Reference component referred to by the interface fault reference
   property of the Binding Fault Reference component.

Let *BindingFaultRefArgs* represent the arguments for the Binding Fault Reference pointer part:

BindingFaultRefArgs

$$
\begin{array}{l}
BindingOpArgs \\
BindingFaultArgs \\
message : NCName
\end{array}
$$

See *BindingOpArgs, BindingFaultArgs, NCName.*

Let *BindingFaultRefDesignator* express the association between a Binding Fault Reference component and its pointer part arguments:

BindingFaultRefDesignator

$$
\begin{array}{l}
BindingOpDesignator \\
BindingFaultDesignator \\
interfaceFaultRefComp : InterfaceFaultReference \\
bindingFaultRefComp : BindingFaultReference \\
BindingFaultRefArgs \\
\hline
interfaceFaultRefComp \in interfaceFaultRefComps \\
interfaceFaultRefComp.parent = interfaceOpComp.id \\
interfaceFaultRefComp.interfaceFault = interfaceFaultComp.id \\
interfaceFaultRefComp.messageLabel = message \\
bindingFaultRefComp \in bindingFaultRefComps \\
bindingFaultRefComp.parent = bindingOpComp.id \\
bindingFaultRefComp.interfaceFaultReference = interfaceFaultRefComp.id
\end{array}
$$

See *BindingOpDesignator, BindingFaultDesignator, InterfaceFaultReference, BindingFaultReference, BindingFaultRefArgs.*

The pointer part defined by a Binding Fault Reference component is *wsdlBindingFaultReference*:

$\forall$ *BindingFaultRefDesignator*;
id : *ID* |
id = *bindingFaultRefComp.id* •
pointerPart(θ*ComponentID*) =
wsdlBindingFaultReference(*binding*, *operation*, *message*, *fault*)

See *BindingFaultRefDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.14 The Service Component

wsdl.service(*service*)

1. *service*

   is the local name of the name property of the Service component.

Let *ServiceArgs* represent the arguments for the Service pointer part:

ServiceArgs
service : *NCName*

See *NCName.*

Let *ServiceDesignator* express the association between a Service component and its pointer part arguments:

ServiceDesignator
ComponentModel
serviceComp : *Service*
ServiceArgs
---
serviceComp $\in$ *serviceComps*
serviceComp.name.localName = *service*

See *ComponentModel, Service, ServiceArgs.*

The pointer part defined by a Service component is *wsdlService*:

$\forall$ *ServiceDesignator*;
id : *ID* |
id = *serviceComp.id* •
pointerPart(θ*ComponentID*) =
wsdlService(*service*)

See *ServiceDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.15 The Endpoint Component

wsdl.endpoint(*service*/*endpoint*)

1. *service*

   is the local name of the name property of the parent Service component.

2. *endpoint*

   is the name property of the Endpoint component.

Let *EndpointArgs* represent the arguments for the Endpoint pointer part:

EndpointArgs

$$\begin{array}{l} ServiceArgs \\ endpoint : NCName \end{array}$$

See *ServiceArgs, NCName.*

Let *EndpointDesignator* express the association between an Endpoint component and its pointer part arguments:

EndpointDesignator

$$\begin{array}{l} ServiceDesignator \\ endpointComp : Endpoint \\ \\ EndpointArgs \\ \hline endpointComp \in endpointComps \\ endpointComp.parent = serviceComp.id \\ endpointComp.name = endpoint \end{array}$$

See *ServiceDesignator, Endpoint, EndpointArgs.*

The pointer part defined by a Endpoint component is *wsdlEndpoint*:

$$\begin{array}{l} \forall\, EndpointDesignator; \\ \quad id : ID \mid \\ \quad id = endpointComp.id \bullet \\ \quad pointerPart(\theta ComponentID) = \\ \qquad wsdlEndpoint(service, endpoint) \end{array}$$

See *EndpointDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.16 The Feature Component

wsdl.feature(*parent*/*feature*)

1. *parent*

   is the pointer part of the parent component.

2. *feature*

   is the ref property of the Feature component.

Let *FeatureArgs* represent the arguments for the Feature pointer part:

FeatureArgs

$$parent : wsdlPointerPart$$
$$feature : AbsoluteURI$$

See *wsdlPointerPart, AbsoluteURI.*

Let *FeatureDesignator* express the association between a Feature component and its pointer part arguments:

FeatureDesignator

$$ComponentModel$$
$$parentComp : Component$$
$$id : ID$$
$$featureComp : Feature$$
$$FeatureArgs$$

$$id = Id(parentComp)$$
$$parentComp \in components$$
$$pointerPart(\theta ComponentID) = parent$$
$$featureComp \in featureComps$$
$$featureComp.parent = id$$
$$featureComp.ref = feature$$

See *ComponentModel, Component, ID, Feature, FeatureArgs, Id, pointerPart, ComponentID.*

The pointer part defined by a Feature component is *wsdlFeature*:

$$\forall FeatureDesignator;$$
$$id : ID \mid$$
$$id = featureComp.id \bullet$$
$$pointerPart(\theta ComponentID) =$$
$$wsdlFeature(parent, feature)$$

See *FeatureDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.17 The Property Component

wsdl.property(*parent*/*property*)

1. *parent*

   is the pointer part of the parent component.

2. *property*

   is the ref property of the Property component.

Let *PropertyArgs* represent the arguments for the Property pointer part:

PropertyArgs

$$parent : wsdlPointerPart$$
$$property : AbsoluteURI$$

See *wsdlPointerPart, AbsoluteURI.*

Let *PropertyDesignator* express the association between a Property component and its pointer part arguments:

PropertyDesignator

$$ComponentModel$$
$$parentComp : Component$$
$$id : ID$$
$$propertyComp : Property$$
$$PropertyArgs$$

$$id = Id(parentComp)$$
$$parentComp \in components$$
$$pointerPart(\theta ComponentID) = parent$$
$$propertyComp \in propertyComps$$
$$propertyComp.parent = id$$
$$propertyComp.ref = property$$

See *ComponentModel, Component, ID, Property, PropertyArgs, Id, pointerPart, ComponentID.*

The pointer part defined by a Property component is *wsdlProperty*:

$$\forall PropertyDesignator;$$
$$id : ID \mid$$
$$id = propertyComp.id \bullet$$
$$pointerPart(\theta ComponentID) =$$
$$wsdlProperty(parent, property)$$

See *PropertyDesignator, ID, pointerPart, ComponentID, wsdlPointerPart.*

A.2.18 Extension Components

WSDL 2.0 is extensible and it is possible for an extension to define new components types. The XPointer Framework scheme for extension components is:

wsdl.extension(*namespace*, *identifier*)

1. *namespace*

   is the namespace URI that identifies the extension, e.g. for the WSDL 2.0 SOAP 1.2 Binding the namespace is http://www.w3.org/2006/01/wsdl/soap.

2. *identifier*

   is defined by the extension using a syntax specific to the extension. The owner of the extension must define any components contributed by the extension and a syntax for identifying them.

Let *ExtensionArgs* represent the arguments for the extension component pointer part:

ExtensionArgs

$$namespace : AbsoluteURI$$
$$identifier : ExtensionIdentifier$$

See *AbsoluteURI, ExtensionIdentifier.*

Let *ExtensionDesignator* express the association between an extension component its pointer part arguments:

ExtensionDesignator

$$ComponentModel$$
$$extensionComp : Component$$
$$ExtensionArgs$$

$$extensionComp \in components$$

See *ComponentModel, Component, ExtensionArgs.*

The details of the association are defined by each extension specification.

The namespace IRI of an extension component is defined by the extension specification.

The pointer part defined by an extension component is *wsdlExtension*:

$$\forall\, ExtensionDesignator;$$
$$\quad id : ID \mid$$
$$\quad id = Id(extensionComp) \bullet$$
$$\quad pointerPart(\theta ComponentID) =$$
$$\qquad wsdlExtension(namespace, identifier)$$

See *ExtensionDesignator, ID, Id, pointerPart, ComponentID, wsdlPointerPart.*

A.3 Security considerations

This media type uses the `"+xml"` convention, it shares the same security considerations as described in [*RFC 3023*], section 10.

Appendix B

Acknowledgements (Non-Normative)

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Appendix C

IRI-References for WSDL 2.0 Components (Non-Normative)

This appendix provides a syntax for IRI-references for all components found in a WSDL 2.0 document. The IRI-references are easy to understand and compare, while imposing no burden on the WSDL 2.0 author.

C.1 WSDL 2.0 IRIs

There are two main cases for WSDL 2.0 IRIs:

- the IRI of a WSDL 2.0 document
- the IRI of a WSDL 2.0 namespace

The IRI of a WSDL 2.0 document can be dereferenced to give a resource representation that contributes component definitions to a single WSDL 2.0 namespace. If the media type is set to the WSDL 2.0 media type, then the fragment identifiers can be used to identify the main components that are defined in the document.

However, in keeping with the recommendation in **2.1.1 The Description Component** that the namespace URI be dereferencible to a WSDL 2.0 document, this appendix specifies the use of the namespace IRI with the WSDL 2.0 fragment identifiers to form an IRI-reference.

The IRI in an IRI-reference for a WSDL 2.0 component is the namespace name of the name property of either the component itself, in the case of Interface, Binding, and Service components, or the name property of the ancestor top-level component. The IRI provided by the namespace name of the name property is combined with a fragment identifier as defined in **A.2 Fragment Identifiers**.

C.2 Example

Consider the following WSDL 2.0 document located at http://example.org/TicketAgent.wsdl:

```
<?xml version="1.0" encoding="UTF-8"?>
<wsdl:description
    targetNamespace="http://example.org/TicketAgent.wsdl20"
    xmlns:xsTicketAgent="http://example.org/TicketAgent.xsd"
    xmlns:wsdl="http://www.w3.org/2006/01/wsdl"
    xmlns:xs="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.w3.org/2006/01/wsdl http://www.w3.org/2006/01/wsdl/wsdl20

    <wsdl:types>
        <xs:import schemaLocation="TicketAgent.xsd"
                   namespace="http://example.org/TicketAgent.xsd" />
    </wsdl:types>

    <wsdl:interface name="TicketAgent">
        <feature ref="http://example.com/secure-channel"
                 required="true"/>

        <wsdl:operation name="listFlights"
                        pattern="http://www.w3.org/2006/01/wsdl/in-out">
            <wsdl:input element="xsTicketAgent:listFlightsRequest"/>
            <wsdl:output element="xsTicketAgent:listFlightsResponse"/>
        </wsdl:operation>

        <wsdl:operation name="reserveFlight"
                        pattern="http://www.w3.org/2006/01/wsdl/in-out">
            <wsdl:input element="xsTicketAgent:reserveFlightRequest"/>
            <wsdl:output element="xsTicketAgent:reserveFlightResponse"/>
        </wsdl:operation>
    </wsdl:interface>
</wsdl:description>
```

Its components have the following IRI-references:

```
http://example.org/TicketAgent.wsdl20#
  wsdl.description()

http://example.org/TicketAgent.wsdl20#
  xmlns(xsTicketAgent=http://example.org/TicketAgent.xsd)
  wsdl.elementDeclaration(xsTicketAgent:listFlightsRequest)
```

```
http://example.org/TicketAgent.wsdl20#
  xmlns(xsTicketAgent=http://example.org/TicketAgent.xsd)
  wsdl.elementDeclaration(xsTicketAgent:listFlightsResponse)

http://example.org/TicketAgent.wsdl20#
  xmlns(xsTicketAgent=http://example.org/TicketAgent.xsd)
  wsdl.elementDeclaration(xsTicketAgent:reserveFlightRequest)

http://example.org/TicketAgent.wsdl20#
  xmlns(xsTicketAgent=http://example.org/TicketAgent.xsd)
  wsdl.elementDeclaration(xsTicketAgent:reserveFlightResponse)

http://example.org/TicketAgent.wsdl20#
  wsdl.interface(TicketAgent)

http://example.org/TicketAgent.wsdl20#
  wsdl.feature(
  wsdl.interface(TicketAgent)/http://example.com/secure-channel)

http://example.org/TicketAgent.wsdl20#
  wsdl.interfaceOperation(TicketAgent/listFlights)

http://example.org/TicketAgent.wsdl20#
  wsdl.interfaceMessageReference(TicketAgent/listFlights/In)

http://example.org/TicketAgent.wsdl20#
  wsdl.interfaceMessageReference(TicketAgent/listFlights/Out)

http://example.org/TicketAgent.wsdl20#
  wsdl.interfaceOperation(TicketAgent/reserveFlight)

http://example.org/TicketAgent.wsdl20#
  wsdl.interfaceMessageReference(TicketAgent/reserveFlight/In)

http://example.org/TicketAgent.wsdl20#
  wsdl.interfaceMessageReference(TicketAgent/reserveFlight/Out)
```

Appendix D

Component Summary (Non-Normative)

Table D.1 lists all the components in the WSDL 2.0 abstract Component Model, and all their properties.

Table D.1: Summary of WSDL 2.0 Components and their Properties

Component	Defined Properties
	features, name, parent, properties
Binding	binding faults, binding operations, features, interface, name, properties, type
Binding Fault	features, interface fault , parent, properties
Binding Fault Reference	features , interface fault reference , parent , properties
Binding Message Reference	features , interface message reference , parent , properties
Binding Operation	binding fault references , binding message references , features, interface operation , parent, properties
Description	bindings, element declarations, interfaces, services, type definitions
Element Declaration	name, system
Endpoint	address, binding, features, name, parent, properties

Feature	parent, ref, required
Interface	extended interfaces, features, interface faults, interface operations, name, properties
Interface Fault	element declaration, features, name, parent, properties
Interface Fault Reference	direction, features, interface fault, message label, parent, properties
Interface Message Reference	direction, element declaration, features, message content model, message label, parent, properties
Interface Operation	features, interface fault references, interface message references, message exchange pattern, name, parent, properties, style
Property	parent, ref, value, value constraint
Service	endpoints, features, interface, name, properties
Type Definition	name, system

Property	**Where Defined**
address	Endpoint.address
binding	Endpoint.binding
binding faults	Binding.binding faults
binding operations	Binding.binding operations
bindings	Description.bindings
direction	Interface Fault Reference.direction, Interface Message Reference.direction
element declaration	Interface Fault.element declaration, Interface Message Reference.element declaration
element declarations	Description.element declarations
endpoints	Service.endpoints

extended interfaces	Interface.extended interfaces
features	.features, Binding.features, Binding Fault.features, Binding Fault Reference. features , Binding Message Reference. features , Binding Operation.features, Endpoint.features, Interface.features, Interface Fault.features, Interface Fault Reference.features, Interface Message Reference.features, Interface Operation.features, Service.features
interface	Binding.interface, Service.interface
interface fault	Binding Fault. interface fault , Interface Fault Reference.interface fault
interface fault references	Interface Operation.interface fault references
interface faults	Interface.interface faults
interface message references	Interface Operation.interface message references
interface operations	Interface.interface operations
interfaces	Description.interfaces
message content model	Interface Message Reference.message content model
message exchange pattern	Interface Operation.message exchange pattern
message label	Interface Fault Reference.message label, Interface Message Reference.message label
name	.name, Binding.name, Element Declaration.name, Endpoint.name, Interface.name, Interface Fault.name, Interface Operation.name, Service.name, Type Definition.name
parent	.parent, Binding Fault.parent, Binding Fault Reference. parent , Binding Message Reference. parent , Binding Operation.parent, Endpoint.parent, Feature.parent, Interface Fault.parent, Interface Fault Reference.parent, Interface Message Reference.parent, Interface Operation.parent, Property.parent

properties	.properties, Binding.properties, Binding Fault.properties, Binding Fault Reference. properties , Binding Message Reference. properties , Binding Operation.properties, Endpoint.properties, Interface.properties, Interface Fault.properties, Interface Fault Reference.properties, Interface Message Reference.properties, Interface Operation.properties, Service.properties
ref	Feature.ref, Property.ref
required	Feature.required
services	Description.services
style	Interface Operation.style
system	Element Declaration.system, Type Definition.system
type	Binding.type
type definitions	Description.type definitions
value	Property.value
value constraint	Property.value constraint

Appendix E

Part 1 Change Log (Non-Normative)

E.1 WSDL 2.0 Specification Changes

Table E.1: Summary of WSDL 2.0 Specification Changes

Date	Author	Description
20060309	AGR	Added quotes to xmlns attribute in example as reported by Menon, 2006-02-28 .
20060226	AGR	Reviewed and added assertions to sections 2. 2.1, 4, 5, 6, 7, 8 and Appendix A.
20060224	RRC	Added assertions to sections 2.2, 2.3, 2.4, 2.5, 2.6, 3.
20060220	AGR	CR005 : Added the 44 built-in datatypes to the type definitions property of the Description.
20060109	AGR	Added assertions posted to mailing list: "Binding, Service, Modularization, Extensibility, and Location assertions", Lawrence Mandel, 2006-01-06.
20051121	AGR	Added assertions posted to mailing list: "types, description, interface, feature, and property assertions", Lawrence Mandel, 2005-11-17.
20051118	AGR	Added assertions posted to mailing list: "types assertions", Lawrence Mandel, 2005-11-15.
20051118	AGR	Simiplified Z Notation for fragment identifiers and updated Example IRIs.

20051117	AGR	LC344 : Reviewed use of "Note that" throughout and removed usages where they would be incorrectly interpreted as non-normative. Implemented resolutions of #1, #2, #6, #10, and #14.
20051117	AGR	Fixed typos posted to mailing list: WSDL 2.0 spec typos, Lawrence Mandel, 2005-11-16.
20051117	JJM	LC358 : fixed formatting in example C.2.
20051117	JJM	LC356 : fixed contradiction between sections 2.1.2 and 2.2.1.
20051117	JJM	LC302 : point to RFC3987 instead of the draft TAG finding.
20051117	JJM	LC355 : fixed section 2.10.3, table had error, "interface fault component".
20051116	AGR	Added Z Notation for fragment identifiers and component designators for Description, Feature, Property, and Extension components in Appendix A - Fragment Identifiers.
20051115	AGR	Added Z Notation for fragment identifiers and component designators for Element Declaration and Type Definition components in Appendix A - Fragment Identifiers.
20051113	AGR	Added Z Notation for fragment identifiers and component designators for Interface, Binding, and Service component families in Appendix A - Fragment Identifiers.
20051112	AGR	Corrected order of arguments in fragment identifier for Binding Fault Reference to match that in Interface Fault Reference.
20051112	AGR	LC361 : Defined what should be declared as a fault.
20051112	AGR	LC344#5 : Allow an operation style to constrain faults as per the resolution at the Yokohama F2F.
20051112	AGR	LC350 : Corrected Introduction.
20051112	AGR	LC336 : Soften statement about use of xs:anyURI and refer to WS-Addressing Endpoint Reference.
20051112	AGR	LC305 : Aligned BNF notational conventions with WS-Addressing, Pseudo schemas do not include extensibility points for brevity.

20051110	AGR	LC353 : Added definition of a valid WSDL 2.0 component model.
20051110	JJM	LC360 : What should be declared as a fault, as per Tokyo f2f.
20051110	JJM	LC357 : Added anyURI-IRI warning, as per Tokyo f2f.
20051110	JJM	LC344#5 : Incorporated text regarding mutually exclusive operation styles, as per Tokyo f2f.
20051103	AGR	LC344#12 : Completed editorial improvements to message label rules. Moved long definitions out of tables.
20051101	AGR	Added Z Notation for message exchange pattern, placeholder message, and fault propagation ruleset in **2.4.1 Message Exchange Pattern** . Replaced the term *fault pattern* with *fault propagation ruleset* throughout for consistency and agreement with Part 2.
20051027	AGR	Added bidirectional linking between assertions and the summary table, and added a section on notation, **1.4.10 Assertions**.
20051027	AGR	Updated **3.1 Using W3C XML Schema Description Language** as per proposal How to Treat Built-In Schema Types.
20051027	AGR	LC344#12 : Editorial improvements to message label rules. Added precise definitions of message exchange pattern, placeholder message, and fault propagation ruleset in **2.4.1 Message Exchange Pattern**.
20051020	AGR	LC344#6 : Editorial improvements to 2.7.1 The Feature Component.
20051016	AGR	LC328 : Added introductory paragraph to **8 Conformance** in response to comment #2.
20050924	AGR	Added initial markup for assertions.
20050914	AGR	LC311: Clarified that the URI associated with alternative schema languages for defining other type systems is the namespace used for its extension elements and attributes and that it is an absolute IRI.
20050914	AGR	LC309: Replaced the list of operation style definitions with a general reference to Part 2.
20050914	AGR	LC308: Added references to Fragment Identifier appendix to show how Interface Fault and Interface Operation can be uniquely identified.
20050901	RRC	LC310: Removed uses of undefined "ws:" prefix and made use of prefixes in section 4.2 more regular.

20050730	AGR	Removed obsolete editorial notes.
20050727	AGR	LC96 : Added clarification to section 4.2 stating that imported WSDL components are pervasive like in XML Schema as per resolution agreed to at F2F.
20050727	AGR	LC91 : Added clarification to section 3.1.1 stating that some differences to xs:import apply as per resolution agreed to at F2F.
20050727	AGR	Corrected typo in section 3.1.2 on inlining two or more schemas that have the same namespace.
20050719	AGR	Added xs:import and xs:schema to XML Syntax Summary for types.
20050711	AGR	Updated Example C-2. IRI-References - Example IRIs to match Appendix A.
20050616	AGR	Corrected Feature and Property composition rules for Interface, Service, and Endpoint.
20050615	AGR	LC117: Removed Service References and Endpoint References and added wsdlx:interface and wsdlx:binding.
20050613	RRC	LC74c: changed `wsdl:documentation` element cardinality to zero or more and adding sentence on use of `xml:lang`.
20050613	RRC	LC74a: changed URIs to IRIs except in Feature and Property Components.
20050613	AGR	LC75v: Removed any text that discussed conformance for WSDL 2.0 processors.
20050613	JJM	LC131: added pseudo-schema comment.
20050613	JJM	LC70: reiterated behavior is undefined when several schema languages used simultaneously.
20050613	JJM	LC70: moved appendix D (other schema languages) to a separate specification.
20050612	AGR	Finshed first pass at adding markup for WSDL component and property definitions and references.
20050610	AGR	Added table of components and their properties, courtesy of JM.
20050608	AGR	Added markup for WSDL component and property definitions and references.
20050602	HH	LC75c: moved safety to Part 2.
20050601	JJM	LC75x: removed appendix "migrating from WSDL 1.1 to WSDL 2.0".

20050531	JJM	LC82: removed ONMR section (transfer to primer).
20050531	JJM	LC71: added default value for pattern attribute (".../inout").
20050526	AGR	LC64: Added fragment identifiers for Description, Element Declaration, and Type Definition components.
20050525	AGR	Added final ComponentModel to Z Notation.
20050523	AGR	Reordered some paragraphs to improve consistency.
20050522	AGR	Added consistency and key constraints to the Z notation.
20050520	JJM	LC129: wsdlLocation can now also point to WSDL 1.1 documents.
20050520	JJM	LC126: Added default value for wsdl:required (false).
20050520	JJM	Fixed typo in 2.14.1.1.
20050519	JJM	LC97: Uniformized setting default values. Fixed typos along the way.
20050518	AGR	Added parent and integrity constraints to the Z notation.
20050513	JJM	LC18: Fixed the SOAP 1.2/WSDL 2.0 feature text. Wordsmithed the introduction.
20050513	JJM	LC127: Fixed wsld:include description, which is not about merging.
20050512	JJM	LC75o: Remove "if any" from Service/{endpoints}, since there is always one.
20050511	AGR	LC121: Distinguished between wsdl:import and xs:import, and wsdl:include and xs:include in Description component mapping table.
20050504	JJM	Rewrote the "Operation Name Mapping Requirement" section to make it best practice.
20050504	JJM	Removed empty subsections in "XML Schema 1.0 Simple..."
20050504	JJM	Rewrote the "Single Interface" section, as per editorial AI dated 2005-01-19.
20050503	JJM	Rewrote the ONMR as Best practice.
20050503	JJM	LC112: Implemented resolution for issue LC112.
20050503	JJM	Completed editorial action LC78.
20050501	AGR	LC120: Clarified description of include and import, removed contradictions, and added references to QName resolution.
20050501	AGR	LC116: Clarified that `schemaLocation` is not required if the namespace has been resolved in the component model. Replaced the term "embedded schema" with "inlined schema" throughout.
20050501	AGR	LC89m: Made all top-level components behave the same under include and import.
20050501	AGR	LC89f: Added statement on XML document conformance.
20050501	AGR	LC74: Refer to WSDL 2.0 explicitly throughout. In particular, only imports and includes of WSDL 2.0 documents are allowed.
20050501	AGR	LC99: Added #other to {message content model} property of Interface Message Reference component, and to WSDL schema.

20050501	AGR	LC125: Renamed components Fault Reference -¿ Interface Fault Reference, Message Reference -¿ Interface Message Reference, and the corresponding properties.
20050430	AGR	LC117: Added use of EndpointType for endpoint references.
20050429	AV	LC96 and LC120: Modified section 4.2 to align wsdl:import with xs:import.
20050429	RRC	LC75w: Removed "is not dereferenceable or" from section 4.1.1 and removed references to a WSDL processor.
20050429	RRC	Added clarification that an operation style MAY affect only input or only output messages (or any other combination).
20050421	AGR	LC81 : Added constraints to ensure the component model can be serialized as a WSDL 2.0 XML Infoset. In the Interface component, the declared Interface Faults and Operations MUST have the same namespace as the Interface.
20050418	RRC	LC115: Moved document conformance section after 1.1.
20050418	RRC	LC89g: Replaced incorrect references to the [owner] Infoset property with the correct [owner element].
20050417	AGR	LC107 : Use a consistent naming convention for properties that refer to components. Make the property name match the component name as follows: • Interface.{faults} -¿ {interface faults} • Interface.{operations} -¿ {interface operations} • InterfaceFault.{element} -¿ {element declaration} • MessageReference.{element} -¿ {element declaration} • FaultReference.{fault reference} -¿ {interface fault} • Binding.{faults} -¿ {binding faults} • Binding.{operations} -¿ {binding operations} • BindingFault.{fault reference} -¿ {interface fault} • BindingOperation.{operation reference} -¿ {interface operation} • BindingOperation.{message references} -¿ {binding message references} • BindingOperation.{fault references} -¿{binding fault references}

20050417	AGR	LC34b : Added the constraint that the {uri} property of a Feature or Property component within a {features} or {properties} property MUST be unique.
20050416	AGR	LC105 : Added {parent} property to nested components.
20050416	AGR	Moved the fragment identifier definition into the media registration appendix.
20050414	JJM	Fixed XML Schema P1/P2 version listed in the bibliography section.
20050413	AGR	LC87 : Improved clarity of the decription of Component Designators in Appendix C.
20050407	JJM	Reworded the introduction for wsdlLocation, as per LC26 resolution.
20050407	JJM	Moved paragraphs 6-9 of section 2.1.1 into 2.1.2.
20050331	AGR	LC113 : In the Feature and Property Composition sections, the in-scope components for Binding Operation, Binding Fault, Binding Message Reference, and Binding Fault Reference should include those of the corresponding Interface Operation, Interface Fault, Message Reference, and Fault Reference, respectively. Also updated specification references use Part 2: Adjuncts, and corrected validation errors.
20050320	AGR	LC104: The operations, faults, features, and properties of an Interface component are those defined directly on the component and do not include those from the extended interfaces.
20050320	AGR	Rename Z Notation versions as wsdl20-z.html and wsdl20-z-ie-html.
20050315	AGR	Hide Z Notation in the Normative version of the spec.
20050314	AGR	Removed section on RPC Style so it can be included in Adjuncts.
20050310	AGR	Fixed minor Binding Operation errors introduced by addition of Binding Message Reference.
20050310	JJM	Replaced schema visibility table with Asir's revised version.
20050309	AGR	Fixed minor Z typechecking errors introduced by addition of Binding Message Reference. Kudos to RRC for updating the Z Notation!

20050301	RRC	LC55: added Binding Fault Reference component and updated the definition of the Binding Message Reference component to be in sync with it, per issue resolution.
20050301	RRC	LC51: added Fault Reference component to the feature composition section; added mapping of {type definitions} property of the Description component from the XML representation.
20050301	RRC	LC48a, LC49: implemented resolutions.
20050228	JJM	X and Y: Added note clarifying extensibility semantics.
20050228	JJM	X: Added note clarifying extensibility semantics.
20050228	JJM	X: Added text on the meaning of a service description.
20050218	RRC	Replaced "provider agent" with "Web service" and "requester agent" with "client" (resolution of LC30).
20050218	RRC	Moved section on the operation name mapping requirement to section 2.13 (resolution of LC8).
20050218	RRC	Implemented resolution of LC5h.
20050220	AGR	Refactored Feature and Property Z Notation in preparation for formalization of composition model.
20050220	AGR	LC27: Partial Resolution from 2005-01-19: value sets intersect. Resolve Property Composition Edge Cases by requiring the conjunction of all constraints to apply. The composed value of a Property is intersection of the value set of each in-scope Property.
20050220	AGR	LC20: Partial Resolution from 2005-01-19: "true" trumps. Resolve Feature Composition Edge Cases by requiring the conjunction of all constraints to apply. The composed value of a Feature is "true" if and only if at least one in-scope value of the Feature is "true".
20050220	AGR	LC75i: At least one of the [children] of an Operation MUST be an "input" or "output". Agree to remove "infault" and "outfault" from the list since it does not make sense to have an Operation with only faults.
20050220	AGR	Completed Action Item - 2005-02-10: DBooth to mail Arthur change to wording on media type registration, Arthur to incorporate.
20050217	JJM	LC75s: Add table indicating the visibility of schema components.
20050217	JJM	LC52a: Indicate included components also belong to the same target namespace, as per Jacek original suggestion.
20050216	JJM	LC60: Indicate it is OK to embed 2 schemas from the same targetNS.

20050216	JJM	LC75t: Remove the restriction that wsdl:include cannot be transitive.
20050216	JJM	LC91: Fixed wording regarding importing schema and effect on WSDL components.
20050211	AGR	email: Added an informative reference to WS-Addressing and referred to it from the Operation Name Mapping Requirement.
20050210	AGR	email: Corrected WSDL Media Type Registration as per David Booth's email.
20050209	AGR	Editorial: Combine {name} NCName and {target namespace} URI properties into a single {name} QName property.
20050121	AGR	LC75l LC103: Make {message label} property of Binding Message Reference component REQUIRED and fix up XML mapping table. /¿.
20050121	AGR	LC75 LC89b LC89c: Drop support for XML 1.1, drop wsdls types, and use XSD 1.0 types. /¿.
20050120	AGR	LC73 LC75n: Added "single_interface_per_service".
20050119	AGR	Editorial improvements to Z Notation. Added referential integrity constraints.
20050118	AGR	Edited Notational Conventions and References sections. Added character entity references for accented characters.
20050117	AGR	Edited table markup to simplify PDF generation.
20041231	AGR	Added reference to non-normative IE version of the specification.
20041227	AGR	Added reference to non-normative DHTML version of the specification.
20041218	AGR	LC34a: Refer to "Appendix C - URI References for WSDL Components" whenever a component cannot be referred to by QName .
20041126	AGR	LC43: Rename ¡definitions¿ to ¡description¿.
20041102	HH	LC38: Using real URI for DTD import
20041024	AGR	Added initial Z Notation for component model.
20040930	AGR	LC6d: Revised Appendix C, URI References.
20040929	AGR	LC34b, LC34c, LC34d: Revised Appendix C, URI References.
20040802	RRC	Removed paragraph added per resolution of issue 211 (undone per action item 5 of the 2004-07-29 concall).
20040802	RRC	Added clarification on the meaning of required language extensions.

20040802	RRC	Added operation name requirement to the Interface component section.
20040802	RRC	Added introductory text for the Property Component (per action item 2 of the 2004-07-29 concall).
20040727	RRC	Made the Property component independent of XML Schema (issue 248).
20040727	SW	Issue 243 text
20040727	SW	Incorporated Paul's words for issue 235
20040727	SW	Added MarkN's text for issue 211
20040727	SW	Added note to processor conf rules for optional extensions and features about what optional means.
20040727	SW	Removed contentious area ed note thing per decision to do those via minority opinions.
20040722	HH	Defined wsdls:int for http:code.
20040721	RRC	Made almost all set-valued properties optional and added a rule to default them to the empty set, per agenda item 7 of 2004-07-15 concall.
20040715	RRC	Marked the {message label} property of the Message Reference and Fault Reference components as required.
20040715	RRC	Made the {style} property into a set of xs:anyURI.
20040714	RRC	Added definition of simple types used by the component model (issue 177).
20040713	RRC	Added clarification to interface extensions per issue 220.
20040713	RRC	Added clarification to Binding Operation section (issue 227).
20040713	RRC	Fixed references to Interface Fault components in the Fault Reference component section.
20040713	RRC	Added description of pseudo-schema syntax.
20040714	SW	Made f&p allowed in the remaining places and updated composition rules
20040713	SW	Added negative conformance criteria: not required to process XML1.1 etc.
20040713	SW	Corrected reference to frag ID syntax to for issue 209
20040713	SW	Implemented Jonathan's proposal for issue 160.
20040713	SW	Put ednote in contentious areas asking for extra feedback.
20040712	RRC	Marked all component model properties as REQUIRED or OPTIONAL (issue 213).
20040712	RRC	Added definition for equivalence of list-typed values.
20040712	RRC	Clarified RPC style rules for one-way operations (issue 215).
20040708	JJM	Finished adding clarifications for non-XML type system extensibility.
20040708	JJM	Include the definition of "actual value" from XML Schema (Issue 219).
20040708	JJM	Added resolution to issue 218 (2004Jun/0276.html, including Mark's amendment).

20040708	JJM	Component equivalence (2004Jun/0195.html, 2004Jun/0199.html and ref to the charmod [Issue 210]).
20040706	RRC	Added clarifications for non-XML type system extensibility.
20040706	RRC	Expanded component model definition.
20040706	RRC	Added clarification to section 2.1.1 per resolution of issue 222.
20040706	RRC	Made it possible to use rpc style with schema languages other than XML Schema.
20040702	SW	Made operation/@style be a list of URIs.
20040702	SW	Had forgotten to map to the {type} property of binding.
20040625	SW	Allowed F&P *nearly* everywhere. Sigh.
20040618	SW	Changed F&P composition model to nearest enclosing scope.
20040618	SW	Incorporated Jacek's purpose of bindings text as appropriate.
20040526	SW	Added @address to /definitions/service/endpoint per F2F decision
20040526	SW	Added @type to /definitions/binding per F2F decision
20040519	SW	Renamed wsoap12: to wsoap:.
20040323	JJM	Commented out the (missing) property example.
20040322	RRC	Added definition of wsdli:wsdlLocation attribute.
20040322	JJM	Added faults to properties and features.
20040319	JJM	Use lowercase "should" in notes.
20040319	JJM	Comment out features at service level. Uniformize scope between features and properties.
20040318	JJM	Moved normative notes into the main body of the document.
20040318	JJM	Incorporated the property text from Glen.
20040318	JJM	Addressed comments from Yuxiao Zhao.
20040318	JJM	Updated the feature description, as per Glen and David Booth's suggestions.
20040317	RRC	Removed redundant {styleDefault} property of the interface component.
20040317	JJM	Include comments from Kevin.
20040315	RRC	Added clarification on embedded XML schemas that refer to siblings.
20040315	RRC	Updated RPC signature extension to use #in/#out/#inout/#return tokens.
20040315	RRC	Added explanatory text to types and modularization sections per resolution of issue #102.
20040315	SW	Change binding/{fault,operation}/@name to @ref
20040312	RRC	Fixed appendix D to take the removal of wsdl:message into account.
20040312	RRC	Added definition of wrpc:signature extension attribute.
20040311	SW	Change fault stuff per decision to make faults first class in interfaces.
20040308	SW	Renamed {message} property to {element} and @message to @element

20040305	SW	Added {safety} property
20040227	MJG	Merged in branch Issue143 containing resolution of issue 143
20040227	SW	Dropped {type definitions} property from definitions; leftover from ¡message¿ days.
20040226	SW	Working thru various edtodo items.
20040106	JS	Per 18 Dec 2003 telecon decision, added text re: circular includes.
20031204	JS	Per 4 Dec 2003 telecon decision, removed redundant binding/operation/{infault, outfault}/@messageReference.
20031105	JS	Added point to attributes task force recommendation accepted by the working group.
20031104	JS	Mapping to component model for {message} of Fault Reference component indicated that `message` *attribute information item* was optional, but the pseudo syntax and XML representation indicated it was required. Made uniformly optional to allow other type systems as was previously done for {message} of Message Reference component.
20031104	JS	Renamed interface /operation /{input,output} /@body to ./@message and interface /operation /{infault,outfault} /@details to ./@message per 4 Nov face-to-face decision.
20031104	JS	Made interface /operation /{input,output,infault,outfault} /@messageReference optional per 4 Nov face-to-face decision.
20031104	JS	Removed interface/operation/{input,output}/@header per 4 Nov face-to-face decision.
20031102	SW	Updated fault reference components to indicate that if operation's MEP uses MTF then the fault is in the opposite direction as the referenced message and if it use FRM then its in the same direction. Per 10/30 telecon decision.
20031102	SW	Updated operation styles terminology per message #57 of Oct. and the RPC style rules per message #58 of Oct. per decision on 10/30 telecon to consider those status quo.
20031102	SW	Clarified wording in operation styles discussion to better explain the use of the {style} attribute.
20031102	SW	Clarified wording in XML ¡-¿ component model mapping section for message reference components to say that {body} and {headers} may not have a value.
20031102	SW	Made interface/operation/(input—output)/@messageReference REQUIRED per 10/30 telecon decision.
20031028	SW	Renamed to wsdl20.xml and updated contents.
20031028	SW	Updated bindings.
20031025	SW	Updated faults.

20031013	JJM	Moved appendix C to a separate document, as per 24 Sep 2003 meeting in Palo Alto, CA.
20031003	SW	Softened ¡documentation¿ wording to allow machine processable documentation.
20031002	SW	Changed binding/operation/@name to QName per edtodo.
20030930	SW	Added placeholders for set-attr/get-attr operation styles.
20030929	SW	Inserted Glen Daniels' feature text.
20030919	RRC	Removed import facility for chameleon schemas and added a description of a workaround.
20030918	JJM	Changed message pattern to message exchange pattern, as per WG resolution on 18 Sep. 2003
20030916	RRC	Added editorial note for the missing RPC encoding style.
20030915	RRC	Yet more updates for REQUIRED, OPTIONAL; updated section 3 to reflect the removal of "wsdl:message".
20030911	RRC	More updates for REQUIRED, OPTIONAL; removed diff markup; fixed example C.4.
20030911	RRC	Renamed message reference "name" attribute and property to "messageReference"; fixed incorrect reference to "fault" element in the binding operation section.
20030910	SW	Fixed message references and added proper use of REQUIRED etc. for the part I've gone through so far.
20030910	SW	Updating spec; fixed up interface operation component more.
20030808	JCS	Fixed errors found by IBM\Arthur.
20030804	JCS	Removed Message component per 30 July-1 Aug meeting.
20030803	JCS	Replaced substitution groups with xs:any namespace='##other' per 3 July, 17 July, and 24 July telecons.
20030801	JCS	Made binding/@interface optional per 31 July meeting.
20030724	JCS	Remove @targetResource per 17 July 2003 telecon.
20030612	JJM	Incorporate revised targetResource definition, as per 12 June 2003 telcon.
20030606	JJM	Refer to the two graphics by ID. Indicate pseudo-schemas are not normative.
20030604	JJM	Fixed figures so they don't appear as tables. Fixed markup so it validates.
20030603	JCS	Plugged in jmarsh auto-generated schema outlines
20030529	MJG	Fixed various issues with the XmlRep portions of the spec
20030527	MJG	Added text to **2.2.1 The Interface Component** and **2.2.3 Mapping Interface's XML Representation to Component Properties** indicating that recursive interface extension is not allowed.
20030523	JJM	Added pseudo-syntax to all but Type and Modularizing sections.
20030523	JJM	Added the "interface" and "targetResource" attribute on ¡service¿.

20030523	JJM	Fixed miscellaneous typos (semi-colon instead of colon, space after parenthesis, etc.).
20030523	JJM	Rewrote the service-resource text and merge it with the introduction.
20030522	JCS	s/set of parts/list of parts/.
20030514	JJM	Updated the service-resource figure, and split the diagram into two.
20030512	JJM	Added service-resource drawing and description.
20030512	JJM	Added syntax summary for the Interface component.
20030428	MJG	Various edits to **3 Types**, other-schemalang to accommodate other type systems and spell out how extensibility elements/attributes play out in such scenarios.
20030428	MJG	Added text to **1.4 Notational Conventions** regarding normative nature of schema and validity of WSDL documents
20030411	JJM	Allowed features and properties at the interface, interface operation, binding and binding operation levels, as agreed at the Boston f2f http://lists.w3.org/Archives/Public/www-ws-desc/2003Mar/0019.html.
20030411	JJM	Incorporate features and properties' text from separate document and merged change logs
20030313	MJG	Changed title to include 'part 1'
20030313	MJG	Changed port to endpoint
20030313	MJG	Changed type to interface in binding
20030313	MJG	Changed mep to pattern and message exchange pattern to message pattern
20030313	MJG	Added text to 'mig_porttypes'
20030313	MJG	Changed portType to interface
20030407	JJM	Refined and corrected the definitions for features and properties.
20030304	JJM	Filled in blank description of Feature and Property component.
20030303	MJG	Skeleton Feature and Property components
20030305	MJG	Merged ComponentModelForMEPs branch (1.46.2.5) into main branch (1.54). Below is change log from the branch:
20030220	MJG	ComponentModelForMEPs: Minor wording change at suggestion of JJM
20030212	MJG	ComponentModelForMEPs: Updated component model to include Fault Reference component. Associated changes to Port Type Operation component
20030211	MJG	ComponentModelForMEPs: Changes to component model to support MEPs
20030228	MJG	Updated **4.2 Importing Descriptions** to be consistent in layout with other XML rep sections. Detailed that documentation and extensibility attributes are allowed, per schema
20030228	MJG	Updated **4.1 Including Descriptions** to be consistent in layout with other XML rep sections. Detailed that documentation and extensibility attributes are allowed, per schema

20030228	MJG	Updated **2.9.2 XML Representation of Binding Component** to list type attribute
20030217	MJG	Minor edits to wording in **2.4.1 The Interface Operation Component**
20030213	MJG	Added xlink nsdecl to spec element
20030213	MJG	Incorporated text from dbooth's proposal on semantics, per decision 20021031
20030213	MJG	Merged operationnames branch (1.37.2.3) into main branch (1.46). Below is the change log from the branch.
20030130	MJG	operationnames: Updated binding section to match changes to port type section WRT operation names
20030130	MJG	operationnames: Added best practice note on operation names and target namespaces to **2.4.1 The Interface Operation Component**
20030122	MJG	operationnames: Started work on making operations have unique names
20030213	MJG	Change name of {message exchange pattern} back to {variety} to consolidate changes due to MEP proposal
20030206	MJG	Updated Appendix A to refer to Appendix C
20030204	MJG	Tidied up appendix C
20030203	MJG	Incorporated resolution to R120
20030124	MJG	Fixed error in **2.5.2 XML Representation of Interface Message Reference Component** which had name *attribute information item* on input, output and fault *element information item* being mandatory. Made it optional.
20030123	JJM	Change name of {variety} property to {message exchange pattern}
20030130	MJG	Updated binding section to match changes to port type section WRT operation names
20030130	MJG	Added best practice note on operation names and target namespaces to **2.4.1 The Interface Operation Component**
20030122	MJG	Started work on making operations have unique names
20030122	MJG	Added some ¡emph¿, ¡el¿, ¡att¿, &AII;, &EII;, ¡el¿ markup
20030120	MJG	Incorporated Relax NG section from Amy's types proposal
20030120	MJG	Incorporated DTD section from Amy's types proposal
2003020	MJG	Incorporated Amy's types proposal except annexes
20030118	MJG	Made some changes related to extensibility
20030118	MJG	Amended content model for operation to disallow fault element children in the input-only and output-only cases
20030118	MJG	Removed {extension} properties from Binding components and Port components. Added text relating to how extension elements are expected to annotate the component model.
20030117	MJG	Made further edits related to extensibility model now using substitution groups
20030117	MJG	Added initial draft of section on QName resolution

20030117	MJG	Reworked section on extensibility
20030116	MJG	Added text regarding multiple operations with the same {name} in a single port type
20030116	MJG	Added section on symbol spaces
20030116	MJG	Removed various ednotes
20030116	MJG	Added section on component equivalence
20030116	MJG	More work on include and import
20021201	MJG	Did some work on wsdl:include
20021127	MJG	Added placeholder for wsdl:include
20021127	MJG	Cleaned up language concerning `targetNamespace` *attribute information item* **2.1.2** `targetNamespace` ***attribute information item***
20021127	MJG	changed the language regarding extensibility elements in **2.1.2 XML Representation of Description Component**.
20021127	MJG	Moved all issues into issues document (../issues/wsd-issues.xml)
20021127	MJG	Removed name attribute from definitions element
20021127	MJG	Removed 'pseudo-schema'
20021121	JJM	Updated media type draft appendix ednote to match minutes.
20021111	SW	Added appendix to record migration issues.
20021107	JJM	Incorporated and started adapting SOAP's media type draft appendix.
20021010	MJG	Added port type extensions, removed service type.
20020910	MJG	Removed parameterOrder from spec, as decided at September 2002 FTF
20020908	MJG	Updated parameterOrder description, fixed some spelling errors and other types. Added ednote to discussion of message parts
20020715	MJG	AM Rewrite
20020627	JJM	Changed a few remaining ¡emph¿ to either ¡att¿ or ¡el¿, depending on context.
20020627	SW	Converted portType stuff to be Infoset based and improved doc structure more.
20020627	SW	Converted message stuff to be Infoset based and improved doc structure more.
20020625	SW	Mods to take into account JJM comments.
20020624	JJM	Fixed spec so markup validates.
20020624	JJM	Upgraded the stylesheet and DTD
20020624	JJM	Added sections for references and change log.
20020624	JJM	Removed Jeffrey from authors :-(Added Gudge :-)
20020620	SW	Started adding abstract model
20020406	SW	Created document from WSDL 1.1

Appendix F

Assertion Summary (Non-Normative)

This appendix summarizes assertions about WSDL 2.0 documents and components that are not enforced by the WSDL 2.0 schema. Each assertion is assigned a unique identifier which WSDL 2.0 processors may use to report errors.

Table F.1: Summary of Assertions about WSDL 2.0 Documents

Id	Assertion
	Its value MUST be an absolute IRI (see [*IETF RFC 3987*]) and should be dereferenceable.
	WSDL 2.0 definitions are represented in XML by one or more WSDL 2.0 Information Sets (Infosets), that is one or more `description` *element information item*s.
	If a WSDL 2.0 document is split into multiple WSDL 2.0 documents (which may be combined as needed via **4.1 Including Descriptions**), then the `targetNamespace` *attribute information item* SHOULD resolve to a master WSDL 2.0 document that includes all the WSDL 2.0 documents needed for that service description.
	Zero or more *element information item*s amongst its [children], in order as follows:
	However, any WSDL 2.0 document that contains component definitions that refer by QName to WSDL 2.0 components that belong to a different namespace MUST contain a `wsdl:import` *element information item* for that namespace (see **4.2 Importing Descriptions**).
	Imported components have different target namespace values from the WSDL 2.0 document that is importing them.

	As with XML schema, any WSDL 2.0 document that references a foreign component MUST have a `wsdl:import` *element information item* for the associated foreign namespace (but which does not necessarily provide a `location` *attribute information item* that identifies the WSDL 2.0 document in which the referenced component is defined).
	This value MUST NOT match the actual value of `targetNamespace` *attribute information item* in the enclosing WSDL 2.0 document.
	If the location attribute in the `import` *element information item* is dereferencible then it MUST reference a WSDL 2.0 document and the actual value of the `namespace` *attribute information item* MUST be identical to the actual value of the `targetNamespace` *attribute information item* of the referenced WSDL 2.0 document.
	If a WSDL 2.0 document contains more than one `wsdl:import` *element information item* for a given value of the `namespace` *attribute information item* then they MUST provide different values for the `location` *attribute information item*.
	The actual value of the `targetNamespace` *attribute information item* of the included WSDL 2.0 document MUST match the actual value of the `targetNamespace` *attribute information item* of the `description` *element information item* which is the [parent] of the `include` *element information item*.
	The IRI indicated by `location` MUST resolve to a WSDL 2.0 document.
	Its value, if present, MUST contain absolute IRIs (see [*IETF RFC 3987*]).
	It is an error for the `element` *attribute information item* to have a value and for it to not resolve to an Element Declaration component from the element declarations property of the Description component.
	The `messageLabel` *attribute information item* MUST be present in the XML representation of an Interface Fault Reference component with a given direction if the message exchange pattern of the parent Interface Operation component has more than one fault with that direction.
	The type of the `element` *attribute information item* is a union of *xs:QName* and *xs:token* where the allowed token values are *#any*, *#none*, or *#other*.
	It is an error for the `element` *attribute information item* to have a value and for it to NOT resolve to an Element Declaration from the element declarations property of the Description.
	Its value MUST be an absolute IRI (see [*IETF RFC 3987*]).
	Its value MUST be an absolute IRI (see [*IETF RFC 3987*]).

	It MUST NOT appear on a `wsdl:description` element or any of its children/descendants.
	For each pair of IRIs, if the location IRI of the pair is dereferencible then it MUST reference a WSDL 2.0 (or 1.1) document whose target namespace is the namespace IRI of the pair.
	The `messageLabel` *attribute information item* of an interface message reference *element information item* MUST be present if the message exchange pattern has more than one placeholder message with {direction} equal to the message direction.
	The `messageLabel` *attribute information item* of an interface fault reference *element information item* MUST be present if the message exchange pattern has more than one placeholder message with {direction} equal to the message direction.
	The `messageLabel` *attribute information item* of a binding message reference *element information item* MUST be present if the message exchange pattern has more than one placeholder message with {direction} equal to the message direction.
	The `messageLabel` *attribute information item* of a binding fault reference *element information item* MUST be present if the message exchange pattern has more than one placeholder message with {direction} equal to the message direction.
	If the `messageLabel` *attribute information item* of an interface message reference *element information item* is present then its actual value MUST match the {message label} of some placeholder message with {direction} equal to the message direction.
	If the `messageLabel` *attribute information item* of an interface fault reference *element information item* is present then its actual value MUST match the {message label} of some placeholder message with {direction} equal to the message direction.
	If the `messageLabel` *attribute information item* of a binding message reference *element information item* is present then its actual value MUST match the {message label} of some placeholder message with {direction} equal to the message direction.

	If the `messageLabel` *attribute information item* of a binding fault reference *element information item* is present then its actual value MUST match the {message label} of some placeholder message with {direction} equal to the message direction.
	If the `messageLabel` *attribute information item* of an interface message reference *element information item* is absent then there MUST be a unique placeholder message with {direction} equal to the message direction.
	If the `messageLabel` *attribute information item* of an interface fault reference *element information item* is absent then there MUST be a unique placeholder message with {direction} equal to the message direction.
	If the `messageLabel` *attribute information item* of a binding message reference *element information item* is absent then there MUST be a unique placeholder message with {direction} equal to the message direction.
	If the `messageLabel` *attribute information item* of a binding fault reference *element information item* is absent then there MUST be a unique placeholder message with {direction} equal to the message direction.
	A WSDL 2.0 document MUST NOT refer to XML Schema components in a given namespace unless an `xs:import` or `xs:schema` *element information item* for that namespace is present or the namespace is the XML Schema namespace which contains built-in types as defined in XML Schema Part 2: Datatypes Second Edition [*XML Schema: Datatypes*].
	The referenced schema MUST contain a `targetNamespace` *attribute information item* on its `xs:schema` *element information item*.
	A WSDL 2.0 document MUST NOT define the same element or type in more than one inlined schema.
	The `xs:schema` *element information item* MUST contain a `targetNamespace` *attribute information item*.
	An `element` *attribute information item* MUST NOT refer to a global `xs:simpleType` or `xs:complexType` definition.
	A specification of extension syntax for an alternative schema language MUST use a namespace that is different than the namespace of XML Schema.

	If `wsdlx:interface` and `wsdlx:binding` are used together then they MUST satisfy the same consistency rules that apply to the interface property of a Service component and the binding property of a nested Endpoint component, that is either the binding refers the interface of the service or the binding refers to no interface.
	The value of the `targetNamespace` *attribute information item* of the `xs:schema` *element information item* of an imported schema MUST equal the value of the `namespace` of the `import` *element information item* in the importing WSDL 2.0 document.
	The namespace used for an alternate schema language MUST be an absolute IRI.
	A specification of extension syntax for an alternative schema language MUST include the declaration of an *element information item*, intended to appear as a child of the `wsdl:types` *element information item*, which references, names, and locates the schema instance (an "import" *element information item*).
	It is an error if a QName is not resolved (see **2.19 QName resolution**).
	When resolving QNames references for schema definitions, the namespace MUST be imported by the referring WSDL 2.0 document.
	Specifically components that the schema imports via xs:import are NOT referenceable.
	Similarly, components defined in an inlined XML schema are NOT automatically referenceable within WSDL 2.0 document that imported (using `wsdl:import`) the WSDL 2.0 document that inlines the schema (see **4.2 Importing Descriptions** for more details).
	A `constraint` *attribute information item* MUST NOT refer to a global `xs:element` definition.
	The type of the `wsdlx:interface` *attribute information item* is an *xs:QName* that specifies the name property of an Interface component.
	The type of the `wsdlx:binding` *attribute information item* is an *xs:QName* that specifies the name property of a Binding component.

Table F.2: Summary of Assertions about WSDL 2.0 Components

Id	Assertion

	If a Binding component specifies any operation-specific binding details (by including Binding Operation components) or any fault binding details (by including Binding Fault components) then it MUST specify an interface the Binding component applies to, so as to indicate which interface the operations come from.
	A Binding component that defines bindings for an Interface component MUST define bindings for all the operations of that Interface component.
	This *xs:anyURI* MUST be an absolute IRI as defined by [*IETF RFC 3987*].
	For each Binding component in the bindings property of a Description component, the name property MUST be unique.
	For each Binding Fault component in the binding faults property of a Binding component, the interface fault property MUST be unique.
	For each Binding Fault Reference component in the binding fault references property of a Binding Operation component, the interface fault reference property MUST be unique.
	There MUST be an Interface Fault Reference component in the interface fault references of the Interface Operation being bound with message label equal to the effective message label and with interface fault equal to an Interface Fault component with name equal to the actual value of the `ref` *attribute information item.*
	For each Binding Message Reference component in the binding message references property of a Binding Operation component, the interface message reference property MUST be unique.
	For each Binding Operation component in the binding operations property of a Binding component, the interface operation property MUST be unique.
	When such absolute URIs and IRIs are being compared to determine equivalence (see **2.17 Equivalence of Components**) they MUST be compared character-by-character as indicated in [*IETF RFC 3987*].
	Each WSDL 2.0 or type system component of the same kind MUST be uniquely identified by its qualified name.
	The value of the `targetNamespace` *attribute information item* SHOULD be dereferenceable.
	It SHOULD resolve to a human or machine processable document that directly or indirectly defines the intended semantics of those components.

	It MAY resolve to a WSDL 2.0 document that provides service description information for that namespace.
	This *xs:anyURI* MUST be an absolute IRI as defined by [*IETF RFC 3987*].
	For each Endpoint component in the endpoints property of a Service component, the name property MUST be unique.
	For each Endpoint component in the endpoints property of a Service component, the binding property MUST either be a Binding component with an unspecified interface property or a Binding component with an interface property equal to the interface property of the Service component.
	Extension properties which are not string values, sets of strings or references MUST describe their values' equivalence rules.
	An extension that is NOT marked as mandatory MUST NOT invalidate the meaning of any part of the WSDL 2.0 document.
	If a WSDL 2.0 document declares an extension, Feature or Property as optional (i.e., NON-mandatory), then the Web service MUST NOT assume that the client supports that extension, Feature or Property, *unless* the Web service knows (through some other means) that the client has in fact elected to engage and support that extension, Feature or Property.
	Therefore, the Web service MUST support every extension, Feature or Property that is declared as optional in the WSDL 2.0 document, in addition to supporting every extension, Feature or Property that is declared as mandatory.
	The meaning of an extension SHOULD be defined (directly or indirectly) in a document that is available at its namespace IRI.
	This *xs:anyURI* MUST be an absolute IRI as defined by [*IETF RFC 3987*].
	The ref property of a Feature component MUST be unique within the features property of an Interface, Interface Fault, Interface Operation, Interface Message Reference, Interface Fault Reference, Binding, Binding Fault, Binding Operation, Binding Message Reference, Binding Fault Reference, Service, or Endpoint component.
	For QNames, any prefix MUST be defined by a preceding xmlns pointer part.
	The fragment identifier in a WSDL 2.0 component IRI-reference MUST resolve to some component as defined by the construction rules in Table A.1 .
	To avoid circular definitions, an interface MUST NOT appear as an element of the set of interfaces it extends, either directly or indirectly.

	For each Interface component in the interfaces property of a Description component, the name property MUST be unique.
	The namespace name of the name property of each Interface Fault in this set MUST be the same as the namespace name of the name property of this Interface component.
	For each Interface Fault component in the interface faults property of an Interface component, the name property must be unique.
	In cases where, due to an interface extending one or more other interfaces, two or more Interface Fault components have the same value for their name property, then the component models of those Interface Fault components MUST be equivalent (see **2.17 Equivalence of Components**).
	The value of this property MUST match the name of a placeholder message defined by the message exchange pattern.
	The direction MUST be consistent with the direction implied by the fault propagation ruleset used in the message exchange pattern of the operation.
	For each Interface Fault Reference component in the interface fault references property of an Interface Operation component, the combination of its interface fault and message label properties MUST be unique.
	The direction MUST be the same as the direction of the message identified by the message label property in the message exchange pattern of the Interface Operation component this is contained within.
	When the message content model property has the value *#any* or *#none* the element declaration property MUST be empty.
	For each Interface Message Reference component in the interface message references property of an Interface Operation component, its message label property MUST be unique.
	An *xs:token* with one of the values *in* or *out*, indicating whether the message is coming to the service or going from the service, respectively.
	An *xs:token* with one of the values *#any*, *#none*, *#other*, or *#element*.
	The namespace name of the name property of each Interface Operation in this set MUST be the same as the namespace name of the name property of this Interface component.
	For each Interface Operation component in the interface operations property of an Interface component, the name property MUST be unique.

	In cases where, due to an interface extending one or more other interfaces, two or more Interface Operation components have the same value for their name property, then the component models of those Interface Operation components MUST be equivalent (see **2.17 Equivalence of Components**).
	An Interface Operation component MUST satisfy the specification defined by each operation style identified by its style property.
	This *xs:anyURI* MUST be an absolute IRI (see [*IETF RFC 3987*]).
	These *xs:anyURI*s MUST be absolute IRIs (see [*IETF RFC 3986*]).
	Its actual value MUST be a list of pairs of IRIs; where the first IRI of a pair, which MUST be an absolute IRI as defined in [*IETF RFC 3987*], indicates a WSDL 2.0 (or 1.1) namespace name, and, the second a hint as to the location of a WSDL 2.0 document defining WSDL 2.0 components (or WSDL 1.1 elements [*WSDL 1.1*]) for that namespace name.
	A message exchange pattern is uniquely identified by an absolute IRI which is used as the value of the message exchange pattern property of the Interface Operation component, and it specifies the fault propagation ruleset that its faults obey.
	The value of this property MUST match the name of a placeholder message defined by the message exchange pattern.
	A reference to a Type Definition component in the type definitions property of the Description component constraining the value of the Property, or the token *#value* if the value property is not empty.
	The ref property of a Property component MUST be unique within the properties property of an Interface, Interface Fault, Interface Operation, Interface Message Reference, Interface Fault Reference, Binding, Binding Fault, Binding Operation, Binding Message Reference, Binding Fault Reference, Service, or Endpoint component.
	All specified values MUST be equal and belong to each specified value set.
	This *xs:anyURI* MUST be an absolute IRI as defined by [*IETF RFC 3987*].
	Furthermore, all QName references, whether to the same or to different namespaces MUST resolve to components (see **2.19 QName resolution**).
	For each Service component in the services property of a Description component, the name property MUST be unique.
	Each XML Schema type definition MUST have a unique QName.
	Each XML Schema element declaration MUST have a unique QName.