



U.S. Department
of Transportation

**Federal Aviation
Administration**

**U.S. Department of Transportation
Federal Aviation Administration**

Standard Practice

**PREPARATION OF
WEB SERVICE DESCRIPTION DOCUMENTS**

FOREWORD

This standard is approved for use by all Departments of the Federal Aviation Administration (FAA).

This standard sets forth requirements for documenting [Web services](#) within the FAA.

This standard has been prepared in accordance with FAA-STD-068, Department of Transportation Federal Aviation Administration, *Preparation of Standards* [\[4\]](#).

Comments, suggestions, or questions on this document shall be addressed to:

Federal Aviation Administration
System Wide Information Management (SWIM) Program Office, AJM-316
800 Independence Avenue, SW
Washington, DC 20591

Table of Contents

1	SCOPE.....	1
1.1	INTRODUCTION	1
1.2	MOTIVATION FOR REVISING THIS STANDARD	1
1.3	INTENDED AUDIENCE	2
1.4	BASIC CONCEPTS	2
1.4.1	<i>Web Service Description.....</i>	<i>2</i>
1.4.2	<i>Usage of a Web Service Description.....</i>	<i>2</i>
1.4.3	<i>Structure of a Web Service Description Document (WSDD)</i>	<i>3</i>
1.4.4	<i>Relationship to Other Artifacts.....</i>	<i>4</i>
2	APPLICABLE DOCUMENTS.....	7
2.1	GOVERNMENT DOCUMENTS	7
2.2	NON-GOVERNMENT DOCUMENTS	7
2.3	ORDER OF PRECEDENCE	9
3	DEFINITIONS.....	10
3.1	KEY WORDS	10
3.2	TERMS AND DEFINITIONS	10
3.3	ACRONYMS AND ABBREVIATIONS.....	14
4	GENERAL REQUIREMENTS	16
4.1	TEXT, GRAMMAR AND STYLE	16
4.2	USE OF DIAGRAMS	16
5	DETAILED REQUIREMENTS.....	17
5.1	COVER PAGE	17
5.2	APPROVAL PAGE (OPTIONAL)	17
5.3	REVISION RECORD PAGE (OPTIONAL)	18
5.4	WSDD STRUCTURE	18
5.5	SCOPE	19
5.6	APPLICABLE DOCUMENTS.....	19
5.7	DEFINITIONS.....	20
5.8	SERVICE PROFILE	20
5.8.1	<i>Service Provider.....</i>	<i>21</i>
5.8.2	<i>Service Consumers (Optional)</i>	<i>22</i>
5.8.3	<i>Service Functionality</i>	<i>22</i>
5.8.4	<i>Security</i>	<i>23</i>
5.8.5	<i>Qualities of Service.....</i>	<i>23</i>
5.8.6	<i>Service Policies</i>	<i>24</i>

5.8.7	<i>Environmental Constraints</i>	24
5.9	SERVICE INTERFACE	25
5.9.1	<i>Interfaces</i>	25
5.9.2	<i>Operations</i>	26
5.9.3	<i>Messages</i>	27
5.9.4	<i>Faults</i>	28
5.9.5	<i>Data</i>	28
5.9.5.1	Referencing Data Description Documents	30
5.10	SERVICE IMPLEMENTATION	30
5.10.1	<i>Bindings</i>	30
5.10.1.1	Data Protocol	31
5.10.1.2	Message Protocol	32
5.10.1.3	Transport Protocol	32
5.10.1.4	Other Protocols.....	33
5.10.2	<i>End Points</i>	33
APPENDIXES	35
APPENDIX A.	EXAMPLE OF A WSDD COVER PAGE	35
APPENDIX B.	EXAMPLE OF A WSDD APPROVAL SIGNATURE PAGE.....	36
APPENDIX C.	EXAMPLE OF A WSDD REVISION RECORD PAGE	37
APPENDIX D.	EXAMPLES OF QUALITY OF SERVICE (QoS) PARAMETERS.....	38
APPENDIX E.	SERVICE DESCRIPTION CONCEPTUAL MODEL	39
APPENDIX F.	CLASSIFICATION SCHEMES USED IN THE NSRR.....	42
APPENDIX G.	WRITING GOOD DEFINITIONS	45

List of Figures

FIGURE 1.	WEB SERVICE DESCRIPTION USE CASES	3
FIGURE 2.	USE CASES OF THE PARTS OF A WEB SERVICE DESCRIPTION DOCUMENT.....	4
FIGURE 3.	WSDD RELATIONSHIP TO NSRR	6
FIGURE 4.	INTERFACE MODEL - CONCEPTUAL DIAGRAM	25
FIGURE 5.	BINDING - CONCEPTUAL DIAGRAM	30
FIGURE 6.	END POINT - CONCEPTUAL DIAGRAM	33

List of Tables

TABLE I.	WSDD STRUCTURE.....	18
TABLE II.	WEB SERVICE SECURITY MECHANISMS.....	23

1 SCOPE

This standard provides a set of requirements for developing a Web Service Description Document (WSDD). The WSDD provides the details needed to sufficiently describe a [Web service](#) as a part of the FAA's implementation of a [service-oriented architecture](#) (SOA).

This standard does not prescribe or suggest any technological solutions for implementing a Web service. Rather, it seeks to provide a [semantic](#) basis for a [service description](#) that is flexible enough to accommodate different Web service implementations for use across multiple business domains.

This standard does not specify any configuration management (CM) or quality assurance (QA) policies, rules or assertions to which the developed WSDD may be subjected.

1.1 Introduction

Over the last decade, the FAA has been evolving its traditional mode of information exchange by migrating from systems that interact in a point-to-point, custom interface fashion to systems that are based upon the concepts of [service-oriented architecture](#) (SOA). SOA is an architectural paradigm that supports service orientation as a way of thinking in terms of services, service-based development, and the outcomes provided by services. The special case of services that leverage Web-based technologies, known as [Web services](#), are commonly used in the FAA as one of the major means of realizing SOA-based services.

To facilitate adaptation of the SOA paradigm, the FAA established the [System Wide Information Management](#) (SWIM) program. The goal of this program is to support information sharing among stakeholders by providing governance as well as architectural and technical solutions for identifying, developing, provisioning, and operating a framework of shareable and reusable services.

One of the central ingredients of any service-centric implementation is a [service description](#). A service description is commonly defined as *"the information needed in order to use, or consider using, a service"* [21]. A service description is realized as an externalized document or set of documents produced by the [organization](#) responsible for implementing the service, the [service provider](#). The requirements specified by this standard are intended to equip providers with a uniform approach for documenting their services in a way consistent with FAA system engineering standards and practices.

1.2 Motivation for Revising this Standard

The need to create Revision B of this standard was motivated by two main factors:

- Changes took place in the infrastructure responsible for supporting some provisions of Revision A.

Revision A included procedures for service [identification](#) and classification that required using the FAA Data Registry (FDR), a tool which the FAA retired in 2017 in favor of more modern and cost-effective solutions. Revision B provides requirements that do not depend on the existence of the FDR.

- The opportunity arose to align the FAA [SOA](#)-based implementation of the [service description](#) with an architectural model developed together with international partners.

The FAA worked extensively with EUROCONTROL to develop a shared vision of a service description.

This effort resulted in the creation of a Service Description Conceptual Model (SDCM) [\[7\]](#) in 2016.

Revision B makes the WSDD compatible with the SDCM, while continuing to support FAA engineering practices.

In addition to addressing these factors, Revision B updates obsolete references and provides additional information about the [NAS Service Registry/Repository](#) (NSRR) and its relationship to the WSDD.

1.3 Intended Audience

The intended audience for this standard includes architects and developers designing, identifying, developing, or deploying a system based on the [Web service](#) paradigm; decision makers seeking a better understanding of the application of [SOA](#) principles; and [users](#) of current and future Web services.

1.4 Basic Concepts

The goal of this section is to establish a clear and unambiguous understanding of several important concepts used in this standard. The concepts are based on and fully consistent with corresponding concepts described in FAA-STD-070, Preparation of Web Service Requirements Documents [\[5\]](#).

1.4.1 Web Service Description

In a [SOA](#)-based environment, components are integrated through a set of [service interfaces](#) and communicate via [messages](#). For successful interactions between a [Web service](#) and [consumer](#) components, the Web service description should provide the consumer with information about “how to interact with the service in order to achieve the required objectives, including the [format](#) and content of information exchanged between the service and the consumer and the sequences of information exchange that may be expected.” [\[21\]](#) This information may also describe a certain [function](#) or set of functions performed by the service, say whether the service operates under a specified set of constraints and policies, and specify one or more network locations at which the service can be invoked.

1.4.2 Usage of a Web Service Description

A [Web service description](#) can be used in various settings and artifacts. It can be used by decision makers, including services architects and business managers, to identify a Web service to be used in a [SOA](#)-based environment. It can be used by [service consumers](#) to develop a [consumer agent](#) to make use of the Web service. And, it can be used by service consumers to construct request [messages](#) for, correctly interpret and decode information received from, and enable connection to the Web service.

Figure 1 presents use cases that depict the usage of a Web service description in the context of service implementation.

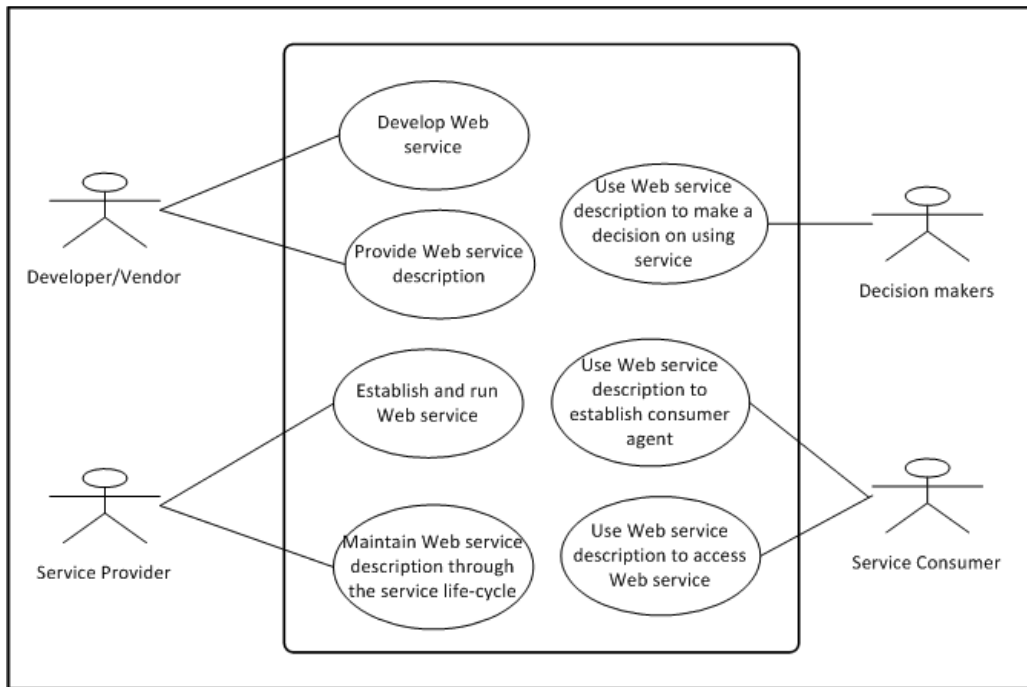


FIGURE 1. Web service description use cases

1.4.3 Structure of a Web Service Description Document (WSDD)

A Web Service Description Document, or WSDD, is a [Web service description](#) that is rendered as a human-readable document. This standard asserts the following structure for a WSDD.

The core of the Web service description consists of three parts: Service Profile, Service Interface, and Service Implementation, which correspond to sections 4, 5, and 6 of the document. (This layout is consistent with the structures used in the SDCM [7]; see [Appendix E](#).) Each part represents important aspects of describing a Web service, and each can be characterized as answering a particular question:

- The Service Profile part (called “Profile” in the SDCM) answers the question “what does the service do?” It represents a general description of a Web service from the perspective of a potential [service consumer](#). The Service Profile includes functional capabilities of the service, related [provider](#) information and constraints on the functionality of the service (e.g., [security](#), availability, contextual limitations).
- The Service Interface part (called “Model” in the SDCM) answers the question “how does the service work?” It describes the [operations](#) performed by the service, [messages](#) and data that the Web service exchanges, and the [format](#) of those messages.
- The Service Implementation part (called “Grounding” in the SDCM) answers the question “how does one access the service?” It specifies the [protocols](#) that the service supports and the location on the network (or endpoint) of the provider's Web service.

Each part can be associated with activities that are performed by or may be of interest to different [SOA](#) stakeholders: the Service Profile part can be used by business managers to make a decision about using a Web service, the Service Interface part is needed by developers of [consumer agents](#) for constructing requests for the service and being able to interpret responses, and the Service Implementation part allows a service consumer to access the service. It certainly should be understood that these [user](#) roles and uses can overlap each other in many different ways.

Figure 2 presents use cases that describe some of the ways that different stakeholders use the parts of a WSDD.

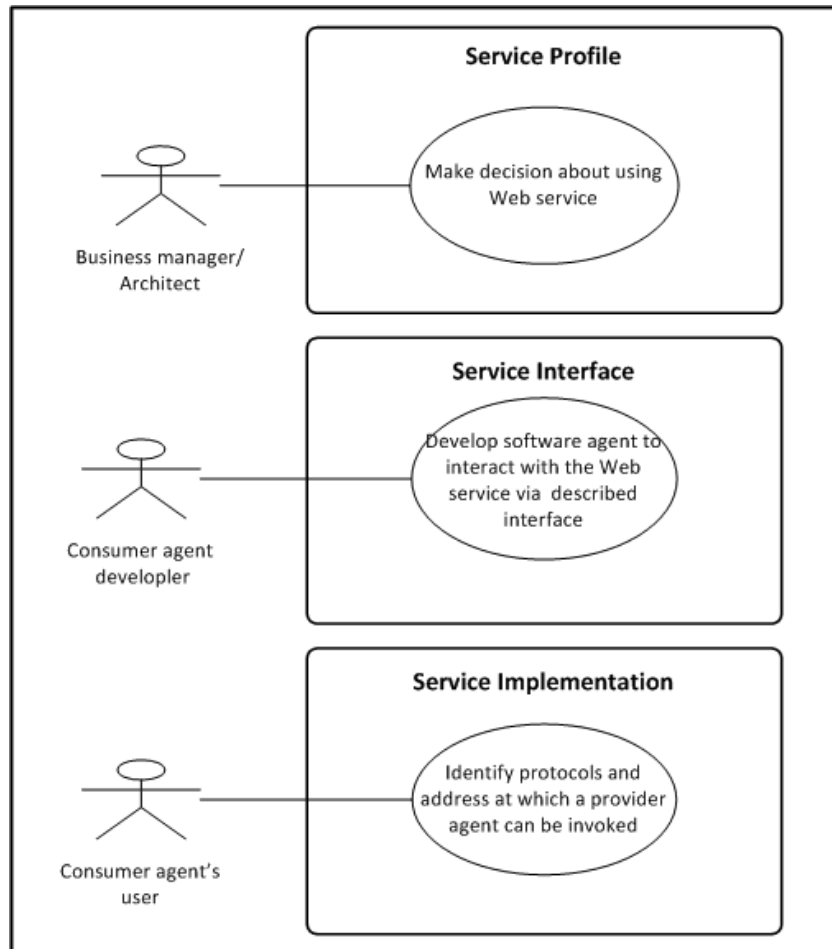


FIGURE 2. Use cases of the parts of a Web service description document

NOTE: the purpose of Figure 2 is not to provide an exhaustive list of possible scenarios, but rather to provide a few examples.

1.4.4 Relationship to Other Artifacts

The FAA's notion of a [WSDD](#) has been influenced by models and specifications defined by major industry standards bodies. Among the most prevalent are the World Wide Web Consortium (W3C) Web Services

Description Language (WSDL) [32], the Capabilities document defined in the Open Geospatial Consortium (OGC) Web Service Common specification [23], and a relatively new breed of [semantically](#) motivated works such as OWL-S: Semantic Markup for Web Services [24], W3C's Web Service Modeling [Ontology](#) (WSMO) [28], and Semantic Annotations for WSDL Working Group (SAWSDL) [29].

Drawing upon these well-established industry works, as well as from earlier versions of the FAA's service description standards, the FAA and EUROCONTROL [SWIM](#) programs working together have also introduced the Service Description Conceptual Model (SDCM) [7], an artifact that establishes a structural and semantic vision of a [service description](#) shared by both organizations. It provides a common graphical and lexical representation of the properties, structure, and interrelationships of all service [metadata](#) elements for a service description and is used by both SWIM programs to support service discovery and to exchange information about services. This standard prescribes a service description document that is fully compliant with SDCM v.2.

The FAA and EUROCONTROL also produced the Service Description Model in XML (SDM-X) [8], a document that serializes SDCM as an [XML](#) document and supports both transmitting and [processing](#) information about services by [software agents](#). This interaction among software agents is also referred to as machine-to-machine information exchange.

An artifact that closely aligns with a WSDD and has similar objectives is a [service registry](#), a mechanism that supports storing information about services and makes this information available to [users](#). The FAA SWIM program has established a service registry called the [NAS Service Registry and Repository \(NSRR\)](#), whose database structurally and semantically imitates a WSDD's architecture. This alignment allows the service description information traditionally conveyed in a text-based document (the WSDD) to be stored in an automated discovery tool. Figure 3 depicts commonalities between a WSDD table of contents (on the right) and an NSRR Web page (on the left) that presents one of the registered services. It also allows the NSRR to automatically generate a traditional WSDD that can be downloaded or printed.

NAS Service Registry and Repository (NSRR)

[HOME](#)
[SERVICES](#)
[LIFECYCLE MANAGEMENT](#)
[SEARCH](#)
[HELP](#)
[LOG OUT](#)

» Services » Service Profile

Service Profile

Flight Plan Service (FPS)

- Service Profile
 - Service Background
- Service Provider
 - Points of Contact
 - Service Consumers
 - Service Functionality
 - Security
 - Qualities of Service
 - Service Policies
 - Environmental Constraints
- Service Interface
 - Operations

Service Name: Flight Plan Service

Service Description: This fictitious service provides the ability to create, update, or cancel flight plans.

GRID: <http://nsrr.faa.gov>

Service Version: 1.0

ATM Service Category: En Route

Table of Contents

- 4 Service Profile.....12
 - 4.1 Service Provider12
 - 4.1.1 Point of Contact.....12
 - 4.2 Service Consumers13
 - 4.2.1 Traffic Modernization Program (TMP)13
 - 4.2.2 Alpha Airline13
 - 4.3 Service Functionality14
 - 4.4 Security.....14
 - 4.4.1 Security Policies14
 - 4.4.2 Security Mechanisms14
 - 4.4.2.1 Authentication14
 - 4.4.2.2 Authorization15
 - 4.4.2.3 Integrity16
 - 4.4.2.4 Non-repudiation16
 - 4.4.2.5 Auditing.....16
 - 4.5 Qualities of Service.....16
 - 4.6 Service Policies17
 - 4.7 Environmental Constraints.....17
- 5 Service Interface.....18
 - 5.1 Interfaces.....18
 - 5.2 Operations18
 - 5.2.1 Operation FileFlightPlan.....18

FIGURE 3. WSDD relationship to NSRR

2 APPLICABLE DOCUMENTS

2.1 Government Documents

- [1] FAA Order 1000.36, FAA Writing Standards, 31 March 2003.
http://www.faa.gov/documentlibrary/media/order/branding_writing/order1000_36.pdf
- [2] FAA Order 1700.6C, FAA Branding Policy, Use of the FAA Logo, FAA Signature, and DOT Seal, 11 September 2006.
http://www.faa.gov/documentLibrary/media/order/branding_writing/Branding_Order_17006.pdf
- [3] FAA Order 1800.66, FAA Configuration Management Policy with Change 3 Incorporated, 2 March 2012.
<https://www.faa.gov/documentLibrary/media/Order/1800.66.pdf>
- [4] FAA-STD-068, Preparation of Standards, 4 December 2009.
<http://www.tc.faa.gov/its/worldpac/standards/faa-std-068.pdf>
- [5] FAA-STD-070, Preparation of Web Service Requirements Documents, 12 July 2012.
<http://www.tc.faa.gov/its/worldpac/standards/faa-std-070.pdf>
- [6] SWIM-005, Artifacts Versioning for SWIM-enabled Services 1.0.0, FAA, December 2015.
https://www.faa.gov/air_traffic/technology/swim/governance/standards/media/SWIM%20Service%20Versioning%20Spec.pdf
- [7] Service Description Conceptual Model (SDCM) 2.0, SESAR CP 2.1, 3 June 2016.
<http://swim.aero/sdcm/2.0.0/sdcm-2.0.0.html>
- [8] Service Description Model – XML (SDM-X), FAA/SESAR, 12 October 2017.
<https://standards.tiaonline.org/resources/telecom-glossary>
- [9] SWIM Controlled Vocabulary (CV) 1.0, FAA, 25 March 2019.
<https://semantics.aero/>
- [10] Telecommunications Industry Association (TIA) Glossary of Telecommunications Terms, 2019.
<https://standards.tiaonline.org/resources/telecom-glossary>
- [11] U.S. Government Printing Office Style Manual, 30th edition 2008.
<https://www.govinfo.gov/app/details/GPO-STYLEMANUAL-2008>

2.2 Non-Government Documents

- [14] DCMI Glossary, Dublin Core Metadata Initiative, User Guide Committee, 23 April 2004.
<http://dublincore.org/documents/usageguide/glossary.shtml>

- [15] Glossary of Security Terms, SANS Institute, August 2011.
<http://www.sans.org/resources/glossary.php>
- [16] ISO/IEC 11179, Information Technology – Metadata Registries (MDR) – Parts 1 - 6.
<http://metadata-standards.org/11179/>
- [17] ISO/IEC 11404, Information technology — General-Purpose Datatypes (GPD), Second Edition, 15 December 2007.
[http://standards.iso.org/ittf/PubliclyAvailableStandards/c039479_ISO_IEC_11404_2007\(E\).zip](http://standards.iso.org/ittf/PubliclyAvailableStandards/c039479_ISO_IEC_11404_2007(E).zip)
- [18] ISO/IEC/IEEE 12207, Systems and Software Engineering – Software Life Cycle Processes, 2017.
<https://www.iso.org/standard/63712.html>
- [19] ISO/IEC 6523-1, Structure for the Identification of Organizations and Organization Parts, 1998.
http://www.iso.org/iso/catalogue_detail?csnumber=25773
- [20] ISO/IEC CD 20944-002, Information Technology – Metadata Interoperability and Bindings (MDIB) – Part 002, Common Vocabulary, 12 April 2004.
<http://jtc1sc32.org/doc/N1101-1150/32N1105T-CD20944-002.pdf>
- [21] OASIS Reference Model for SOA 1.0, 12 October 2006.
<http://docs.oasis-open.org/soa-rm/v1.0/soa-rm.pdf>
- [22] OASIS Reference Ontology for Semantic Service Oriented Architectures, Public Review 1, 5 November 2008.
[http://www.oasis-open.org/apps/group_public/download.php/29909/Reference Ontology for Semantic Service Oriented Architectures Public Review 1.doc](http://www.oasis-open.org/apps/group_public/download.php/29909/Reference_Ontology_for_Semantic_Service_Oriented_Architectures_Public_Review_1.doc)
- [23] OGC Web Services Common Standard, Version 2.0.0, Open Geospatial Consortium Inc., 7 April 2010.
<http://www.opengeospatial.org/standards/common>
- [24] OWL-S: Semantic Markup for Web Services, W3C Member Submission, 22 November 2004.
<http://www.w3.org/Submission/OWL-S>
- [25] RFC 2119, Key words for Use in RFCs to Indicate Requirement Levels, Network Working Group, March 1997.
<http://www.rfc-editor.org/rfc/rfc2119.txt>
- [26] RFC 2828, Internet Security Glossary, Network Working Group, May 2000.
<http://www.rfc-editor.org/rfc/rfc2828.txt>
- [27] RFC 3986, Uniform Resource Identifier (URI): Generic Syntax, Network Working Group, January 2005.
<http://www.rfc-editor.org/rfc/rfc3986.txt>

- [28] [Web Service Modeling Ontology \(WSMO\), W3C Member Submission, 3 June 2005.](https://www.w3.org/Submission/WSMO/)
<https://www.w3.org/Submission/WSMO/>
- [29] [Semantic Annotations for WSDL and XML Schema, W3C Recommendation 28 August 2007.](https://www.w3.org/TR/sawSDL/)
<https://www.w3.org/TR/sawSDL/>
- [30] [Web Services Architecture, W3C Working Group Note, 11 February 2004.](http://www.w3.org/TR/ws-arch)
<http://www.w3.org/TR/ws-arch>
- [31] [Web Services Description Language \(WSDL\) Version 2.0 Part 0: Primer, W3C Recommendation, 26 June 2007.](http://www.w3.org/TR/wsdl20-primer/)
<http://www.w3.org/TR/wsdl20-primer/>
- [32] [Web Services Description Language \(WSDL\) Version 2.0 Part 1: Core Language, W3C Recommendation, 26 June 2007.](http://www.w3.org/TR/wsdl20/)
<http://www.w3.org/TR/wsdl20/>
- [33] [Web Services Description Requirements, W3C Working Draft, 28 October 2002.](http://www.w3.org/TR/2002/WD-ws-desc-reqs-20021028/)
<http://www.w3.org/TR/2002/WD-ws-desc-reqs-20021028/>
- [34] [Web Services Glossary, W3C Working Group Note, 11 February 2004.](https://www.w3.org/TR/2004/NOTE-ws-gloss-20040211/)
<https://www.w3.org/TR/2004/NOTE-ws-gloss-20040211/>
- [35] [Web Services Policy 1.5 – Framework, W3C Recommendation, 04 September 2007.](http://www.w3.org/TR/2007/REC-ws-policy-20070904/)
<http://www.w3.org/TR/2007/REC-ws-policy-20070904/>
- [36] [XML Schema Part 1: Structures Second Edition, W3C Recommendation, 28 October 2004.](http://www.w3.org/TR/xmlschema-1/)
<http://www.w3.org/TR/xmlschema-1/>
- [37] [XML Schema Part 2: Datatypes Second Edition, W3C Recommendation, 28 October 2004.](http://www.w3.org/TR/xmlschema-2/)
<http://www.w3.org/TR/xmlschema-2/>

2.3 Order of Precedence

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3 DEFINITIONS

3.1 Key Words

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this standard are to be interpreted as described in [RFC 2119 \[25\]](#). These key words are capitalized when used to unambiguously specify requirements. When these words are not capitalized, they are meant in their natural-language sense.

All examples in the document are labeled as "non-normative", which means they are not to provide a canonical implementation for use in a [registry](#) or artifact, but merely to illustrate technical features of a particular approach.

3.2 Terms and Definitions

Asynchronous Operation	A type of operation whose message exchange pattern allows messages to be sent without precise sequencing, e.g., a flow of sensor event messages which need not be individually acknowledged. [34]
Audit	A process that records information needed to establish accountability for system events and for the actions of system entities that cause them. [26]
Authentication	The process of verifying an identity claimed by or for a system entity. [26]
Authorization	The granting of rights or permission to a system entity (mainly but not always a user or a group of users) to access a Web service . [5]
Binding	An association between an interface , a concrete protocol , and a data format . A binding specifies the protocol and data format to be used in transmitting messages defined by the associated interface. [33]
Business Function	A characteristic action or activity that needs to be performed to achieve a desired objective, or in the context of this standard, to achieve a real world effect . (Adapted from [22])
Confidentiality	Protective measures that assure that information is not made available or disclosed to unauthorized individuals, entities, or processes (i.e., to any unauthorized system entity). [26]
Consumer Agent	A software agent that is designed to interact with a service in order to request that a task be performed on behalf of its owner – the service consumer . [9]
Data Element	A unit of data for which the definition, identification, representation, and permissible values are specified by means of a set of attributes. [16]
Datatype	A set of distinct values, characterized by properties of those values, and by operations on those values. [17]

End Point	An association between a fully specified binding and a physical point (i.e., a network address) at which a service may be accessed. [7]
Fault	A message that is returned as a result of an error that prevents a service from implementing a required function. A fault usually contains information about the cause of the error. [5]
Format	The arrangement of bits or characters within a group, such as a data element , message , or language. [5]
Idempotent	A term used to describe an operation in which a given message will have the same effect whether it is received once or multiple times; i.e., receiving duplicates of a given message will not cause any undesirable effect. [5]
Identifier	A sequence of characters, capable of uniquely identifying that with which it is associated, within a specified context. [16]
Input	Data entered into, or the process of entering data into, an information processing system or any of its parts for storage or processing . (Adapted from [20])
Integrity	Protective measures that assure that data has not been changed, destroyed, or lost in an unauthorized or accidental manner. [26]
Message	An identifiable collection of units of information (data elements), presented in a manner suitable for communication, interpretation, or processing within a context of interacting SOA components. [5]
Message Body (Payload)	The actual (business) data transferred by a message . [9]
Message Exchange Pattern (MEP)	A template, devoid of application semantics , that describes a generic pattern for the exchange of messages between agents . It describes the relationships (e.g., temporal, causal, sequential, etc.) of multiple messages exchanged in conformance with the pattern, as well as the normal and abnormal termination of any message exchange conforming to the pattern. [34]
Metadata	Data that defines or describes other data. [16]
Namespace	A collection of names, identified by a URI reference, that are used in XML documents as element types and attribute names. The use of XML namespaces to uniquely identify metadata terms allows those terms to be unambiguously used across applications, promoting the possibility of shared semantics . [14]
NAS Service Registry/ Repository (NSRR)	A SWIM -supported capability for making services visible, accessible, and understandable across the NAS. The NSRR (https://nsrr.faa.gov/) provides a flexible mechanism for service discovery, an automated policies-based way to manage services throughout the service lifecycle, and a catalog for relevant artifacts. [9]

Non-Repudiation	Protective measures against false denial of involvement in a communication. [26]
Normative Document	A document that provides rules, guidelines, or characteristics for activities or their results. NOTE: The term "normative document" is a generic term that covers such documents as standards, technical specifications, codes of practice, and regulations. [20] In the context of this standard, a normative document is a set of rules that (1) determines the behavior of interacting entities and (2) has been developed by a recognized body in industry or academia and established by consensus in the FAA. [5]
Ontology	An explicit and formal specification of a shared conceptualization.
Operation	A set of messages related to a single Web service action. [33]
Organization	A unique framework of authority within which a person or persons act, or are designated to act, towards some purpose. Any department, service , or other entity within an organization which needs to be identified for information exchange. [19]
Output	Data transferred out of, or the process by which an information processing system or any of its parts transfers data out of, that system or part. (Adapted from [20])
Permissible Values	The set of allowable instances of a data element . [5]
Processing	A set of algorithms, calculations, or business rules that operate on input data in order to produce the required output or to produce a change of internal state. [5]
Protocol	A formal set of conventions governing the format and control of interaction among communicating functional units. [10]
Quality of Service (QoS)	A parameter that specifies and measures the value of a provided service . [7]
Real World Effect	An ultimate purpose associated with the interaction with a particular service . It may be the response to a request for information or the change in the state of some entities shared between the participants in the interaction. (Adapted from [22])
Security	The protection of information and data so that unauthorized persons or systems cannot read or modify them and authorized persons or systems are not denied access to them. [18]
Security Mechanism	A process (or a device incorporating such a process) that can be used in a system to implement a security service that is provided by or within the system. [26]
Semantics	A conceptualization of the implied meaning of information that requires words and/or symbols within a usage context. [21]
Service Consumer	An organization that seeks to satisfy a particular need through the use of capabilities offered by means of a service . (Adapted from [21])
Service Criticality	The level of significance given to a functional failure of a service . [5]

Service Description	The information needed in order to use, or consider using, a service . (Adapted from [21])
Service Interface	The means by which the underlying capabilities of a service are accessed. [21]
Service Provider	An organization that offers the use of capabilities by means of a service . (Adapted from [21])
Service Registry	An enabling infrastructure that uses a formal registration process to store, catalog, and manage metadata relevant to a service . A registry supports the search, identification, and understanding of resources, as well as query capabilities. [9]
Service-Oriented Architecture (SOA)	A paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. A SOA provides a uniform means to offer, discover, interact with, and use capabilities to produce desired effects consistent with measurable preconditions and expectations. [21]
Software Agent	A running program that drives services , both to implement them and to access them. [30]
Structured Data	Data that is organized in well-defined semantic "chunks" or units that are variously called fields, elements, objects, or entities. Individual units are often combined to form larger, more complex units. (Adapted from [5])
Synchronous Operation	A type of operation whose message exchange pattern describes temporally coupled or "lock-step" interactions, e.g., remote procedure call (RPC)-style request-response interactions. [34]
Taxonomy	A system or controlled list of values by which to categorize or classify objects. [7]
Uniform Resource Identifier (URI)	A compact string of characters for identifying an abstract or physical resource. [27]
Uniform Resource Locator (URL)	A type of URI that identifies a resource via a representation of its primary access mechanism (e.g., its network "location"), rather than by some other attributes it may have. [27]
Unstructured Data	Data that does not follow any hierarchical sequence or any relational rules. Examples of unstructured data may include audio, video, and unstructured text such as the body of an e-mail or word processor document. (Adapted from [5])
User	A human, his/her agent , a surrogate, or an entity that interacts with information processing systems. [20] A person, organization entity, or automated process that accesses a system, whether authorized to do so or not. [15]

Web Service	A platform-independent, loosely-coupled software component designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format . Other systems interact with the Web service in a manner prescribed by its description by means of XML -based messages conveyed using Internet transport protocols in conjunction with other Web-related standards. (Adapted from [34])
Web Service Interface	A logical grouping of operations , where each operation represents a single interaction between consumer agents and a Web service . Each operation specifies the types of messages that the service can send or receive as part of that operation without any commitment to transport or wire protocol . (Adapted from [31])

3.3 Acronyms and Abbreviations

AIXM	Aeronautical Information Exchange Model
DCMI	Dublin Core Metadata Initiative
DDD	Data Description Document
DOT	Department of Transportation
FAA	Federal Aviation Administration
FTP	File Transfer Protocol
GML	Geography Markup Language
HTTP(S)	Hypertext Transfer Protocol (Secure)
ISO/IEC	International Organization for Standardization/International Electrotechnical Commission
JMS	Java Message Service
MEP	Message Exchange Pattern
MTBCF	Mean Time Between Critical Failure
MTBF	Mean Time Between Failure
MTTR	Mean Time To Restore
NAS	National Airspace System
NSRR	NAS Service Registry/Repository
OASIS	Organization for the Advancement of Structured Information Standards
OGC	Open Geospatial Consortium
OWL-S	Ontology Web Language (OWL)-based Web Service Ontology

<i>PNG</i>	Portable Network Graphics
<i>QoS</i>	Quality of Service
<i>RFC</i>	Request For Comment
<i>RPC</i>	Remote Procedure Call
<i>SAWSDL</i>	Semantic Annotations for WSDL and XML Schema
<i>SESAR</i>	Single European Sky Air Traffic Management (ATM) Research Programme
<i>SOA</i>	Service-Oriented Architecture
<i>SOAP</i>	Originally “Simple Object Access Protocol”; the full spelling is no longer used
<i>SVG</i>	Scalable Vector Graphics
<i>SWIM</i>	System Wide Information Management
<i>TCP/IP</i>	Transmission Control Protocol/Internet Protocol
<i>UML</i>	Unified Modeling Language
<i>URI</i>	Uniform Resource Identifier
<i>URL</i>	Uniform Resource Locator
<i>W3C</i>	World Wide Web Consortium
<i>WS</i>	Web Service
<i>WSDD</i>	Web Service Description Document
<i>WSDL</i>	Web Service Description Language
<i>WSMO</i>	Web Service Modeling Ontology
<i>XML</i>	eXtensible Markup Language

4 GENERAL REQUIREMENTS

This section describes requirements for the stylistic aspects of the [WSDD](#). Detailed requirements for the structure and content of the WSDD are provided in [section 5](#).

4.1 Text, Grammar and Style

- a. The text SHALL be written in clear and simple language, free of vague terms, or those subject to misinterpretation.
- b. All sentences SHALL be complete and grammatically correct. Refer to FAA Order 1000.36, FAA Writing Standards [\[1\]](#) for guidance.
- c. The United States Government Printing Office Style Manual [\[11\]](#) SHALL be used as a guide for capitalization, spelling, punctuation, syllabification, compounding words, tabular work, and other elements of grammar and style.

4.2 Use of Diagrams

There are a number of sections in the [WSDD](#) where using diagrams is suggested to enhance the understanding of a described topic.

- a. Unified Modeling Language (UML) diagrams are RECOMMENDED since UML is able to concisely describe concepts without implying any specific technology. Information about UML diagrams is available at <http://www.uml.org/>.

5 DETAILED REQUIREMENTS

This section describes requirements for the structure and content of the [WSDD](#).

5.1 Cover Page

- a. The [WSDD](#) SHALL include a cover page as the first page.
- b. The cover page SHALL include the FAA signature (the Department of Transportation triskelion figure with the words “U.S. Department of Transportation” and the words “Federal Aviation Administration” below it) in accordance with FAA Order 1700.6, FAA Branding Policy [\[2\]](#).
- c. The line “Web Service Description Document” SHALL be centered above the title.
- d. The title SHALL be the name by which the [service](#) will be known. NOTE: In most cases, the title will consist of the approved service’s name issued by the activity authorized to assign the name. That name will be referred to throughout the WSDD as the Web service name.
- e. The cover page SHALL include the version of the service.
- f. The cover page SHALL include the date on which the WSDD was produced or generated.

While this standard does not prescribe configuration management policies, in most cases a WSDD is assigned a document identifier by a governing or configuration management organization under whose authority the service is developed or functions. Refer to FAA Order 1800.66 Configuration Management policies [\[3\]](#) for information about when and how to obtain document identifiers for configuration-controlled documents.

- g. When a WSDD has been assigned a document [identifier](#) for configuration management purposes, the document identifier SHALL be included on the cover page.

An example of a WSDD cover page is shown in [Appendix A](#).

5.2 Approval Page (Optional)

Signatures on this page ensure that the interested parties have approved the [WSDD](#) content. The approval page may not be required based on the configuration management policies established within a given [organization](#).

The following statements apply when signed approval is required.

- a. The approval page SHALL contain the centered line “Approval Signatures” above the list of cosigners.
- b. The approval page SHALL include information for every cosigner.
- c. The information SHALL include the cosigner's full name.
- d. The information SHALL include the cosigner's organization code, i.e., the acronym by which the organization is commonly recognized within the FAA.
- e. The information SHALL include the cosigner's signature.
- f. The information SHALL include the date of the signature.

An example of a WSDD Approval Page is shown in [Appendix B](#).

5.3 Revision Record Page (Optional)

A revision record page may not be required based on the configuration management policies established within a given [organization](#). The following statements apply when a record of revisions to the [WSDD](#) is required.

- a. The revision record page SHALL contain the centered line “Revision Record” above the list of revision records.
- b. Only revisions SHALL be listed.
- c. The revision record page SHALL include information for every revision listed.
- d. The information SHALL include the revision letter or number.
- e. The information SHALL include a brief description of the revision.
- f. The information SHALL include the date of the revision.
- g. The information SHALL include the full name of the person who entered this revision record (“Entered by”).

An example of a WSDD Revision Record Page is shown in [Appendix C](#).

5.4 WSDD Structure

- a. The [WSDD](#) SHALL conform to the basic outline shown in Table I below. NOTE: the sections shown in italics are optional.

TABLE I. WSDD structure

Cover Page
Approval Page
Revision Record Page
<i>Table of Contents</i>
<i>List of Figures</i>
<i>List of Tables</i>
1 Scope
1.1 <i>Background</i>
2 Applicable Documents
3 Definitions
4 Service Profile
4.1 Service Provider
4.2 Service Consumers
4.3 Service Functionality
4.4 Security
4.5 Qualities of Service
4.6 Service Policies

4.7 Environmental Constraints
5 Service Interface
5.1 Interfaces
5.2 Operations
5.3 Messages
5.4 Faults
5.5 Data
6 Service Implementation
6.1 Bindings
6.2 End Points
<i>Appendixes</i>

5.5 Scope

- a. Section 1 of the [WSDD](#) SHALL provide a scope statement that is a clear, concise abstract of the coverage of the WSDD.
- b. Section 1 of the WSDD SHOULD contain (but is not limited to) the following statement: “This Web Service Description Document (WSDD) provides a description of the [*service name*]. The Information presented in the WSDD is consistent with the requirements of Federal Aviation Administration (FAA) Standard Practice FAA-STD-065B, Preparation of Web Service Description Documents.”
- c. Section 1.1 of the WSDD MAY include paragraphs on the service's background, purpose, applicability, etc. as needed to give readers of the WSDD a context for understanding the body of the WSDD.

5.6 Applicable Documents

The Applicable Documents section includes documents that are created at different stages of the service's lifecycle (e.g., service concept of operations, service requirements document, schemas, machine-processable service description (e.g., WSDL) documents, [security](#) approvals, impact analyses, etc.) as well as government or industry standards and [protocols](#) that are referenced in the WSDD.

- a. Section 2 of the [WSDD](#) SHALL list all applicable documents.
- b. Section 2 of the WSDD SHALL present bibliographic information about each document listed.
- c. The information SHALL include the full title of the document.
- d. The information MAY include the alternate title or abbreviated name by which the document is known or recognized.
- e. The information SHOULD include the publisher of the document.
- f. The information SHOULD include the publication date of the document.
- g. The information SHOULD include the appropriate version of the document (e.g., the latest version, the version needed for compatibility with other documents, the version of the document that is under contract by the project.)

- h. The information SHOULD include a brief description of the document.
- i. The information SHALL include the address or location (preferably a persistent Web location, i.e., [URL](#)) where a copy of the document can be obtained.
- j. If a document is listed elsewhere in the WSDD (e.g., a security protocol document in the WSDD Security section; a data description document in the WSDD Data section), listing the document again in section 2 is OPTIONAL.

5.7 Definitions

- a. Section 3 of the [WSDD](#) SHALL define all terms used in the WSDD to provide for clarity, unless the terminology is generally accepted and not subject to misinterpretation.
- b. Only terms that are specifically used in the WSDD SHALL be listed in section 3.
- c. Terms used in the WSDD whose definitions are maintained in the SWIM Controlled Vocabulary [\[9\]](#) MAY be omitted from the Definitions section and referenced by providing hyperlinks to their definitions.
- d. Section 3 of the WSDD SHALL include a list of acronyms and abbreviations used in the WSDD, together with their full spelling, unless they are commonly understood or have been spelled out in position.
- e. Only acronyms and abbreviations that are specifically used in the WSDD SHALL be listed in section 3.

5.8 Service Profile

Section 4 of the [WSDD](#) identifies and describes the [Web service](#), its [provider](#), its [consumers](#), its functional and non-functional characteristics, and constraints over its capabilities.

- a. Section 4 of the WSDD SHALL present information about the service profile.
- b. The information SHALL include the name of the service.
- c. The name SHALL be identical to the name of the service on the cover page of the WSDD.
- d. The information SHALL include a service [identifier](#) that uniquely identifies the service. For guidance on creating a service identifier, contact SWIM Governance. NOTE: The SWIM Governance team will support creation and maintenance of unique identifiers for services that are identified as part of the FAA SWIM implementation. Providers of other services should follow their appropriate organizational policy.
- e. The information SHALL include a brief description of the service.
- f. The information SHALL include a service version. For guidance on service versioning, see [\[6\]](#).
- g. The information SHALL include a [service interface](#) type.
- h. The single value representing the service interface type SHALL be selected from the Interface Type [Taxonomy](#) described in [Appendix F](#) of this standard.

- i. The information SHALL include the [criticality](#) level of the service.
- j. The single value representing the service criticality level SHALL be selected from the Service Criticality Taxonomy described in [Appendix F](#) of this standard.
- k. The information MAY include the types of air traffic management (ATM) operations and services that the service supports.
- l. One or more values representing an ATM service category MAY be selected from the ATM Service Category Taxonomy described in [Appendix F](#) of this standard.
- m. The information MAY include the types of data products that the service delivers.
- n. One or more values representing a service product category MAY be selected from the SWIM Service Product Category Taxonomy described in [Appendix F](#) of this standard.

It should be noted that the NSRR also maintains information about the service's current lifecycle stage as part of the service profile; however, this information is not replicated in the WSDD itself due to its variable nature. The Lifecycle Stage Taxonomy is described in [Appendix F](#) of this standard.

5.8.1 Service Provider

This standard treats the [service provider](#) as an [organization](#) responsible for establishing and maintaining the [Web service](#).

- a. Section 4.1 of the [WSDD](#) SHALL present information about the provider organization.
- b. The information SHALL include the name of the organization.
- c. The provided name SHALL consist of the full name spelled out followed by the acronym by which it is commonly recognized within the FAA.
- d. The information MAY include a brief description of the organization.
- e. The information MAY include an accessible reference (e.g., [URL](#)) for the Web page that supplies information about the Web service and/or organization.
- f. The information SHALL include at least one point of contact, i.e., a person or group within the [provider organization](#), suitable for making a human contact for any purpose.
- g. The information SHALL include the full name of the contact.
- h. The information SHALL include the contact's job title or a brief description of the contact's responsibilities.
- i. The information SHALL include at least one telephone number for the contact.
- j. The information SHALL include at least one e-mail address for the contact.
- k. The information MAY include a postal address for the contact.

- l. If the required point of contact information is maintained at a persistent Web location ([URL](#)), a hyperlink to this location MAY be provided in lieu of the information itself.
- m. Section 4.1 of the WSDD MAY include additional points of contact, each documented as prescribed in requirements (g) through (l) above.

5.8.2 Service Consumers (Optional)

- a. Section 4.2 of the [WSDD](#) MAY present information about each known [service consumer](#).
- b. If service consumer information is presented, the information SHALL include the consumer [organization](#)'s full name and acronym.
- c. The information MAY include a brief description of the organization.
- d. The information SHOULD include an accessible reference (e.g., [URL](#)) for the Web page that supplies information about the organization.
- e. The information MAY include one or more points of contact, i.e., a person or group within the consumer organization, suitable for making a human contact for any purpose.
- f. Each point of contact SHALL be documented as prescribed in [section 5.8.1](#) requirements (g) through (l) of this standard.

5.8.3 Service Functionality

This standard asserts that every [Web service](#) represents a set of one or more identifiable [business functions](#). The goal of section 4.3 of the [WSDD](#) is to describe the business function(s) and the [real world effects](#) that result from invoking these functions from a business point of view, that is, from the point of view of [consumer organizations](#) that will use the service to conduct their business. Section 4.3 should not address the mechanics of invocation (this aspect is addressed in the Service Interface section), but rather it should focus on answering the question of what the service does and what is the ultimate result of using the service. The ultimate result of using a service is referred to as the "real world effect". The real world effect may include:

- "1. Information returned in response to a request for that information,
- 2. A change to the shared state of defined entities, or
- 3. Some combination of (1) and (2)." [\[21\]](#)

For example, a real world effect could be knowledge that "the flight has been rerouted" (change in the state) or a "weather forecast" (response to a request for information).

- a. Section 4.3 of the WSDD SHALL present information about the service functionality from the business perspective.
- b. The information SHALL describe the service's business function(s) and real world effect(s).
- c. The service's business function(s) SHALL be correlated with the real world effect(s).

5.8.4 Security

This standard defines [Web service security](#) as collective measures that enable the service to provide protection against security threats. These threats may include (but are not limited to): [unauthorized](#) access to service information; unauthorized disclosure, modification and destruction of information; unknown status and repudiation in execution; and denial of service. To address the security threats, [security mechanisms](#) are utilized. Table II presents a list of the most typical security mechanisms commonly implemented by Web services, together with their intended purpose. NOTE: this list is neither exhaustive nor prescriptive.

TABLE II. Web service security mechanisms

<i>Mechanism</i>	<i>Purpose</i>
Authentication	To assure that system entities (individuals, agents , organizations , or processes) are who they claim to be.
Authorization	To assure that system entities have been granted the right or permission to access a Web service.
Integrity	To assure that data has not been changed, destroyed, or lost in an unauthorized or accidental manner.
Confidentiality	To assure that information is not made available or disclosed to unauthorized system entities.
Non-Repudiation	To assure that the sender or recipient of a message cannot legitimately claim that they did or did not participate in the message exchange.
Audit	To record information needed to establish accountability for system events and for the actions of system entities that cause them.

- a. Section 4.4 of the [WSDD](#) SHALL present information about the Web service security.
- b. Section 4.4 of the WSDD SHALL describe all security mechanisms implemented by the Web service.
- c. When a security mechanism is implemented by using a standard [protocol](#) or specification document, the information about this document SHALL be presented as prescribed in [section 5.6](#) of this standard.
- d. When the Web service delegates one or more security measures to an external security service, the document that specifies the external security service SHALL be presented as prescribed in [section 5.6](#) of this standard.

5.8.5 Qualities of Service

This standard defines [qualities of service](#) (QoS) as measurable characteristics that the [Web service](#) is expected to meet or possess. To be usable in practice, these QoS should be documented in a way that ensures clear and common understanding for the service stakeholders. Section 4.5 of the [WSDD](#) lists all QoS parameters

associated with the Web service, including the parameter's name, its definition, its value or range of values, the method used to measure or calculate its values, and the unit of measure in which its values are expressed.

- a. Section 4.5 of the WSDD SHALL list all quality of service (QoS) parameters associated with the provided service.
- b. Section 4.5 of the WSDD SHALL present information about each QoS parameter listed.
- c. The information SHALL include the QoS parameter's name.
- d. The information SHALL include the QoS parameter's value or range of values.
- e. The information SHALL include the QoS parameter's definition. See [Appendix G](#) of this standard for guidance on writing good definitions to help ensure that the definition is as informative and understandable as possible.
- f. The information SHALL include a description of how the values are measured or calculated.
- g. The information SHALL include the unit of measure (e.g., seconds, percentage).

[Appendix D](#) contains a comprehensive but not exhaustive list of QoS parameters that are relevant to Web services. WSDD developers may reuse these parameters or provide their own in accordance with the above requirements.

5.8.6 Service Policies

This standard defines policies as constraints on the allowable actions of a [service consumer](#) or [consumer agent](#). [Web service](#) policies can be described as a part of the [WSDD](#) or, more frequently, in a separate document that contains common policies for a business or [organizational](#) domain. The policies can be written in both machine- and human-readable languages (an example of machine-readable policy language is "[WS-Policy](#)"; see [\[35\]](#)).

- a. Section 4.6 of the WSDD SHALL provide information about policies that apply to the Web service.
- b. When service policies are presented as a separate document, this policy document SHALL be referenced as prescribed in [section 5.6](#) of this standard.
- c. If a referenced policy does not have a persistent Web location ([URL](#)), the policy SHALL be described in section 4.6 or included in an Appendix of the WSDD.

5.8.7 Environmental Constraints

Although [Web services](#) are defined as "platform and implementation independent" [\[5\]](#), a Web service is never a "standalone" product and requires integration with surrounding software components and underlying implementation platforms. This standard understands environmental constraints as being characteristics of the "super-system", that is, the larger system within which the Web service operates. Some examples of these constraints are: capacity of existing enterprise network, firewalls, and physical computing resources.

- a. Section 4.7 of the [WSDD](#) SHALL describe all environmental constraints under which the Web service is operated and maintained.

5.9 Service Interface

Section 5 of the [WSDD](#) describes how the functionality of the [Web service](#) is achieved in terms of interaction with the service, that is, it describes a [service interface](#). In so doing, this standard follows the abstract model of interface description defined by the [W3C](#) in the Web Service Description Language (WSDL) specification [\[32\]](#) as well as the [SDCM](#) [\[7\]](#). (NOTE: The concept of “service interface” is called “Model” in the SDCM. See [Appendix E](#) for a correlation between SDCM and WSDD.) The WSDL specification provides a framework for describing a Web service and, more specifically, a [Web service interface](#) in terms of the W3C Abstract Component Model. This model “defines the abstract interface of a Web service as a set of abstract [operations](#), each operation representing a simple interaction between the [consumer](#) and the service. Each operation specifies the types of [messages](#) that the service can send or receive as part of that operation.” [\[31\]](#)

Figure 4 presents a conceptual depiction of this interface model.

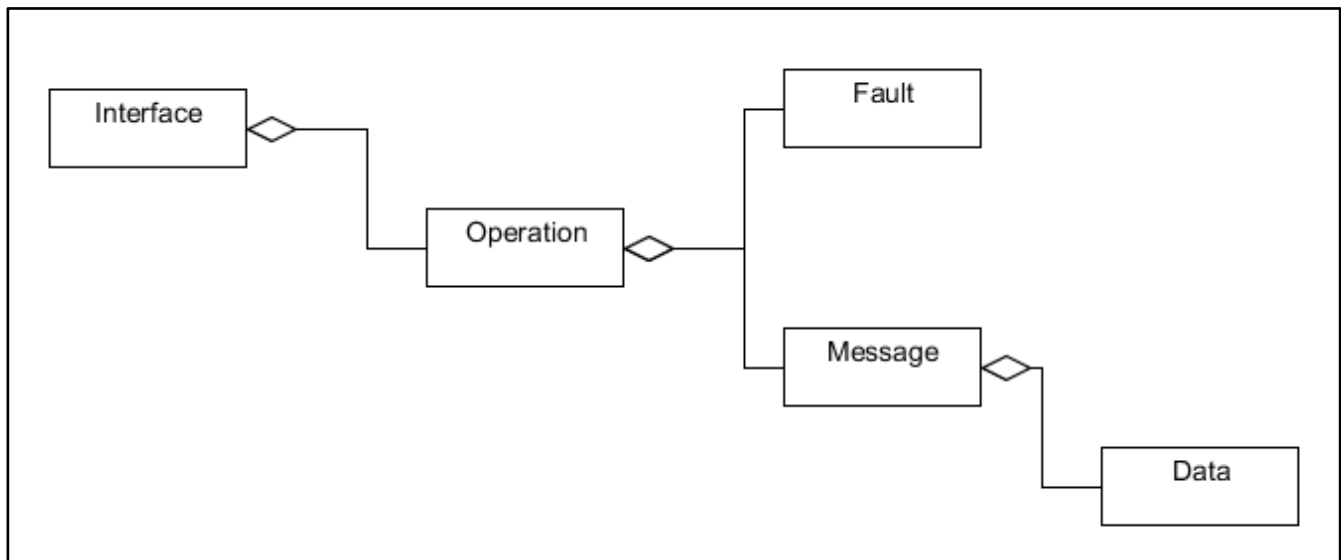


FIGURE 4. Interface model - conceptual diagram

- a. Section 5 of the WSDD SHALL describe the interface or interfaces with the Web service.

5.9.1 Interfaces

Section 5.1 of the [WSDD](#) describes the [interface\(s\)](#) exposed by the [Web service](#). An interface is a named set of [operations](#), each of which is also described in WSDD section 5.2 “Operations”. In the context of a WSDD, it may be said that an interface characterizes the behavior of the service or, alternatively, that an interface is an abstract representation of the service type.

- a. Section 5.1 of the WSDD SHALL present information about the interface being offered by the service.

- b. The information SHALL include a name that uniquely identifies the interface throughout the WSDD.
- c. The information SHALL include a brief plain language description of the interface.
- d. The information SHALL include a list of all names of all the operations that constitute the interface.
- e. All operations that constitute the interface SHALL be defined in section 5.2 of the WSDD as prescribed in [section 5.9.2](#) of this standard.

It is possible, although rarely recommended, that a service may expose more than one interface.

- f. When a service exposes multiple interfaces, each interface SHALL be described in section 5.1 of the WSDD in accordance with requirements (a) through (e) above.

5.9.2 Operations

Section 5.2 of the [WSDD](#) lists and describes all of the [operations](#) that are performed by the [Web service](#) through its [interface\(s\)](#). Every operation that is listed in WSDD section 5.2 "Operations" represents the patterns and content of interactions of [messages](#) described in WSDD section 5.3 "Messages".

- a. Section 5.2 of the WSDD SHALL list all operations offered by the Web service.
- b. Section 5.2 of the WSDD SHALL present information about each operation listed.
- c. The information SHALL include a name that uniquely identifies the operation throughout the WSDD.
- d. The information SHALL include a brief plain language summary of the pattern and goals of the actions that constitute the operation. For example, "allows client to retrieve current status of a specified flight".
- e. The information SHALL include a [Message Exchange Pattern](#) (MEP).
- f. The single value representing the MEP SHOULD be selected from the Message Exchange Pattern [Taxonomy](#) described in [Appendix F](#) of this standard.
- g. If a value that represents the MEP is not available in the Message Exchange Pattern Taxonomy described in Appendix F, the MEP SHALL be provided accompanied by a complete and coherent description of it.
- h. The information SHALL state if the operation is "[synchronous](#)" or "[asynchronous](#)".
- i. The information SHALL state if the operation is "[idempotent](#)" or "non-idempotent".
- j. The information SHALL describe the [input](#), i.e., the data that initiates interaction, including the name of the relevant input message described in WSDD section 5.3 "Messages". NOTE: sometimes there is no input message (e.g., in notification scenarios).
- k. The information SHALL describe the [output](#), i.e., the data that is produced in response to a service request, including the name of the relevant output message described in WSDD section 5.3 "Messages". NOTE: sometimes there is no output generated.

- l. The information SHALL describe the [fault\(s\)](#), i.e., the data that is produced in response to conditions that result in operation failure, including the name of the corresponding fault message described in section 5.4 of the WSDD.
- m. The information SHOULD include a diagram that shows how and in what order messages are exchanged within the context of the operation. Using Unified Modeling Language (UML) diagrams is a RECOMMENDED method for concisely describing concepts without implying a specific technology.

For the purpose of this standard, “[processing](#)” is defined as steps or actions that are required to be taken on data that is received as part of a [Web service](#) request ([input](#)) in order to produce the desired [output](#) or change of internal state. Actions on data that [consumers](#) should know about might be (but are not limited to): transformations, algorithms, unique logic, or business rules (e.g., after a certain period of time, data is not considered valid and should be removed).

- n. The information MAY include a description of the processing that takes place within the [operation](#).

5.9.3 Messages

Section 5.3 of the [WSDD](#) lists and describes all of the [messages](#) exchanged between the [Web service](#) and a [consumer agent](#). It is important to understand that every message that is listed in WSDD section 5.3 “Messages” is the aggregation of [data elements](#), each of which is described in WSDD section 5.5 “Data”.

- a. Section 5.3 of the WSDD SHALL list all messages to be exchanged. (NOTE: [fault](#) messages are listed separately as described in [section 5.9.4](#) below.)
- b. Section 5.3 of the WSDD SHALL present information about each message listed.
- c. The information SHALL include a name that uniquely identifies the message throughout the WSDD.
- d. The information SHALL include a plain language description of the message. See [Appendix G](#) of this standard for guidance on writing good definitions to help ensure that the description is as informative and understandable as possible.
- e. The information SHALL indicate whether the message direction is “in” (provides [input](#)) or “out” (provides [output](#)).
- f. The information SHALL include the [message body](#) type.
- g. The single value representing the message body type SHALL be selected from the Message Body Type [Taxonomy](#) described in [Appendix F](#) of this standard.
- h. The information SHOULD include a list of all data elements that constitute the message body (payload).
- i. All data elements that constitute the message body SHALL be defined in section 5.5 of the WSDD as prescribed in [section 5.9.5](#) of this standard.

5.9.4 Faults

Section 5.4 of the [WSDD](#) lists and describes all of the [faults](#) that are generated in response to conditions that result in failure of an [operation](#) or set of operations.

- a. Section 5.4 of the WSDD SHALL list all faults.
- b. Section 5.4 of the WSDD SHALL present information about each fault listed.
- c. The information SHOULD include a name or error code that uniquely identifies the fault throughout the WSDD.
- d. The information SHALL include a plain language description of the cause of the fault.
- e. The information SHALL include the text of the error message conveyed by the fault.

5.9.5 Data

Section 5.5 of the [WSDD](#) provides information (i.e., [metadata](#)) about the data transmitted via messages between [service providers](#) and [consumers](#). For the purpose of this standard, two categories of data are considered: [structured](#) (e.g., [XML](#) documents) and [unstructured](#) (e.g., images, binary-encoded documents). Structured data is usually stored within a record or file in a database and formally described in a data model or a schema. In a [SOA](#) environment, the most popular approach for exchanging structured data is serializing the data as an XML document using XML Schema [W3C](#) Recommendations [\[36\]](#) and [\[37\]](#) as a formal structure and syntax specification. This standard focuses on structured data as most often used in today's FAA SOA-based implementation (requirements (a) through (s)), but it also addresses unstructured data (requirements (t) and (u)).

- a. Section 5.5 of the WSDD SHALL describe all [data elements](#), complex or primitive, that appear in [messages](#) to be sent or received via the [Web service](#).
- b. Section 5.5 of the WSDD SHALL present information about each element listed.
- c. If the information requested in requirements (d) through (s) is already available in suitable Data Description Documents, such as XML Schemas, Data Exchange Models, or other descriptive documents, section 5.5 of the WSDD MAY reference these Data Description Documents in lieu of listing the elements and presenting the information about each element. See [section 5.9.5.1](#) of this standard for Data Description Documents suitability requirements.
- d. The information SHALL include a [namespace](#) for the element. NOTE: if all elements in the list are defined in the same namespace, the namespace can be indicated once for the whole list.
- e. The information SHALL include a name for the element that uniquely identifies it within its namespace.
- f. The information SHALL include a plain language definition of the element. See [Appendix G](#) of this standard for guidance on writing good definitions to help ensure that the definition is as informative and understandable as possible.

- g. The information SHALL include a description of the element's [permissible values](#) in one of the following forms: a range of numbers, a list of individual values, a reference to a source that lists the values (e.g., "FAA Order 7350.7 Location Identifiers"), or a textual description (e.g., "Not Applicable").
- h. For elements whose values represent codes, the information SHALL include the meanings of the codes (e.g., "BR = Mist, VA = Volcanic Ash, DU = Widespread Dust, etc.").
- i. For elements whose values represent quantitative measures, the information SHALL include the unit of measure (e.g., feet, kilograms, degrees Fahrenheit, dollars).
- j. The information SHALL include the element's [datatype](#).
- k. For primitive elements, i.e., elements that are not composed of other elements, datatype SHOULD be denoted using the typing system defined in section 3.2 of the W3C XML Schema Part 2: Datatypes specification [\[37\]](#).
- l. If another typing system is used, the information SHALL include an explanation of the system or a reference to a source that describes the system. NOTE: if all datatypes are denoted using this system, the explanation or reference may be made once for the whole element list.
- m. The information MAY include the element's maximum length together with units of length (e.g., characters, bytes, etc.), if applicable.
- n. If an element is to be rendered in a special format, the information SHOULD include a [format](#) string.
- o. It is RECOMMENDED that regular expressions as defined in Appendix F of the W3C XML Schema Datatypes specification [\[37\]](#) be used to describe format strings.
- p. If another method is used to express format strings, the information SHALL include an explanation of the method or a reference to a source that describes the method. NOTE: if the method is used to express all format strings, the explanation or reference may be made once for the whole element list.
- q. The information SHALL include the obligation ("Required" or "Optional") of the element, i.e., whether the element is required or optional in the context of its underlying information model.
- r. The information SHALL include the multiplicity (occurrence) of the element in the context of its underlying information model (e.g., 0, 1, ..., unbounded).
- s. Section 5.5 of the WSDD SHALL include a diagram, or a persistent Web location ([URL](#)) of a document or artifact containing such a diagram, that depicts a conceptual or logical model of the data elements listed.
- t. If the data that appears in messages is unstructured, section 5.5 of the WSDD SHALL provide the type, format, and plain language description of the data.
- u. If the data that appears in messages is unstructured, section 5.5 of the WSDD SHALL refer to the data [protocol](#) provided in section 6.1 of the WSDD that describes how the data should be encoded (see also [section 5.10.1.1](#) of this standard).

5.9.5.1 Referencing Data Description Documents

Sometimes a document that describes the data exchanged by a [Web service](#) is produced separately, often by an [organization](#) other than the organization responsible for developing the [WSDD](#). For the purpose of this standard, such a document will be referred to as a Data Description Document (DDD). Usually a DDD is developed for use by multiple services and not just for the service described in the WSDD. If a DDD is to be used as a substitute for the content prescribed above for section 5.5 of the WSDD, the DDD must comply with following requirements:

- a. The DDD SHALL conform to the requirements (d) through (s) specified in [section 5.9.5](#) of this standard.
- b. The DDD SHALL maintain a versioning policy.
- c. The DDD SHALL have a persistent Web location ([URL](#)).
- d. The DDD specified in section 5.5 of the WSDD SHALL be documented as prescribed in the Applicable Documents [section 5.6](#) of this standard.

5.10 Service Implementation

Section 6 of the [WSDD](#) provides details for the means of invoking the [Web service](#). The means include the underlying [protocols](#) and network location(s) of the service.

5.10.1 Bindings

For the purpose of this standard, a [binding](#) is understood to be a named collection of [protocols](#) which are used in the course of an execution of the [Web service](#); i.e., a “binding specifies the protocol and data [format](#) to be used in transmitting [messages](#) defined by the associated [interface](#)” [33].

The binding concept is depicted in Figure 5.

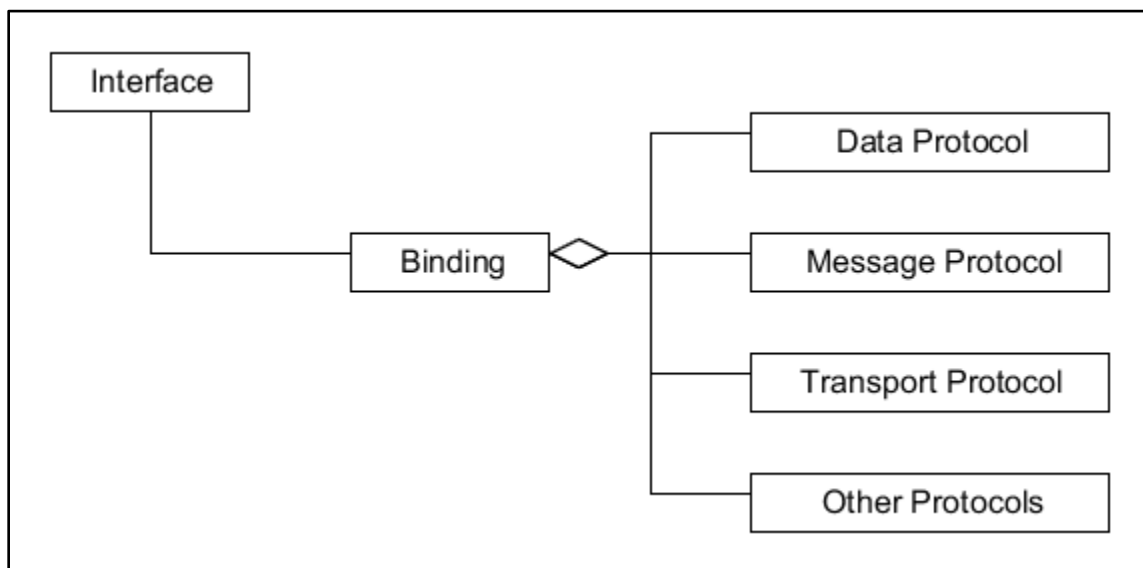


FIGURE 5. Binding - conceptual diagram

- a. Section 6.1 of the [WSDD](#) SHALL list all bindings implemented by the Web service.
- b. Section 6.1 of the WSDD SHALL present information about each binding listed.
- c. The information SHALL include the name that is used throughout the WSDD to refer to that binding.
- d. The information SHALL include a description of the binding.
- e. The information SHALL include the name of the [operation](#), and the name of an interface associated with this operation, that deploys this binding. NOTE: when all operations within the interface deploy the same binding, only the interface name is required.
- f. The name of the operation and/or associated interface SHALL be consistent with the operation and/or interface name established in section 5.2 and/or 5.1 respectively of the WSDD.
- g. The information SHALL specify the data protocol that the service uses for this binding, as described in [section 5.10.1.1](#) of this standard.
- h. The information SHALL specify the message protocol that the service uses for this binding, as described in [section 5.10.1.2](#) of this standard.
- i. The information SHALL specify the transport protocol that the service uses for this binding, as described in [section 5.10.1.3](#) of this standard.
- j. The information SHALL specify any other protocols that the service uses for this binding, as described in [section 5.10.1.4](#) of this standard.

5.10.1.1 Data Protocol

In order to exchange data between [SOA](#) components, an agreed-upon [format](#) must be used. A data [protocol](#) is a formal set of rules governing data encoding and coordination for data exchange among SOA components.

For the purpose of this standard, two categories of data are considered: 1) text-based data (e.g., an [XML](#) document) and binary-encoded data (e.g., a [PNG](#) image, a Microsoft Excel spreadsheet). The XML format is presently the protocol most often employed for exchanging textual data via [Web services](#). Besides transmitting textual data, an important use for XML is serializing data structures according to domain-specific conceptual models; e.g., the Geography Markup Language (GML) used to serialize information about geographical features or the Aeronautical Information Exchange Model (AIXM) used for transmitting aeronautical information.

Binary-encoded data is data that is converted using a code, frequently consisting of binary numbers or two-dimensional arrays of pixels (a graphical-based encoding). Both XML-based and graphical-based formats are used in today's FAA SOA implementation and, in some scenarios, within the same service implementation; e.g., a Web Map service uses XML to request a map rendered as an [SVG](#) image.

- a. Section 6.1 of the [WSDD](#) SHALL present information about the data protocol for this [binding](#).
- b. The information SHALL include the [normative document](#) that regulates the data protocol.

- c. The normative document SHALL be described as prescribed in [section 5.6](#) of this standard.
- d. If an accessible reference (e.g., [URL](#)) to the normative document is not available, the document itself SHALL be included in an Appendix of the WSDD.
- e. The data protocol SHALL be compatible with the data defined in section 5.5 (“Data”) of the WSDD.

5.10.1.2 Message Protocol

In a [SOA](#) environment, the communication and interaction between components is performed by exchanging [messages](#) of predefined content. A message [protocol](#) is a formal set of rules and conventions governing procedure calls and responses among communicating SOA components. The most widely used message protocol for [Web services](#) is [SOAP](#), a specification that defines an [XML](#)-based common message [format](#).

Generally, a message consists of a header part and a message-specific payload. The message header may include directives or contextual information related to the message delivery (e.g. [security](#) or addressing information). The message payload consists of instances of service-defined [data elements](#) (see [section 5.9.5](#) of this standard for requirements for describing payload data).

- a. Section 6.1 of the [WSDD](#) SHALL present information about the message protocol for this [binding](#).
- b. The information SHALL include the [normative document](#) that establishes the message protocol.
- c. The normative document SHALL be described as prescribed in [section 5.6](#) of this standard.
- d. If an accessible reference (e.g., [URL](#)) to the normative document is not available, the document itself SHALL be included in an Appendix of the WSDD.
- e. The message protocol SHALL be compatible with the data protocol for this binding described in section 6.1 of the WSDD.

5.10.1.3 Transport Protocol

A transport [protocol](#) is a formal set of rules governing [message](#) transmission and port handling among communicating [SOA](#) components. Various approaches can be used in SOA for transporting messages, and consequently various transport protocols are deployed; e.g., [HTTP/HTTPS](#) (traditional approach), [JMS](#) (message-based [asynchronous](#) approach), and [FTP](#) (file-based approach).

NOTE: it is assumed that all transport protocols defined in the context of a [WSDD](#) use [TCP/IP](#) as an underlying protocol.

- a. Section 6.1 of the WSDD SHALL present information about the transport protocol for this [binding](#).
- b. The information SHALL include the [normative document](#) that establishes the transport protocol.
- c. The normative document SHALL be described as prescribed in [section 5.6](#) of this standard.
- d. If an accessible reference (e.g., [URL](#)) to the normative document is not available, the document itself SHALL be included in an Appendix of the WSDD.

- e. The transport protocol SHALL be compatible with the message protocol for this binding described in section 6.1 of the WSDD.

5.10.1.4 Other Protocols

Some modern [protocols](#) may combine data definitions with messaging conventions or messaging and transport governing conventions and cannot be classified as strictly a data, [message](#) or transport protocol. This section of the standard describes requirements for such protocols.

- a. Section 6.1 of the WSDD SHALL present information about any other protocols that the [service](#) uses for this [binding](#) and that cannot be clearly identified as a data protocol, a transport protocol, or a message protocol.
- b. The information SHALL include the [normative document](#) that establishes each described protocol.
- c. The normative document SHALL be described as prescribed in [section 5.6](#) of this standard.
- d. If an accessible reference (e.g., [URL](#)) to the normative document is not available, the document itself SHALL be included in an Appendix of the WSDD.

5.10.2 End Points

In the context of this standard, an [end point](#) is understood to be an association between a fully specified [binding](#), as described in [section 5.10.1](#) of this standard, and “a physical point at which a [service](#) may be accessed” [\[7\]](#), i.e., a network address.

NOTE: the term “end point” used in this standard should not be confused with the term “endpoint” defined in the [WSDL](#) specification [\[32\]](#) or the term “EndPoint” defined in the Web Service Description Requirements [\[33\]](#) (both of which documents were produced by [W3C](#)).

The end point concept is depicted in Figure 6.

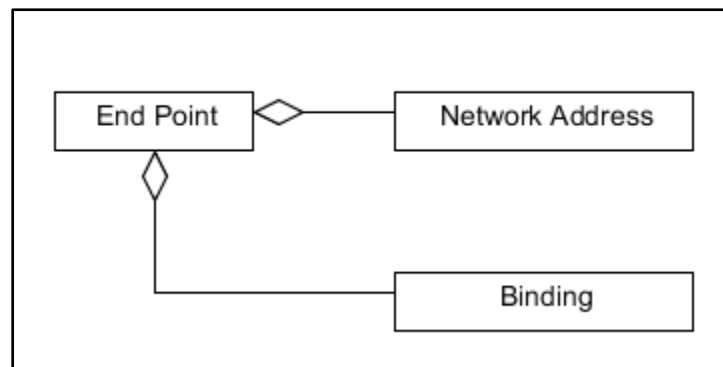


FIGURE 6. End point - conceptual diagram

- a. Section 6.2 of the [WSDD](#) SHALL list all end points implemented by the Web service.
- b. Section 6.2 of the WSDD SHALL present information about each end point listed.
- c. The information SHALL include the name that is used throughout the WSDD to refer to that end point.

- d.** The information SHALL include a description of the end point.
- e.** The information SHALL include the network address of the end point.
- f.** The information SHALL include the name of the associated binding established in section 6.1 of the WSDD.

APPENDIXES

Appendix A. Example of a WSDD Cover Page

NOTE: This Appendix is provided for guidance only; it is not normative.

Generated by the NAS Service Registry and Repository (<https://nsrr.faa.gov>) on December 14, 2018



U.S. Department of
Transportation
Federal Aviation
Administration

FAA-X-XXX

Revision A

Web Service Description Document

Special Activity Airspace Management Web Service, Aeronautical Information Management (AIM)

Service Version: 1.0.0

Appendix B. Example of a WSDD Approval Signature Page

NOTE: This Appendix is provided for example only; it is not normative.

**Web Service Description Document
Special Activity Airspace Management Web Service,
Aeronautical Information Management (AIM)
Service Version: 1.0.0**

Approval Signatures

Name	Organi- zation	Signature	Date Signed

Appendix C. Example of a WSDD Revision Record Page

NOTE: This Appendix is provided for guidance only; it is not normative.

Web Service Description Document
Special Activity Airspace Management Web Service,
Aeronautical Information Management (AIM)
Service Version: 1.0.0

Revision Record

Revision Number	Description	Revision Date	Entered By

Appendix D. Examples of Quality of Service (QoS) Parameters

The table below provides examples of QoS parameters that are relevant to [Web services](#). [WSDD](#) developers may reuse these parameters or provide their own, as well as their own values or range of values.

QoS Parameter Name	Definition	Method	Unit of Measure	Value or Range of Values
Accuracy	Number of errors produced by the service over a period of time.	Simple count. Measurements are taken daily and apply to the preceding 24-hour period.	Whole positive number	250
Availability	Probability that the service is present or ready for immediate use.	$100 * ((24 - \text{Total Outage Time in Hours}) / 24)$. Measurements are taken daily and apply to the preceding 24-hour period.	Percentage, accurate to 3 decimal places.	Greater than or equal to 99.900%
Capacity	Number of service requests that the service can accommodate within a given time period.	Simple count.	Whole positive number, per period of time.	25 per minute
Mean Time Between Critical Failure (MTBCF)	Average time between hardware or software component failures that result in the loss of the service.	The sum of the individual times between critical failures divided by the number of critical failures.	Hours.	Greater than or equal to 3,000
Mean Time Between Failure (MTBF)	Average time between hardware or software component failures that do not result in the loss of the service.	The sum of the individual times between noncritical failures divided by the number of noncritical failures.	Hours.	Greater than or equal to 5,000
Mean Time To Restore (MTTR)	Average time required to localize a component failure, remove and replace the failed component, and to perform tests to confirm operational readiness of the component.	The sum of the individual times to repair divided by the number of repairs.	Hours.	Less than or equal to 0.5
Response Time	Maximum time required to complete a service request.	Measured from the time the provider agent receives the request to the time the service provider transmits the response.	Seconds.	10

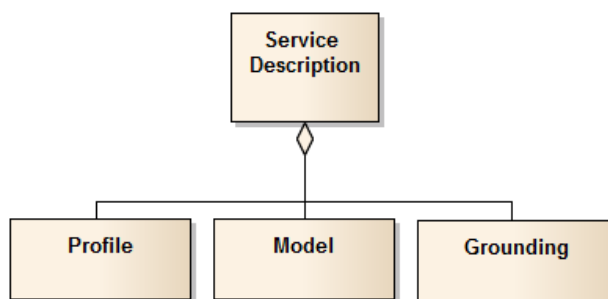
Appendix E. Service Description Conceptual Model

The Service Description Conceptual Model (SDCM) 2.0 provides a graphical and lexical representation of the properties, structure, and interrelationships of all service [metadata](#) elements, collectively known as a Service Description. The SDCM is a product of the U.S. Federal Aviation Administration (FAA) System Wide Information Management Program ([SWIM](#)) and the Single European Sky Air Traffic Management (ATM) Research Programme (SESAR) Joint Undertaking ([SJU](#)). Detailed descriptions of the concepts that appear in the table and diagrams below may be found at <http://swim.aero/sdcm/2.0.0/sdcm-2.0.0.html>.

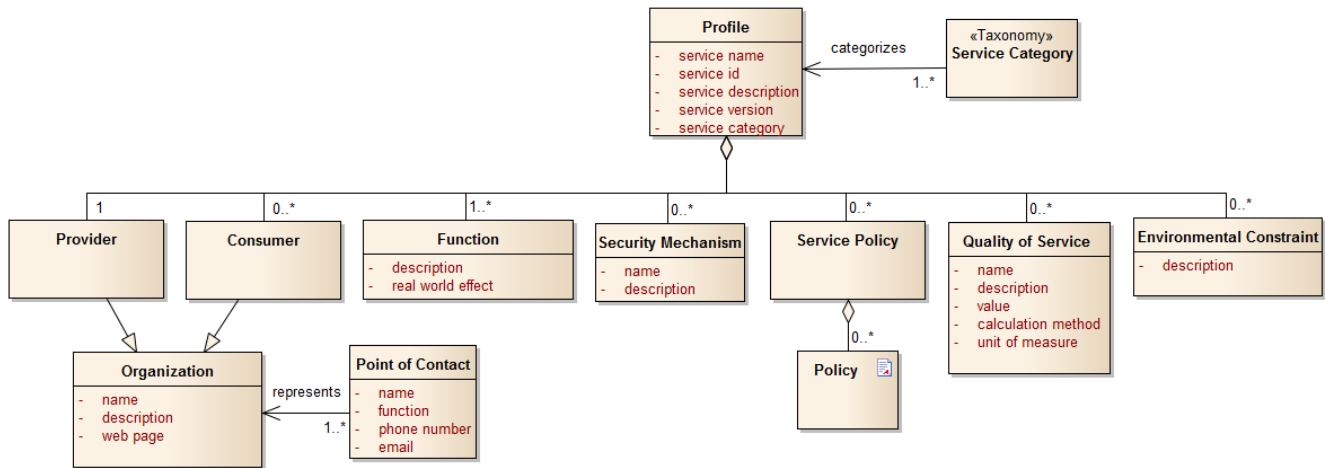
Correlation between WSDD and SDCM:

WSDD Section	SDCM Concept
4 Service Profile	Profile
4.1 Service Provider	Provider
4.2 Service Consumers	Consumer
4.3 Service Functionality	Function
4.4 Security	Security Mechanism
4.5 Qualities of Service	Quality of Service
4.6 Service Policies	Service Policy
4.7 Environmental Constraints	Environmental Constraint
5 Service Interface	Model
5.1 Interfaces	Interface
5.2 Operations	Operation
5.3 Messages	Message
5.4 Faults	Fault
5.5 Data	Data Entity
6 Service Implementation	Grounding
6.1 Bindings	Binding
6.2 End Points	End Point

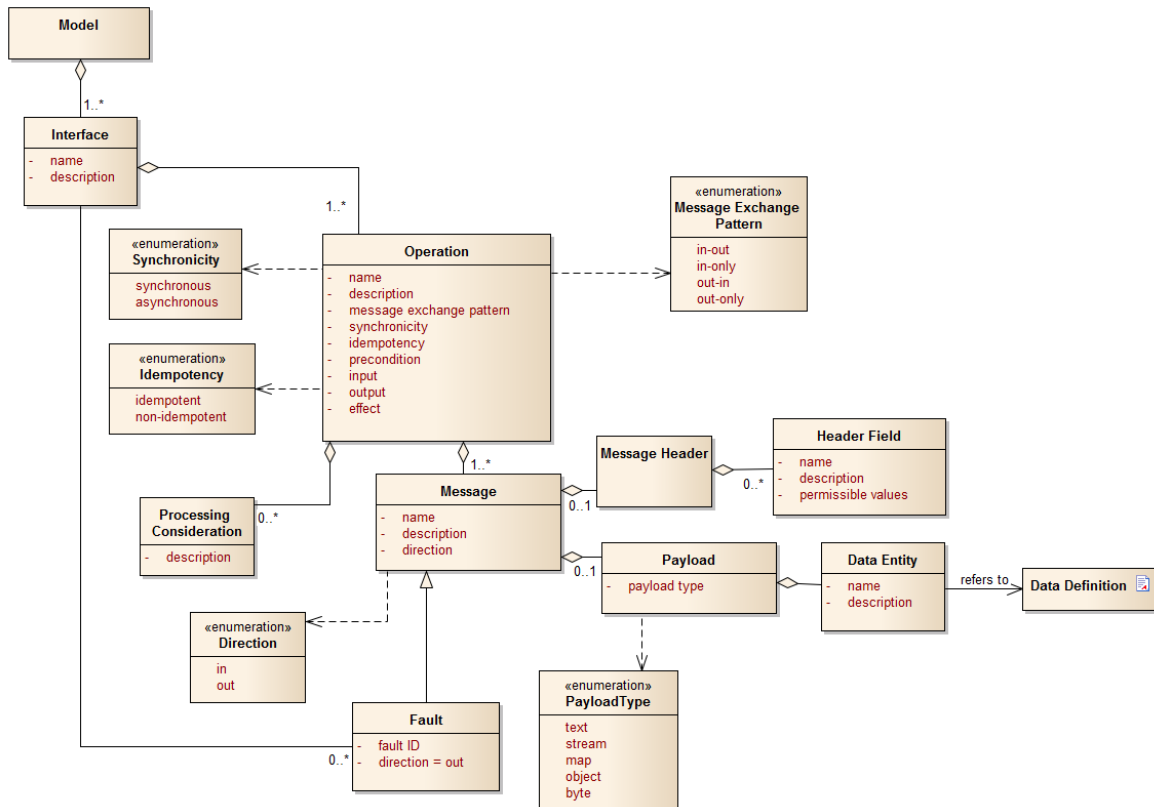
SDCM Service Description Diagram:



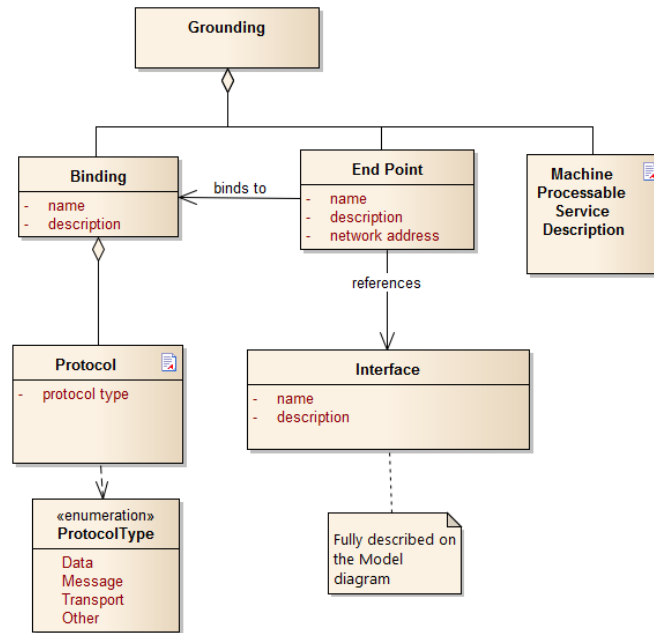
Profile Diagram:



Model Diagram:



Grounding Diagram:



Appendix F. Classification Schemes used in the NSRR

The following schemes are used to classify services and service artifacts in the [NAS Service Registry/Repository](#), NSRR.

Service Interface Type¹ – A single value used to classify the service based on the kind of technological solution deployed by the service. Values are:

Method-oriented	An interface that exposes service capabilities through a set of operations. Technologies that support this interface type are Web Service framework (WS*) and OGC Web Common Services.
Message-oriented	An interface that exposes service capabilities through creating, sending, receiving, and reading messages exchanged by distributed systems. The middleware technologies that support this interface type include Java Message Service (JMS) and .NET WCF.
Resource-oriented	An interface that supports the REST architectural style of interactions, that is, manipulation of XML representations of Web resources using a uniform set of stateless operations, usually a set of HTTP methods.

Lifecycle Stage – A single value used to classify the service based on its current Service Lifecycle Management Process (SLMP) stage. Values are:

Proposed	The stage during which the business needs for the proposed service are identified and assessed as to whether needs can be met through the use of SOA.
Definition	The stage during which the service's business requirements are gathered and the service design is produced based on these requirements.
Development	The stage during which the service specifications are developed and the service is built.
Verification	The stage during which the service is being inspected and/or tested to confirm that the service is of sufficient quality, complies with the prescribed set of standards and regulations, and is approved for use.
Production	The stage during which the service is available for use by its intended consumers.
Deprecated	The stage during which the service can no longer be used by new consumers.
Retired	The stage during which the service is disposed of and is no longer used.

¹ Service Interface Type is also one of a set of artifacts (see <https://semantics.aero/>) developed for supporting exploration and advancement of Semantic Web technologies in the international aviation community.

Criticality Level – A single value used to classify the service based on the level of significance given to a functional failure of the service. Values are:

Critical	Loss of this service would significantly raise the risk associated with providing safe and efficient operations.
Essential	Loss of this service would raise the risk associated with providing safe and efficient operations to an unacceptable level.
Routine	Loss of this service would have a minor impact on the risk associated with providing safe and efficient operations.

ATM Service Category – One or more values used to classify the service based on the strategic Air Traffic Management (ATM) operations and services it supports. Values are:

Flight Planning	Operations and services that support the entry, update, and management of information that describes an intended flight or portion of an intended flight of an aircraft.
Airport	Operations and services that support the control of aircraft and vehicles on the airport surface. Such operations encompass movement from the gate or ramp to the runway at the departure airport and from the runway to the gate or ramp at the destination airport.
Arrival and Departure	Operations and services that support the control of aircraft in arrival and departure airspace, including departure operations to top of climb, arrival operations from top of descent to the airport surface, and transition flights.
En Route Cruise/ Oceanic	Operations and services that support the control of aircraft in that part of a flight in which aircraft are generally level at cruise altitudes, whether in domestic cruise airspace or oceanic airspace.
NAS Management	Operations and services that support the function of monitoring the National Airspace System (NAS) and taking appropriate action when abnormalities are detected.

SWIM Service Product Category – One or more values used to classify the service based on the type of SWIM data product it delivers. Values are:

Aeronautical	Data used to describe, manage and control aeronautical facts, concepts or instructions such as special use airspace restrictions, airport configuration, and Notices to Airmen (NOTAMS).
Flight	Data used to describe, manage, and control the safe movement of aircraft in the NAS, including information such as flight itinerary, flight identification, flight planning, flight events and status, and Air Traffic Management (ATM) control events that affect a single flight.
Navigation	Data used to locate the position and describe the course of aircraft.

Surveillance	Data produced by technologies (e.g., radar, beacon interrogator, automatic dependent surveillance-broadcast) for detecting and locating airborne and taxiing aircraft and ground support vehicles.
Operation and Maintenance	Data used to describe the status of communications and other equipment, systems, facilities, and maintenance schedules and requests.
Weather	Data used to describe current or predicted atmospheric conditions, including terminal and airborne weather observations, forecasts, and reports of weather phenomena.

Message Exchange Pattern (MEP) – A single value that indicates the pattern of message exchange between interacting components. Values are:

In-Only	Indicates an operation which has only an input message, that is, a message is sent to the service and service does not produce any output message.
In-Out	Indicates an operation where an input message is sent to the service first and an output message (or a fault message) is generated in response.
Out-Only	Indicates an operation which has only an output message, that is, the service generates the output message but does not expect to receive any response message or fault messages.
Out-In	Indicates an operation where the service generates the output message and in return the input message (or a fault message) is received.

Message Body Type – A single value that indicates the nature of the actual (business) data transferred by the message. Values are:

Text	The message body contains a text, e.g., XML.
Stream	The message body contains a stream of primitive values that are written and read sequentially.
Map	The message body contains a set of name-value pairs, where names are strings, and values are primitives.
Object	The message body contains a serialized object.
Byte	The message body contains an array of primitive bytes.

Appendix G. Writing Good Definitions

NOTE: This Appendix is provided for guidance only; it is not normative.

The purpose of a definition is to define a concept with words or phrases that describe, explain, or make definite and clear its meaning. Precise and unambiguous definitions are one of the most critical aspects of ensuring interoperability. When two or more parties use a term, it is essential that all be in explicit agreement on the meaning of that term.

[ISO/IEC 11179-4 \[16\]](#) provides rules for writing good definitions. There are mandatory requirements with which all definitions must comply, and there are recommendations that should be followed when writing a definition. Note the difference between requirements and recommendations: compliance with the requirements can be objectively tested, whereas compliance with the recommendations can only be evaluated subjectively. The rules cited below are abstracted from this document.

Requirements

A definition *shall*:

1. Be stated in the singular.
2. State what the concept is, not only what it is not (i.e., never exclusively in the negative).
3. Be stated as a descriptive phrase or sentence(s).
4. Contain only commonly used abbreviations.
5. Be expressed without embedding definitions of other underlying concepts.

Recommendations

A definition *should*:

1. State the essential meaning of the concept.
2. Be precise and unambiguous.
3. Be concise.
4. Be able to stand alone.
5. Be expressed without embedding rationale, functional usage, domain information, or procedural information.
6. Avoid circular reasoning.
7. Use the same terminology and consistent logical structure for related definitions.

For further explanations of these rules as well as examples of definitions that pass and fail the tests, see https://www.faa.gov/air_traffic/technology/swim/governance/service_semantics/faq/#Rules-for-writing-good-definitions.