EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL

Enclosure 1

EUROCONTROL Specification for SWIM Service Description

DOCUMENT IDENTIFIER : EUROCONTROL-SPEC- ####

Edition Number	**:**	**0.2**
Edition Date	**:**	**18 May 2017**
Status	**:**	**Draft**
Intended for	**:**	**General Public**
Category	**:**	**EUROCONTROL Specification**

DOCUMENT CHARACTERISTICS

TITLE		
EUROCONTROL Specification for SWIM Service Description		
	Publications Reference:	SPEC-xxx
	ISBN Number:	xxx
Document Identifier	**Edition Number:**	0.2
EUROCONTROL-SPEC-xxx	**Edition Date:**	18 May 2017

Abstract

This specification contains requirements for describing information services in the context of Initial System Wide Information Management (iSWIM). The requirements prescribe the minimum set of information elements a service description has to contain.

Keywords

Interoperability, Service, Service Description, SWIM, System Wide Information Management

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STATUS, AUDIENCE AND ACCESSIBILITY					
Status		**Intended for**		**Accessible via**	
Working Draft	☐	General Public	☑	Intranet	☐
Draft	☑	EUROCONTROL	☐	Extranet	☐
Proposed Issue	☐	Restricted	☐	Internet (www.eurocontrol.int)	☑
Released Issue	☐				

DOCUMENT APPROVAL

The following table identifies all management authorities who have successively approved the present issue of this document.

AUTHORITY	NAME AND SIGNATURE	DATE

DOCUMENT CHANGE RECORD

The following table records the complete history of the successive editions of the present document.

EDITION NUMBER	EDITION DATE	REASON FOR CHANGE	PAGES AFFECTED
0.1	31 Mar 2017	Released for Specification Package consistency review	All
0.2	18 May 2017	Update following internal review	All

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EXECUTIVE SUMMARY

This specification contains requirements for describing implemented information services within the context of Initial System Wide Information Management (iSWIM). In order for service consumers to make good use of the available information services, it is essential that service descriptions cover the service consumers' needs. Therefore, the requirements focus on the service description that a service provider makes available to service consumers.

More specifically, the requirements prescribes the minimum set of information elements to be contained by a service description in order for a service consumer to discover a service, consider using a service, or implement a service consuming client.

The requirements ensure that a service description covers the information needs of business experts, operational experts and technical experts, more particularly in terms of: what a service does, how a service works, how to access a service, and other information for consuming a service.

1. Introduction

1.1 Purpose

This specification contains requirements for describing implemented information services within the context of Initial System Wide Information Management (iSWIM).

In order for service consumers to make good use of the available information services, it is essential that service descriptions cover the service consumers' needs. Therefore, the requirements focus on the service description that a service provider makes available to service consumers.

More specifically, the requirements prescribes the minimum set of information elements to be contained by a service description in order for a service consumer to discover a service, consider using a service, or implement a service consuming client.

The requirements ensure that a service description covers the information needs of business experts, operational experts and technical experts, more particularly in terms of: what a service does, how a service works, how to access a service, and other information for consuming a service.

1.2 Scope

This specification considers which information needs to be provided to service consumers about implemented services.

This specification does not cover the information needs of service providers, e.g. to implement a service. In addition, this specification does not identify a list of services to be implemented and does not cover governance aspects.

Further complementary requirements to the present specification exist: the EUROCONTROL Specification for SWIM Information Definition [RD 2] contains requirements for creating information definitions that conform to the ATM Information Reference Model; the EUROCONTROL Specification for SWIM Technical Infrastructure Yellow Profile [RD 3] contains requirements on the suite of technological choices concerning service interface binding aspects.

1.3 Applicability

iSWIM supports "*information exchanges that are built on standards and delivered through an internet protocol (IP)-based network by SWIM enabled systems*" [RD 1]. It lists four areas for information exchanges:

- Aeronautical information exchange
- Meteorological information exchange
- Cooperative network information exchange
- Flight information exchange

The Pilot Common Project Regulation (PCP) [RD 1] requires that service implementations in support of the information exchanges "*be compliant with the applicable version of [the ATM] Information Reference Model (AIRM), the AIRM Foundation Material and the Information Service Reference Model (ISRM) Foundation Material*" (see sections 5.1.3, 5.1.4, 5.1.5 and 5.1.6 of the Annex to the Pilot Common Project).

Satisfying the requirements of this specification can be considered as a means of compliance for the enabling ATM functionality iSWIM as defined by the PCP [RD 1] in relation to the "*ISRM Foundation Material*".

This specification can also be adopted outside of the specific PCP context by those seeking to achieve the benefits of SWIM.

This specification is expected to be applied by service providers when describing the services they offer.

1.4 Target Audience

The target audience for the specification includes, but is not limited to:

- Operational stakeholders implementing services supporting the exchange of information over SWIM. This audience includes:
  - Business experts procuring systems and services;
  - Operational experts using systems and services to fulfil operational needs; and
  - Technical experts designing and implementing systems and services.
- Oversight authorities.

1.5 Conventions

In this specification:

- Requirements using the operative verb **shall** indicate that they must be implemented to achieve the minimum objectives of this specification.
- Requirements using the operative verb **should** indicate that they are recommended to achieve the best possible implementation of this specification.
- Requirements using the operative verb **may** indicate options.

Each requirement is detailed in a table with the following structure.

Title	Title of the requirement, used as a short name for the requirement for mnemonic and readability purposes.
Identifier	Unique identifier of the requirement.
Requirement	Statement expressing the requirement.
Rationale	Justification of the existence of the requirement.
Verification	Quality characteristics to be assessed when inspecting a service description with regards to the requirement. Each requirement will indicate the verification method to cover the following characteristics: • Completeness • Consistency • Correctness
Examples/Notes	Examples in support of the requirement or additional notes to clarify the requirement.

Table 1 – Requirement structure

1.6 Abbreviations

Abbreviation	Term
AIRM	ATM Information Reference Model
AIXM	Aeronautical Information Exchange Model
AMQP	Advanced Message Queuing Protocol
ASBU	Aviation System Block Upgrade
ATM	Air Traffic Management
BPM	Business Process Management
DPI	Departure Planning Information
ERAF	EUROCONTROL Advisory Framework
EU	European Union
EUROCAE	European Organisation for Civil Aviation Equipment
ICAO	International Civil Aviation Organization
ICAO IMP	International Civil Aviation Organization Information Management Panel
IER	Information Exchange Requirement
IR	Implementing Regulation
ISO	International Standards Organization
ISO/IEC	International Standards Organization / International Electrotechnical Committee
ISRM	Information Service Reference Model
iSWIM	Initial System Wide Information Management
IWXXM	ICAO Weather Information Exchange Model
MTOM	Message Transmission Optimization Mechanism
NAF	NATO Architecture Framework
NM	Network Manager
OASIS	Organization for the Advancement of Structured Information Standards
OSED	Operational Service and Environment Definition

Abbreviation	Term
PCP	Pilot Common Project
REST	Representational state transfer
SESAR	Single European Sky ATM Research
SLA	Service Level Agreement
SOA	Service Oriented Architecture
SPR	Safety and Performance Requirements
SWAL	Software Assurance Level
SWIM	System Wide Information Management
TI	Technical Infrastructure
TLS	Transport Level Security
UML	Unified Modeling Language
W3C	World Wide Web Consortium
WADL	Web Application Description Language
WSDL	Web Services Description Language
XML	Extensible Markup Language
XSD	XML Schema Definition

Table 2 – List of abbreviations

1.7 Definitions

Term	Definition	Source
accountability	The degree to which the actions of an entity can be traced uniquely to the entity.	ISO/IEC 25010:2011[RD 12]
authenticity	The degree to which the identity of a subject or resource can be proved to be the one claimed	ISO/IEC 25010:2011[RD 12]
availability	The degree to which a system, product or component is operational and accessible when required for use.	ISO/IEC 25010:2011[RD 12]
completeness	The degree to which the content contains the expected information.	Adapted from ISO 25012:2008 [RD 7]
confidentiality	The degree to which a product or system ensures that data is accessible only to those authorized to have access.	ISO/IEC 25010:2011[RD 12]
consistency	The degree to which the content is free from contradiction and is coherent within itself and with referenced resources.	Adapted from ISO 25012:2008 [RD 7]
correctness	The degree to which the content correctly represents the true value.	Adapted from ISO 25012:2008 – Accuracy [RD 7]
information definition	A formal representation of information concepts or data concepts.	-
information exchange requirement	A specification of the information that is to be exchanged.	NAF v3 [RD 14]
information service (synonym: information exchange service)	A type of service that provides an information exchange capability.	-
integrity	The degree to which a system, product or component prevents unauthorized access to, or modification of, computer programs or data	ISO/IEC 25010:2011[RD 12]
interface binding	Specification of the protocol and data format to be used in transmitting messages defined by the associated interface.	W3C Web Services Description Requirements, [RD 10]
interoperability	The ability of information and communication technology (ICT) systems and of the business processes they support to exchange data and to enable the sharing of information and knowledge.	-

Term	Definition	Source
message exchange pattern	A Message Exchange Pattern (MEP) is a template, devoid of application semantics, that describes a generic pattern for the exchange of messages between agents. It describes 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.	W3C Web Services Glossary [RD 9]
non-repudiation	The degree to which actions or events can be proven to have taken place, so that the events or actions cannot be repudiated later	ISO/IEC 25010:2011[RD 12]
operation (synonym: service operation)	Specification of a transformation or query that an object may be called to execute *Note: An operation has a name and a list of parameters.*	ISO 19119:2005, 4.3
operational stakeholders	Civil and military: airspace users, air navigation service providers and airport operators. *Note: The operational stakeholders are identified in the Appendix to the Implementing Regulation.*	EU Implementing Regulation No 409/2013 [RD 8]
protocol	A set of semantic and syntactic rules for exchanging information.	ISO/IEC 14519:2001[RD 13]
quality of service	The degree or level of confidence that the performance of a service meets the requirements of the user.	-
security	The degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization. It includes Confidentiality, Integrity, non-repudiation, accountability, authenticity.	ISO/IEC 25010:2011[RD 12]
semantic correspondence	The relation between a concept in an information definition and the AIRM. *Note: A semantic correspondence takes the form of a mapping to AIRM concepts based on their meanings, an out-of-scope declaration or a reference to a change request.*	-
service	A mechanism to enable access to one or more capabilities, where the access is provided using a prescribed interface.	OASIS (2006) [RD 11]
service category	A class of services which share a common feature.	-
service consumer	An organization that seeks to satisfy a particular need through the use of capabilities offered by means of a service.	OASIS (2006) [RD 11]
service description	The information needed in order to use, or consider using, a service.	OASIS (2006) [RD 11]

Term	Definition	Source
service function	A type of activity describing the functionality of a service.	NAF v3 [RD 14]
service interface	The means by which the underlying capabilities of a service are accessed. *Note: The service interface is the means for interacting with a service.*	OASIS (2006) [RD 11]
service policy	A constraint governing one or more services.	NAF v3 [RD 14]
service provider	An entity (person or organization) that offers the use of capabilities by means of a service.	OASIS (2006) [RD 11]

Table 3 – List of terms with definition

1.8 Reference material

[RD 1] Commission Implementing Regulation (EU) No 716/2014 of 27 June 2014 on the establishment of the Pilot Common Project supporting the implementation of the European Air Traffic Management Master Plan

[RD 2] EUROCONTROL Specification for SWIM Information Definition, Ed. Xx, *date*

[RD 3] EUROCONTROL Specification for SWIM Technical Infrastructure Yellow Profile, Ed. Xx, *date*

[RD 4] AIRM Abbreviations www.airm.aero/

[RD 5] ISRM Service Portfolio. Published within the 5th element of the Initial system-wide information management (SWIM) technology solution pack (http://www.sesarju.eu/node/2255, 05_ISRM_Solution_46_SWIM_Technological_Solution.zip, 0502DEL_08.03.10_D65_ISRM_Service_Portfolio.pdf)

[RD 6] SESAR ISRM Foundation 8[1]. Published within the SESAR Joint Undertaking Transversal Solutions (http://www.sesarju.eu/transversal-solutions), it is composed of 3 documents:

- ISRM Primer (http://www.sesarju.eu/sites/default/files/documents/transversal/08.03.10_D45_ISRM_Primer.docx);

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- ISRM Foundation Rulebook (http://www.sesarju.eu/sites/default/files/documents/transversal/08.03.10_D45_ISRM_Foundation_Rulebook.docx);
- ISRM Modelling Guidelines (http://www.sesarju.eu/sites/default/files/documents/transversal/08.03.10_D45_ISRM_Modelling_Guidelines.docx

[RD 7] International Organization for Standardization - ISO 25012:2008 Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Data quality model

[RD 8] Commission Implementing Regulation (EU) No 409/2013 of 3 May 2013 on the definition of common projects, the establishment of governance and the identification of incentives supporting the implementation of the European Air Traffic Management Master Plan

[RD 9] World Wide Web Consortium (W3C) Web Services Glossary (2004), http://www.w3.org/TR/ws-gloss/

[RD 10] World Wide Web Consortium (W3C) Web Services Description Requirements (2002), http://www.w3.org/TR/ws-desc-reqs/

[RD 11] OASIS Reference Model for Service Oriented Architecture 1.0 (2006) , http://docs.oasis-open.org/soa-rm/v1.0/soa-rm.pdf

[RD 12] International Organization for Standardization - ISO/IEC 25010:2011 – Systems and software engineering – Systems and Software Quality Requirements and Evaluation (SQuaRE) – System and Software quality models

[RD 13] International Organization for Standardization - ISO/IEC 14519:2001 – Information Technology – POSIX Ada Language Interfaces – Binding for System Application Program Interface (API)

[RD 14] NATO Architecture Framework (NAF) version 3

1.9 Document structure

Chapter 1 introduces this document, including scope, applicability and audience. Chapter 2 lists the requirements addressing service descriptions. Annex A provides context for the service descriptions, introducing to their purpose and use. Annex B summarises the requirements to be met when assessing conformity to this specification. Annex C lists contributing subject matter experts.

1.10 Maintenance of the Specification

This EUROCONTROL Specification has been developed under the EUROCONTROL Advisory Framework (ERAF) and is maintained by EUROCONTROL in accordance with this framework.

2. Conformance

The conformity checklist table is available in ANNEX B. It is provided in support of assessing conformance with this specification.

3. Requirements

3.1 General Requirements

3.1.1 Coverage

Title	Service description coverage
Identifier	SWIM-SERV-001
Requirement	A service description **shall** describe a single service.
Rationale	The readability of any service description is improved by keeping it focussed on one service.
Verification	Completeness: Not Applicable. Consistency: Not Applicable. Correctness: Verify that one and only one service is described.
Examples/Notes	

3.1.2 Language

Title	Service description language
Identifier	SWIM-SERV-002
Requirement	The textual descriptions in a service description **shall** be written in English using the spelling listed as the primary British spelling when conflicting spellings exist.
Rationale	By using a single reference language, the risk of translation ambiguities when comparing service descriptions is removed.
Verification	Completeness: Not Applicable. Consistency: Not Applicable. Correctness: Verify that the textual descriptions are correct British English.
Examples/Notes	Note: This requirement does not apply to implementation details that are reflected in the content of the service description e.g. service operation names.

Title	Define abbreviations and acronyms
Identifier	SWIM-SERV-003
Requirement	A service description **shall** define all used abbreviations and acronyms and be in accordance with the AIRM abbreviation list [RD 4].
Rationale	It is best practice to document all abbreviations and acronyms used in a document.

Verification	Completeness: Verify that all used acronyms and abbreviations are defined in the service description. Consistency: For abbreviations/acronyms existing in AIRM, verify that the definitions are the same. Correctness: Not Applicable.
Examples/Notes	Note: It is allowed to use abbreviations/acronyms not defined in AIRM abbreviation list [RD 4]. However, when using one of those, their definitions must be the same.

Title	Use standard abbreviations and acronyms
Identifier	SWIM-SERV-004
Requirement	A service description **should** only use standard abbreviations and acronyms.
Rationale	It is best practice to use standard abbreviations and acronyms only. Using non-standard abbreviations and acronyms makes the reading more difficult and may confuse the reader.
Verification	Completeness: Not Applicable. Consistency: Verify that the acronyms and abbreviations have same definitions as in their source. Correctness: Not Applicable.
Examples/Notes	Note: This applies to ATM and non-ATM abbreviations and acronyms. Examples of sources for standard abbreviations and acronyms are: • ATM: ICAO and AIRM; • Non-ATM: ISO.

3.1.3 Service Description Identification

Title	Service description identification
Identifier	SWIM-SERV-005
Requirement	A service description **shall** include: • A title by which the service description is known. • An edition. • A reference date for use in citing the service description.
Rationale	This requirement supports the identification and citation of a service description.
Verification	Completeness: Verify that the 3 elements are included. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Example: “Flight Management service, edition 20.0, 14 Mar 2016”.

3.1.4 Service Identification

Title	Service identification
Identifier	SWIM-SERV-006
Requirement	A service description **shall** include: • The name of the service. • The version of the service.
Rationale	This requirement makes clear what the subject of the service description is. It supports the identification and citation of the service being described.
Verification	Completeness: Verify that the 2 elements are included Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Note: To improve readability across service descriptions, it is agreed to apply following rules for a service name: • include the operational concept supported or the information being exchanged; • be a maximum of five words in length; • be represented using UpperCamelCase, and not use snake_case; • not end with the 'service' suffix.

Title	Service abstract
Identifier	SWIM-SERV-007
Requirement	A service description **shall** include an abstract as a small textual description in plain language summarising the service.
Rationale	A good abstract is valuable, in particular during service discovery. This requirement supports the decisions on whether the described service is suitable for use in a particular situation.
Verification	Completeness: Verify that the element is included. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Note: It is best practice for an abstract to summarise the information provided elsewhere in the service description and not to bring any new information.

3.1.5 Service Provider

Title	Service provider
Identifier	SWIM-SERV-008
Requirement	A service description **shall** include the following information about the service provider:

	• the name and description of the organisation responsible for the service; • a point of contact where additional information can be obtained.
Rationale	Knowing the service provider is essential to business experts. Point of contact allows getting additional information regarding the service.
Verification	Completeness: Verify that the elements are included. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Note: Consider including information on provider certification when relevant for the service being described (eg for a Meteorological service). Note: A point of contact typically includes an address such as phone number, email address, or postal address (often including person and / or department in charge). Note: When several points of contact are included, it is best practice to include a role for each.

3.1.6 Service Category

Title	Service categories
Identifier	SWIM-SERV-009
Requirement	A service description **shall** include the categories to which the service belongs, with as a minimum the PCP information exchange areas.
Rationale	Service category information allows discovering services by a series of classification criteria. This requirement supports the decisions on whether the service described by the service description is suitable for use in a particular situation.
Verification	Completeness: Verify that the PCP category is present. Consistency: Verify that the mentioned categories are defined in the referenced service categorisation scheme. Correctness: Not Applicable.
Examples/Notes	Note: The PCP information exchange areas are: • Aeronautical information exchange; • Meteorological information exchange; • Cooperative network information exchange; • Flight information exchange. Note: State the service categorisation scheme being followed, by either inclusion or reference. Note: Outside the PCP information exchange areas, there are no

	agreed / standardised / governed service categories yet. Note: The SESAR 1 ISRM Portfolio is a good source of inspiration for service categories [RD 5].

3.1.7 Service References

Title	Service standard reference
Identifier	SWIM-SERV-010
Requirement	A service description **shall** include a reference to the standard to which the service adheres.
Rationale	The reference to standards is essential information, fostering reuse.
Verification	Completeness: Verify that the reference is included or that the "Not Applicable" statement is given. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Note: When the described service is not based on a standard mention "Not Applicable". Example: Mention the EUROCAE Arrival Management Information standardised service design, for an implementation following that standard. Note: It is good practice to include information on the internal or external standards the service is following, such as development process, Software Assurance Level (SWAL), Enterprise Architecture, relation to European ATM Master Plan, etc.

3.1.8 Operational Need

Title	Operational needs
Identifier	SWIM-SERV-011
Requirement	A service description **shall** • include information about the operational needs fulfilled by the service, and • include or refer to the information exchange requirements (IER) used in the identification of the needs for the service, including the reference to the source document.
Rationale	Operational needs hint at the operational context in which the service is used. IERs reference the requirements at the origin of the service. This requirement supports the decisions on whether the described service is suitable for use in a particular situation.
Verification	Completeness: Verify that operational needs are included; verify that, IERs and document references are included or that the "Not Applicable" statement is given. Consistency: If the described service results from SESAR 1, verify

	that the IERs are included. Correctness: Verify that the IERs are available in the referenced source documents.
Examples/Notes	Note: When describing operational needs, it is best practice to add a reference to an existing operational concept document, or contextual description, such as SESAR Operational Service and Environment Definition (OSED) document. Example of operational needs: The Flight Management service fulfils the need to retrieve information about flights and flight plans and the need to provide information about changes in flights. Note: For the information exchange requirements (IER) used in the identification of the needs for the service, include the reference to the source documents, such as SESAR Operational Service and Environment Definition (OSED) and Safety and Performance Requirements (SPR) documents. Note: When the described service is not based on IERs, mention “Not Applicable”.

3.1.9 Service Functionality

Title	Service functionality
Identifier	SWIM-SERV-012
Requirement	A service description **shall** describe the functionality of the service as a list of functions and their associated real world effects.
Rationale	The functions provide business and operational experts with a business view of the interactions with the service, without having to look at the interface details.
Verification	Completeness: Verify that the elements are included. Consistency: Verify that the functions and real world effects are consistent with the operational needs. Correctness: Not Applicable.

Examples/Notes	Note: A function is a type of activity describing the functionality of a service. Every function usually (but not always) can be mapped to service operations defined as a part of the service's interface; i.e., functions provide a "business view" and service operations provide a "technical view" of a particular service activity. Note: A real world effect is an ultimate purpose associated with the interaction with the 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. Examples of functions and real world effects:

function	*real world effect*
Retrieve a list of flights	(Network Information sharing)
Retrieve information of a single flight	(Network Information sharing)
Provide Departure Planning Information (DPI)	NM systems updated with the information; NM systems publish the resulting flight update

3.1.10 Access and Use Conditions

Title	Service access and usage conditions
Identifier	SWIM-SERV-013
Requirement	A service description **shall** include the conditions which apply to accessing and using the service, such as • legal constraint, • security constraints, • service policies, and • service consumption constraints.
Rationale	This requirement ensures that a service consumer is aware of any limitations on the access and use of the service. It is good practice to share business constraint information associated with the conditions of usage of the service.
Verification	Completeness: Verify that the elements included cover the required constraints and policies. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Example legal constraints: • Licenses to be bought, • Intellectual property rights to be respected. Example security constraints: • Confidentiality: o Statement of the confidentiality offered by the service (e.g. message, transport, none…). o Elements of the payload whose confidentiality is

	required or provided (whole payload, body, specific sub-elements…). o Cryptographic algorithms and key sizes. • Integrity: o Statement of the integrity offered by the service (e.g. message, transport…). o Elements of the payload whose integrity is required or provided (whole payload, body, specific sub-elements…). o Cryptographic algorithms and key sizes. • Authentication: o Statement of the authentication mechanisms used on consumer and provider side. o Identity tokens. • Authorisation: o Statement on the authorisation mechanism used. o Credentials used for the authorisation. o Levels of authorisation. Example services policies: • Contingency policy. • Business policy(s) in terms of business rule or objective i.e. how the business is conducted. • Operational policy(s) (i.e. constraints and requirements for how services operate and interoperate at runtime) in terms of rules and guidelines. Operational policies are utility centric (handling operational characteristics) covering mainly; , logging, messaging protocol and versioning. Normally standardised for a defined collection of services. • Technical policy(s). Technical policies can (if available) be provided in machine-readable format. • Versioning scheme used (e.g. major.minor[.fix]) and the compatibility guaranteed between different versions (e.g. backwards compatibility is guaranteed between minor versions but not for major). • Lifecycle policy applied to the service (e.g. to allow consumers to know that he is not investing on a soon to be retired service). Example service consumption constraints: • The maximum number of requests per time window allowed for a service consumer. Note: Additional usage conditions could be diplomatic, geographical reasons, safety criticality and fees to be paid, for instance.

3.1.11 Quality of Service

Title	Quality of service
Identifier	SWIM-SERV-014
Requirement	A service description **shall** include statements on the quality of

	service offered with regards to: • availability of the service, • response time of the service, and • throughput of the service.
Rationale	This is a key criterion in deciding to use the service. This is key information to be included in a service level agreement and will influence the content of the SLA. It informs contract negotiations between consumers and providers.
Verification	Completeness: Verify that quality statements are included in the service description. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Note: The **availability** is typically expressed as a percentage representing the ratio between minimum target uptime versus maximum uptime. The service provider needs to describe the service outages he intends to mask/alleviate. The availability information needs to be expressed for various situations, e.g. planned and unplanned outages. The service provider needs to describe the schedule of planned outages. Example of availability: ≥ 99.95 % of Continuous Operations. Note: The **response time** expressing the delay to process a service request could include: delay in seconds, percentage of messages, message size. Example of response time: 2s delay for 95% of messages of average size 1MB, with no compression. Example of response time: max 3s response to complete a service request, measured from the time the service provider agent receives the request to the time the service provider transmits the response. Note: The **throughput** is typically expressed as a number of service requests that the service can accommodate within the given time period. Example of throughput: 200 service requests per minute. Note: It is a good practice to describe the measuring conditions of the quality of service figures given.

3.1.12 Technical Constraint

Title	Technical constraint
Identifier	SWIM-SERV-015
Requirement	A service description **should** include any known technical constraint requirements that would guide the consumer in their client development.
Rationale	Knowing and satisfying the pre-requisite constraints facilitate good service consumption, such as benefiting from the indicated quality of service statements.

Verification	Completeness: Not Applicable. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Example of technical constraint: firewall, minimum bandwidth or server resources, interface language, integration pattern, protocol and communication ports. Example: For a publication service where the subscription mechanism is not based on a capability of the service itself, stakeholders need to understand how they can subscribe (e.g. using electronic form, email, etc).

3.2 Service Interface Requirements

3.2.1 Service Interfaces

Title	Service interfaces
Identifier	SWIM-SERV-016
Requirement	A service description **shall** list the exposed service interfaces, including for each service interface, • the name of the service interface, • a textual description of the service interface including its purpose, and • the fully qualified network address at which the interface can be accessed.
Rationale	This information facilitates the unambiguous identification of the interface, the understanding of its purpose, and the location to access it.
Verification	Completeness: Verify that the list of interface is included; verify that the 3 elements are included for each interface. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Note: It is best practice to provide, in addition, the network address(es) for accessing the service instance(s) that can be used for testing and development purposes.

Title	Message exchange pattern
Identifier	SWIM-SERV-017
Requirement	A service description **shall** include the message exchange pattern used by the service.
Rationale	The message exchange pattern helps understanding how the information interaction with the service works.
Verification	Completeness: Verify that the information is included. Consistency: Verify that the information is consistent with the

	selected service interface binding. Correctness: Not Applicable.
Examples/Notes	Note: Typical message exchange patterns (as from the SWIM Technical Infrastructure Yellow Profile [RD 3]): • Request/Reply (synchronous or asynchronous); • Publish/Subscribe (Push or Pull); • One Way (also known as Fire and Forget).

3.2.2 Service Interface binding

Title	Service profile and interface bindings
Identifier	SWIM-SERV-018
Requirement	A service description **shall** include for each service interface • the selected SWIM TI Profile and its version, • a reference to a service interface binding as specified in the selected SWIM TI profile, • a reference to a network interface binding as specified in the selected SWIM TI profile, and • a reference to additional supported profile parts as specified in the selected SWIM TI profile.
Rationale	To support the concept of interoperability between the service provider and service consumer, the TI Profiles only allow a certain set of technical solutions, which can be chosen by the service designer. This is used by technical experts to assess feasibility to implement.
Verification	Completeness: Verify that the reference information is provided for each interface. Consistency: Verify that the selected service interface binding, network interface binding and additional parts are consistent with the referenced TI profile and version. Correctness: Not Applicable.
Examples/Notes	Note: If configuration options are available in the service interface binding, these have to be documented (e.g. use of GZIP compression, Message Transmission Optimization Mechanism (MTOM) encoding…). Example of additional supported profile part: Security+.

Title	Service interface protocols
Identifier	SWIM-SERV-019
Requirement	A service description **shall** include the list of service interface protocols, including name, version and data format to be used.
Rationale	Makes explicit within the service description what the protocols are.
Verification	Completeness: Verify that all relevant protocols and versions are

	listed. Consistency: Verify that the protocols are consistent with the selected binding. Correctness: Not Applicable.
Examples/Notes	Note: The list of supported protocols are the ones corresponding to the selected binding. The supported versions of the protocols need to be declared. E.g. version of the Transport Level Security (TLS).

3.2.3 Machine-Readable Service Interface

Title	Machine-readable service interface definition
Identifier	SWIM-SERV-020
Requirement	If the service interface binding specifies the use of machine-readable formats, a service description **shall** include or refer to a service interface definition in a machine-readable format using a standard service definition formalism/language.
Rationale	Enables consumer software components to be created.
Verification	Completeness: If the service interface binding supports it, verify that the required elements are included. Consistency: Verify that provided elements are consistent with the selected binding. Correctness: Not Applicable.
Examples/Notes	Examples of machine-readable descriptions: • service descriptions: o WSDL (e.g. if a Web Service binding using SOAP is selected); • message descriptions: o XSD; o Schematron Rules. Note: AMQP does not mandate a specific machine-readable format. Note: REST may use WSDL 2.0 or WADL. However, WADL is not standardised.

3.2.4 Service Operations

Title	Service operations
Identifier	SWIM-SERV-021
Requirement	A service description **shall** include a technical description of the service operations of each of its interfaces, including: • the name of the service operation, • a description of the intent and the results of the service operation, and • a description of the exchanged information by the service operation, including the input, output and error messages.

Rationale	The consumer needs to know which service operations are available to be called for the expected result.
Verification	Completeness: Verify that all service operations are described. Consistency: Verify the service operations against the messaging technology needs. Correctness: Not Applicable.
Examples/Notes	Note: To improve readability across service descriptions, it is best practice to apply following rules for a service operation name: • include a verb and a noun; and • be represented using lowerCamelCase. Example of service operation names: getAlerts; requestTrajectoryAnalysis; publishAirportMETInducedCapacity; setCoordinationAndTransferData; proposeARESDeActivation. Note: In case of subscription in a Publish / Subscribe message exchange pattern, the management of subscriptions must be specified, including the use and management of subscription id, the mechanism to unsubscribe, etc. Note: When a service operation has several input parameters, it is best practice to indicate the role of each parameter.

3.2.5 Exchanged Information

Title	Precise description of exchanged information
Identifier	SWIM-SERV-022

Requirement	A service description **shall** describe the elements of the exchanged information including:
	• the name of the element;
	• the definition of the element;
	• the cardinality applicable to the element, including whether the element is optional, conditional or mandatory in the exchange;
	• constraints applicable to the element, such as:
	  • datatype,
	  • value ranges,
	  • special values,
	  • character set restrictions;
	• the semantic correspondence of the element with the AIRM; and
	• the structure and relevant relationships between the elements.

Rationale	This requirement ensures that the precise meaning of the exchanged information is shared by all parties of the information exchange.

Verification	Completeness: Verify that the service description describes the elements of the exchanged information and that the required details are provided. Consistency: Verify that the elements are consistent with each other and with the AIRM concepts used in the semantic correspondence. Correctness: Not Applicable.
Examples/Notes	Note: The service description must describe all elements of the exchanged information at all levels, down from the service operation parameters to attributes and data types. Note: It may be beneficial to develop a standalone information definition as specified in EUROCONTROL Specification for SWIM Information Definition [RD 2], ensuring that it contains the extra details required by this requirement. Note: The information definition can be provided by reference when using an AIRM conformant standardised information exchange models, such as Aeronautical Information Exchange Model (AIXM) and ICAO Weather Information Exchange Model (IWXXM).

Title	AIRM conformance statement
Identifier	SWIM-SERV-023
Requirement	A service description **shall** include a statement on the conformance of the information definition used by the service with the ATM Information Reference Model (AIRM).
Rationale	To achieve semantic interoperability.
Verification	Completeness: Verify that the statement is present. Consistency: Not Applicable. Correctness: Verify that the statement is true.
Examples/Notes	Note: The conformance statement is expected to state the AIRM version.

Title	Filter capabilities
Identifier	SWIM-SERV-024
Requirement	A service description **shall** describe the filtering capabilities, including meaning and syntax of filter expressions, which can be applied to the information exchange.
Rationale	This requirement ensures that the precise meaning of the filter expressions is understood.
Verification	Completeness: If filter expressions are applied, verify that the capabilities, meaning and syntax are included. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Examples include indication of how to interpret and/or combine filters, including cases such as usage of wildcards, allowing and interpreting

	empty filters, combinations of filters in terms of logical expressions (e.g. implicit AND, implicit OR, explicit operator), etc. Note: Nothing needs to be provided when the exchanged information has no filter expression.

3.2.6 Service Behaviour

Title	Service behaviour
Identifier	SWIM-SERV-025
Requirement	A service description **shall** include information on the behaviour of the service including: • the sequence of service operations, and • the handling of unexpected behaviour.
Rationale	This requirement facilitates the understanding of the service behaviour, including the sequencing of service operations to support operational processes, and the error handling.
Verification	Completeness: Verify that the behaviour information is included and covers the errors handling as well. Consistency: Verify that the names of the interfaces, service operations and exchanged information are consistent with the interface definitions. Correctness: Not Applicable.
Examples/Notes	Examples of behaviour specification: • The behaviour under normal conditions. • The behaviour with incorrect input data (e.g., out of range or incorrect data type). • The use of error messages, and error handling in general. • The list of error codes and expected effects. Note: The service behaviour is typically captured in formal modelling notations such as a Unified Modeling Language (UML) sequence diagram.

3.2.7 Model View

Title	Model view
Identifier	SWIM-SERV-026
Requirement	A service description **should** • include a model view on the conceptual parts, expressed using a formal and standardised notation, that formalises the representation of the business logic of its service interfaces, service operations and exchanged information; and • declare the notation used to express the model view.
Rationale	Exposing the business logic of the service in a formalised notation and standardised notation allows operational and technical experts to

	understand how the service works and make comparisons.
Verification	Completeness: If the model view is provided, verify that the notation is declared; and verify that the model view fully covers service interfaces, service operations and exchanged information. Consistency: If the model view is provided, verify that the model view is consistent with the service description (e.g. same service operation name). Correctness: If the model view is provided, verify that the model view is aligned with the declared notation.
Examples/Notes	Note: It is recommended to use the UML as notation. Note: The model view covers structural and activity diagrams when using UML as notation. Note: The SESAR ISRM Foundation 8 is an example of a formal and standardised notation [RD 6].

3.3 Other Requirements

3.3.1 Validation Statement

Title	Service validation
Identifier	SWIM-SERV-027
Requirement	A service description **shall** include a statement on the validation method used to validate the service and the results of the validation.
Rationale	This requirement ensures the service description contains sufficient statements on the testing done to enable the consumer to have confidence in the quality of the service.
Verification	Completeness: Verify that the required information is included or that the “no validation information available” statement is given. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Note: If not validated, indicate “no validation information available”. Example: A letter of acceptance from a Regulator.

3.3.2 Service Monitoring

Title	Service monitoring
Identifier	SWIM-SERV-028
Requirement	If a service monitoring mechanism is available to service consumers, a service description **shall** describe how to use the service monitoring mechanism.
Rationale	Allow the service consumer to use the available mechanism and monitor the service.

Verification	Completeness: If a service monitoring mechanism is available, verify that the information is included. Consistency: Not Applicable. Correctness: Not Applicable.
Examples/Notes	Examples: Monitoring the availability of the service (e.g. by heartbeat); monitoring response time.

3.3.3 Code Examples

Title	Examples of Code
Identifier	SWIM-SERV-029
Requirement	A service description **should** include or refer to examples of code exemplifying the implementation of the consuming interface.
Rationale	Best practice to speed up prototyping.
Verification	Completeness: Not Applicable. Consistency: If provided, verify that the provided examples correspond to the described service. Correctness: Not Applicable.
Examples/Notes	Examples include source code in a given programming language, input and output messages.

ANNEX A – Service descriptions

A.1 Purpose of a service description

A service description provides information about an implemented service. Providers and consumers of information services use a service description to exchange information about the capabilities of a specific implemented service.

A well-formulated service description, built according to the present specifications, enables the unambiguous interpretation of the underlying information exchanges and service design, both inside and outside the European ATM Network context.

From the viewpoint of a **service *consumer***, a service description is essential to obtain information about available services (e.g. in the context of iSWIM implementation). For each service, the consumer can find in the service description the information needed in order to use, or consider using, a service made available. This covers for example aspects such as the behaviour of the service, the information it provides, and any constraint attached to its use. Based on the information provided, a well-formulated service description enables a consumer to compare and assess services in terms of usefulness (e.g. fitness for purpose), usage (e.g. feasibility to implement) and quality.

From the viewpoint of a **service *provider***, a shared service description enables a service to be discoverable within the SWIM environment. Typically, an organisation publishes the service description information through a common registry. This provides an organisation with a means to expose the services it offers. Additionally, a well-defined and standardised way of describing a service might improve efficiency when exploring and comparing new services.

A.2 Use of a service description

Depending on the context of the service consumer (e.g. business, operational or technical) the actual use of the service description may be different.

Typically, the following usage contexts exist:

- Discover a SWIM Service
- Consider using a SWIM Service
    - from business points of view (=assess fitness for business purpose)
    - from operational points of view (=assess fitness for operational purpose)
    - from technical points of view (=assess technical feasibility)
- Implement a consuming client (technical by nature)

To meet the different expectations of service description information, the usage contexts listed above require different types of information about a service. They constitute the drivers for the requirements on the service description provided in this specification.

The usages further described below are informative and are provided in order to highlight the main differences that could occur in terms of the information need of each type of expert using service description information. In reality, the differences explained may be distributed to the expert roles in different ways, depending on the each organisation's internal mode of operations.

A.2.1 Discover SWIM services

In support of business decision-making, experts need to:

- discover and compare services that would meet the business or operational objectives;
- discover and compare services in relation to technical considerations;

- explore service description information to become aware of what the service delivers (e.g. through a SWIM registry);

To enable the above steps, service providers need to:

- provide business information about the service to document service usage conditions;
- provide information about the service to document what the service delivers;

A.2.2 Consider using a SWIM service

Assess fitness for business purpose

In support of operational decision-making, business experts need to:

- evaluate the service in relation to the business objective.

To enable the above steps, service providers need to:

- provide business information about the service

Assess fitness for operational purpose

In support of operational decision-making, operational experts need to:

- understand what the service delivers in relation to the operational context;
- understand how the service works without being overloaded by technology details;
- evaluate the service in relation to the operational goals.

To enable the above steps, service providers need to:

- provide operational information about the service to document the intended operational usage;
- provide information about the service to document what the service delivers in relation to the operational context;
- provide information about how the service works without technology details;

Assess technical feasibility

In support of technical considerations and decision-making, technical experts need to:

- evaluate the service in relation to technical feasibility;
- understand how the service interfaces must be implemented in technical systems in order to use the service

To enable the above steps, service providers need to:

- provide technical information about the service interfaces.

A.2.3 Implement a SWIM service consuming client

In support of technical considerations and decision-making, technical experts need to:

- understand how the service works at the technical level;
- understand how to access the service;
- use machine-readable artefacts in support of prototyping and development;

To enable the above steps, service providers need to:

- provide information which explains how the service works at the technical level;
- provide information about how to access the service;

- provide machine-readable artefacts allowing the service consumer to use the service.

ANNEX B – Conformity Checklist

This annex summarises the requirements to be met when assessing conformity to this specification.

Table 4 lists each requirement in the specification using its identifier and title. It then states the level of implementation to be achieved (see Table 5). In some cases, the implementation is conditional which means that the requirement is to be implemented when the condition applies.

Identifier	Title	Level of Implementation
	General Requirements	
SWIM-SERV-001	Service description coverage	M
SWIM-SERV-002	Service description language	M
SWIM-SERV-003	Define abbreviations and acronyms	M
SWIM-SERV-004	Use standard abbreviations and acronyms	R
SWIM-SERV-005	Service description identification	M
SWIM-SERV-006	Service identification	M
SWIM-SERV-007	Service abstract	M
SWIM-SERV-008	Service provider	M
SWIM-SERV-009	Service categories	M
SWIM-SERV-010	Service standard reference	M
SWIM-SERV-011	Operational needs	M
SWIM-SERV-012	Service functionality	M
SWIM-SERV-013	Service access and usage conditions	M
SWIM-SERV-014	Quality of service	M
SWIM-SERV-015	Technical constraint	R
	Service Interface Requirements	
SWIM-SERV-016	Service interfaces	M
SWIM-SERV-017	Message exchange pattern	M
SWIM-SERV-018	Service profile and interface bindings	M
SWIM-SERV-019	Service interface protocols	M
SWIM-SERV-020	Machine-readable service interface definition	M Conditional
SWIM-SERV-021	Service operations	M
SWIM-SERV-022	Precise description of exchanged information	M
SWIM-SERV-023	AIRM conformance statement	M
SWIM-SERV-024	Filter capabilities	M
SWIM-SERV-025	Service behaviour	M
SWIM-SERV-026	Model view	R

Identifier	Title	Level of Implementation
	Other Requirements	
SWIM-SERV-027	Service validation	M
SWIM-SERV-028	Service monitoring	M Conditional
SWIM-SERV-029	Examples of Code	R

Table 4 – Conformity checklist

Level of Implementation	Operative verb used in the requirement	Meaning
M = Mandatory	**shall**	The requirement must be implemented to achieve the minimum objectives of this specification.
R = Recommended	**should**	The requirement is recommended to be implemented to achieve the best possible implementation of this specification.
O = Optional	**may**	The requirement indicates options.

Table 5 – Level of implementation

ANNEX C – List of Contributors

This specification was prepared by EUROCONTROL with the assistance of the following subject matter experts:

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Table 6 – List of subject matter experts