EUROCONTROL Guidelines for ASM Support Systems Interfaces Implementation

Edition number: 1.0
Edition date: 12/04/2021
Document reference: EUROCONTROL-GUID-185

EUROCONTROL

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DOCUMENT IDENTIFIER : EUROCONTROL-GUID-185

Edition Number	**:**	**1.0**
Edition Date	**:**	**12/04/2021**
Status	**:**	**Released Issue**
Intended for	**:**	**General Public**
Category	**:**	**EUROCONTROL Guidelines**

DOCUMENT CHARACTERISTICS

TITLE		
EUROCONTROL Guidelines for ASM Support Systems Interfaces		
	Publications Reference:	GUID-185
	ISBN Number:	978-2-87497-113-6
Document Identifier	**Edition Number:**	1.0
EUROCONTROL-GUID-185	**Edition Date:**	12/04/2021

Abstract

These Guidelines complement the EUROCONTROL Specification for Airspace Management (ASM) Support System Requirements supporting the ASM processes at local and FAB level Part II – ASM to ASM Systems Interface Requirements and provide guidance to support stakeholders in the implementation of interfaces between ASM Support Systems.

Keywords

ASMtoASM Service	Operational Interfaces	ASM Actors	WSDL
Filtering	Technologies	Information Definition	Information Exchange Mechanism
Publish/Subscribe	Error handling	Service Quality	Documentation

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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

AUTHORITY	NAME AND SIGNATURE	DATE
Director General	 Eamonn BRENNAN	12/4/21

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	25/11/2019	Creation of the document	All
0.2	14/04/2020	Update following internal review	All
0.3	07/09/2020	Update following internal review	All
0.4	04/11/2020	Update following internal review	All
0.5	23/11/2020	Update following internal review	All
0.6	07/12/2020	Update following internal review	All
1.0	12/04/2021	Proposed Issue, following external stakeholder consultation	All

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EXECUTIVE SUMMARY

These EUROCONTROL Guidelines provide implementation guidance to support stakeholders in their effort to implement the necessary interfaces between ASM Support Systems. As such, this document complements the EUROCONTROL Specification for Airspace Management (ASM) Support System Requirements supporting the ASM processes at local and FAB level - Part II – ASM to ASM Systems Interface Requirements [RD 2].

The implementation guidance covers the definition and the implementation of the ASMtoAMS service, the associated technologies, the information definition and the deployment of the operational interfaces.

Guidelines are also provided regarding the functional requirements – publish-subscribe behaviour and filter behaviour, as well as regarding the non-functional requirements – error handling, service quality and documentation.

1. Introduction

1.1 Purpose of the document

These Guidelines complement the EUROCONTROL Specification for Airspace Management (ASM) Support System Requirements supporting the ASM processes at local and FAB level: Part II – ASM to ASM Systems Interface Requirements [RD 2], and provide guidance to support stakeholders in the implementation of interfaces between ASM Support Systems.

1.2 EUROCONTROL Guidelines

EUROCONTROL guidelines, as defined in EUROCONTROL Regulatory and Advisory Framework (ERAF), are advisory materials and contain:

"Any information or provisions for physical characteristic, configuration, material, performance, personnel or procedure, the use of which is recognised as contributing to the establishment and operation of safe and efficient systems and services related to ATM in the EUROCONTROL Member States."

Therefore, the application of EUROCONTROL guidelines document is not mandatory.

In addition, EUROCONTROL Regulatory and Advisory Framework specifies that:

"EUROCONTROL Guidelines may be used, inter alia, to support implementation and operation of ATM systems and services, and to:

- *complement EUROCONTROL Rules and Specifications;*
- *complement ICAO Recommended Practices and Procedures;*
- *complement EC legislation;*
- *indicate harmonisation targets for ATM Procedures;*
- *encourage the application of best practice;*
- *provide detailed procedural information."*

1.3 Use of the document

This document is intended to be read and used by all civil and military ATS Providers in the EUROCONTROL Member States (41) and Comprehensive Agreement States (2).

EUROCONTROL makes no warranty for the information contained in this document, nor does it assume any liability for its completeness or usefulness. Any decision taken on the basis of the information is at the sole responsibility of the user.

1.4 Maintenance of the Guidelines

This EUROCONTROL Guidelines document has been developed under the EUROCONTROL Regulatory and Advisory Framework (ERAF) and is maintained by EUROCONTROL in accordance with this framework and in line with the EUROCONTROL Standards Development Procedures. The procedures are described in detail in Annex A.

1.5 Conventions

The following conventions are used in this EUROCONTROL Guidelines:

1) Guidelines using the operative verb **shall** indicate that they **must be** implemented to achieve the minimum objectives of this guidance material.

2) Guidelines using the operative verb **should** indicate that they are **recommended** to achieve the best possible implementation of this guidance material.

3) Guidelines using the operative verb **may** indicate **options**.

Numbers within square brackets are used to identify reference documents listed in Section 1.8, e.g. [1] identifies the first reference documents of Section 1.8.

Keywords are highlighted in the requirement text using **bold** as shown above.

Every requirement in this EUROCONTROL Guidelines is followed by a structured identifier, which can be used to uniquely reference the requirement/recommendation from associated documents and traceability tools. Such identifiers have the form:

ASM-[yy]-[Fn]-[nnn], where:

ASM stands for ASM Support System requirement.

[yy]: Is a sequence of 2 to 4 characters to identify the environment to which the requirement is referring to;

*Note: In this Guidelines this sequence of characters will be **INTF***

[Fn]: Is a sequence of 2 to 4 characters to identify the functionality of ASM Support System to which the requirement applies.

*Note: In this Guidelines this sequence of characters will be **IMPL***

[nnn]: Is a numeric identifier, for a sequence of requirements with the same **[Fn]** identifier[1].

1.6 Abbreviations and acronyms

Abbreviation	Term
AIRM	ATM Information Reference Model
AIXM	Aeronautical Information Exchange Model
AMQP	Advanced Message Queuing Protocol
ASM	Airspace Management
ATM	Air Traffic Management
ATS	Air Traffic Services
CR	Change Request
EC	European Commission

[1] Requirement numbers are initially allocated incrementally in tens. This aids the subsequent management of this guidelines document allowing new requirements to be inserted between existing requirements whilst maintaining a logical number sequence.

Abbreviation	Term
ERAF	EUROCONTROL Advisory Framework
FAB	Functional Airspace Block
GML	Geographical Markup Language
ICAO	International Civil Aviation Organisation
ID	Identifier
INTF	Interface
IMPL	Implementation
LoA	Letter of Agreement
SWIM	System Wide Information Management
TTL	Time-To-Live
XML	Extensible Markup Language
XSD	XML Schema Definition
WSDL	Web Services Description Language

1.7 Definitions

Term	Definition	Source
airspace management	A planning function with the primary objective of maximising the utilisation of available airspace by dynamic time-sharing and, at times, the segregation of airspace among various categories of airspace users on the basis of short-term needs.	European Route Network Improvement Plan – Part 3 – ASM Handbook
action	A specific permission to interact with a booking via the interfaces offered by this service. Actions may change with time and the state of the booking. Different actions may be performed via the same service operation in which case the modifiable data fields may be restricted by the currently available actions.	-

Term	Definition	Source
activity data	Represents additional system specific data associated with an airspace structure.	-
ASM actors	Human or system that participate in the ASM process	EUROCONTROL Specification for Airspace Management (ASM) System Requirements supporting the ASM processes at local and FAB level Part I - Baseline Requirements [RD 1]
conflict	An overlap, both spatial and temporal, between any of the airspace structures in one airspace reservation (ARES) with any of the airspace structures of another ARES.	EUROCONTROL Specification for Airspace Management (ASM) System Requirements supporting the ASM processes at local and FAB level Part I - Baseline Requirements [RD 1]
client	An application making use of any given service.	-
consumer	A Consumer is the application that receives the messages from the message queue.	RabbitMQ and AMQP Concepts Glossary [RD 4]
external user	Any local/FAB external system and its users that is a client of the ASM to ATC service including other ASM Support Systems	-
Interface binding	Specification of the protocol and data format to be used in transmitting messages defined by the associated interface.	W3C Web Services Glossary [RD 3]

Term	Definition	Source
interoperability	A set of functional, technical and operational properties required of the systems and constituents of the European ATM network and of the procedures for its operation, in order to enable its safe, seamless and efficient operation. Interoperability is achieved by making the systems and constituents compliant with the essential requirements.	European Route Network Improvement Plan – Part 3 – ASM Handbook [RD 5]
procedures	As used in the context of the interoperability Regulation, means a standard method for either the technical or the operational use of systems, in the context of agreed and validated concepts of operation requiring uniform implementation throughout the European ATM network.	European Route Network Improvement Plan – Part 3 – ASM Handbook [RD 5]
producer	A Producer is the application that is sending the messages to the message queue.	RabbitMQ and AMQP Concepts Glossary [RD 4]
proposal	Update to a subset of the reservation data, namely FLs, times, or area. Proposals could be accepted or rejected.	-
synchronous	An interaction is said to be synchronous when the participating agents must be available to receive and process the associated messages from the time the interaction is initiated until all messages are actually received or some failure condition is determined. The exact meaning of "available to receive the message" depends on the characteristics of the participating agents (including the transfer protocol it uses); it may, but does not necessarily, imply tight time synchronization, blocking a thread, etc.	W3C Web Services Glossary [RD 3]

Term	Definition	Source
system	The aggregation of airborne and ground based constituents, as well as space-based equipment, that provides support for air navigation services for all phases of flight.	European Route Network Improvement Plan – Part 3 – The ASM Handbook [RD 5]
topic or subscription topic	A subject to which clients can subscribe to receive related notifications.	-

1.8 Reference material

[RD 1] EUROCONTROL Specification for Airspace Management (ASM) System Requirements supporting the ASM processes at local and FAB level Part I - Baseline Requirements, EUROCONTROL-SPEC-166, dated 26/09/2017. https://www.eurocontrol.int/publication/eurocontrol-specification-airspace-management-asm-support-system-requirements

[RD 2] EUROCONTROL Specification for Airspace Management (ASM) Support System Requirements supporting the ASM processes at local and FAB level: Part II – ASM to ASM Systems Interface Requirements, EUROCONTROL-SPEC-179, dated 13/01/2020 (also referred to as ASMtoASM service specification), https://www.eurocontrol.int/publication/eurocontrol-specification-airspace-management-asm-support-system-requirements

[RD 3] World Wide Web Consortium (W3C) Web Services Glossary (2004), http://www.w3.org/TR/ws-gloss/

[RD 4] RabbitMQ and AMQP glossary and concepts https://www.cloudamqp.com/blog/2017-07-25-RabbitMQ-and-AMQP-concepts-glossary.html

[RD 5] European Route Network Improvement Plan (ERNIP), Part 3, Procedures for Airspace Management - The ASM Handbook – Airspace Management Handbook for the Application of the Concept of the Flexible Use of Airspace, ed. 5.7, dated 18/11/2020, https://www.eurocontrol.int/sites/default/files/2020-11/ernip-part-3-asm-handbook-edition-5-ver-5-7.pdf

1.9 Document structure

The document is structured as follows:

- Section 1 describes the purpose, scope and structure of the document and lists reference documents, explains terms and contains a list of abbreviations.
- Section 2 contains the guidance for the implementation of the ASMtoASM service.
- Section 3 provides implementation guidance on functional requirements.
- Section 4 provides implementation guidance on non-functional requirements.
- Annex A describes the Guidelines update procedure.

2. Implementation guidance

2.1 Definition of the ASMtoASM service

2.1.1 Operational information exchange requirements definition

The implementation of the ASMtoASM service[2] starts with the definition of the applicable operational requirements. Any existing documented requirements need to be reviewed and confirmed as applicable in the context of the information exchange enabled by the ASMtoASM service. The ASMtoASM service specification [RD 2] (Section 2.2 and Annex B) provides detailed description of the aspects that need to be considered when defining the operational requirements.

ASM-INTF-IMPL-010: The implementation of the ASMtoASM service **shall** start with the definition of the operational requirements.

A 'Conformity Checklist' (Annex D) is defined as part of the ASMtoASM service specification [RD 2]. This should be used to ensure the expected level of conformity is achieved by any implementation.

2.1.2 Definition of the ASM actors

The ASMtoASM Service is designed to be used either between two ASM Support Systems or between an ASM Support System and an External ASM User. An External ASM User could be, for example, a mission planning system, or any other system that needs ASM data and information.[3]

The target ASM actors should be identified along with their requirements for this service. Figure 1 shows an ASM system with 3 pre-existing client applications connected to the system via other, non-SWIM interfaces. Of these clients, two consume data that forms part of the ASMtoASM service, thus these two clients are the potential service consumers.

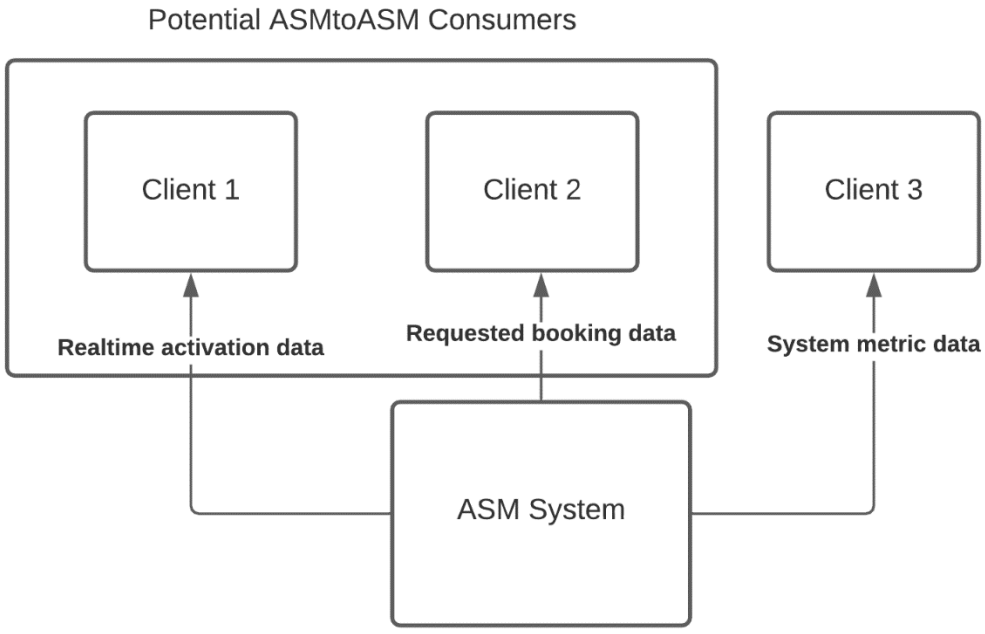

Figure 1 Identification of potential ASMtoASM clients

[2] The full definition of the ASMtoASM Service is provided in Section 2 of the ASMtoASM service specification) [RD 2]

[3] The Guidelines do not include requirements on NM systems. The scope of this Guideline document remains within the scope of the ASMtoASM service specification) [RD 2], as defined in Section 1.3 Scope of the document: "This Specification does not address interfaces requirements of other systems such as NM, NOTAM and FDPS. The NM B2B Airspace Structure Services are already specified in the document NM NOP/B2B Reference Manuals – Airspace Services, Document Reference B2B/Airspace, latest release, and are outside of the scope of this Specification. Requirements for local ASM Support Systems to interface with NM systems are also not addressed in this specification."

2.1.3 Definition of the information exchange mechanism

The ASMtoASM Service supports both a Synchronous Request/Reply mechanism and a Publish/Subscribe Push mechanism. Depending on the ASM actors involved in the implementation the appropriate mechanisms need to be selected. It should be noted that the ASMtoASM service manages subscriptions through a Request/Reply mechanism and so ASM actors requiring only a Publish/Subscribe mechanism will still need to make use of a Request/Reply interface.

Although the service can operate only with the Synchronous Request/Reply mechanism, it is recommended that both mechanisms are implemented in order to ensure timely reception of frequently changing data, thus ensuring information exchange efficiency.

Figure 2 *Identification of required information exchange mechanisms* shows the two potential ASMtoASM service clients for an ASM system. Client 1 requires real-time activation data which can be fulfilled using a Publish/Subscribe mechanism. Client 2 is only interested in the booking data of the ASM system at certain times of day and so it can make use of a Request/Reply mechanism to retrieve the data it requires when it requires it.

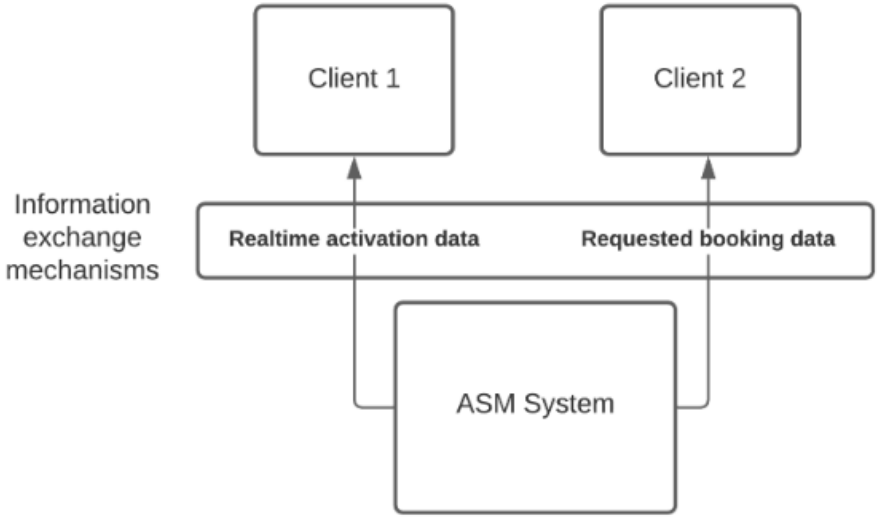

***Figure 2* Identification of required information exchange mechanisms**

2.2 Implementation of ASMtoASM service

The ASMtoASM service is a single overall service, broken down into several different interfaces. Each of these interfaces constitutes a contract that must be respected in order to achieve interoperability. This section outlines the steps required to implement any given interface as defined by the service.

2.2.1 Interface implementation

Each of the interfaces defined in the ASMtoASM service provides the means of exchanging a variety of data and information for different aspects of the ASM process. While there are some data dependencies between these interfaces they can be implemented and, to an extent, consumed independently.

This interdependence does not mean the interfaces cannot be implemented or used independently but more that the data may not be understandable without information from another interface. For instance, choosing to share booking conflict information without sharing any booking information would leave the conflict information unusable whereas the opposite may be appropriate for an application to share.

ASM-INTF-IMPL-020: Each interface **should** be assessed to determine its usefulness and applicability to the end goal for both the provision and consumption of data.

ASM-INTF-IMPL-030: When carrying out the assessment of the interfaces to be implemented, the following activities **shall** be performed:

- Identify the data subject to exchange and the associated interfaces, based on existing LoAs, contracts, etc., as well as the description of the interfaces (ASMtoASM service specification, [RD 2] Section 2.11 Service Behaviour)
- Build an understanding of the purpose and scope of those interfaces
- Analyse the workflows defined in the interfaces and how they correspond to the existing system to identify gaps
- Analyse the inputs and outputs and how they correspond to the existing data in the system to identify gaps
- Analyse how any potential gaps can be filled, where workflows and data in the interfaces and current system may need to be supplemented

To supplement the basic requirement and to further aid interoperability, Section 2.11 Service Behaviour of the ASMtoASM service specification [RD 2] also defines service behaviour examples for each interface outlining simple use cases for each interface. The content of this section will facilitate both the interface selection and implementation.

ASM-INTF-IMPL-040: When implementing any of the ASMtoASM service interfaces the use cases defined in the ASMtoASM service specification, [RD 2], Section 2.11 Service Behaviour **should** be followed as guidance.

ASM-INTF-IMPL-050: Each selected interface **shall** be implemented to conform to the corresponding requirements from the EUROCONTROL ASMtoASM service specification [RD 2].

ASM-INTF-IMPL-060: Interfaces **should** be selected for both provision and consumption of data.

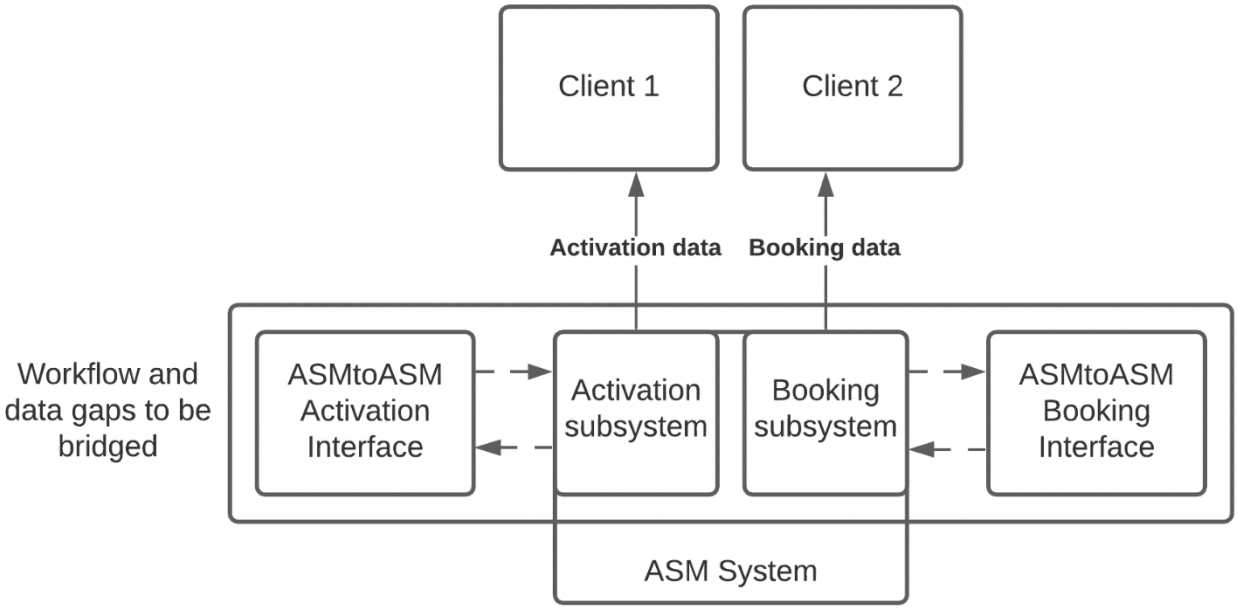

***Figure 3* Identification of appropriate interfaces and gap analysis**

Figure 3 *Identification of appropriate interfaces and gap analysis* shows the ASM system with two clients, one interested in activation data and the other interested in booking data. The ASMtoASM Activation and Booking interfaces have been selected for implementation to serve these clients. In order to implement these interfaces, they must integrate with the existing parts of the ASM System responsible for the activation and booking processes. Any difference in the internal processes and

data models need to be bridged to provide the interface.

2.3 Technologies

The goal of the ASMtoASM service is to enable an ASM Support System to exchange information with other ASM Support Systems and/or External Clients. To be able to do this seamlessly, all the implementations, both servers and clients, must be interoperable. To enable a smooth and efficient implementation it is necessary to build a solid understand of the technology requirements of the interfaces, including identifying any possible conflicts with existing technologies in use. From an overall system point of view, it needs to be determined how the selected interfaces will be incorporated into the existing operational system.

The required technologies, to enable interoperability, are defined by the selected SWIM interface bindings in the ASMtoASM service specification [RD 2], Section 2.5 Technologies, and specified by the ASM-INTF-TIP-010, ASM-INTF-TIP-020 and ASM-INTF-TIP-030.

2.3.1 Web Services Description Language

The Web Services Description Language (WSDL) is used to describe the operations provided by a web service. The ASMtoASM service definition is supplied with a companion WSDL for each of the interfaces. These WSDLs describe the operations as well as the inputs and outputs of the interfaces in exact detail. This allows the generation of interface stubs and data model from the WSDL. Compliance with the WSDL is essential for interoperability.

With the growing use of web services and the WSDL specification, the most widely used high-level programming languages provide support to generate the interface code. This allows either a client or server implementation to be guaranteed to be syntactically compatible with any other implementation. Implementations using such a technology will be able to work entirely with their chosen technology to produce and consume interface messages and exchange them with other clients.

Where code generation technologies are not available, the WSDL will need to be examined and understood in greater detail. The rules defined in the WSDL will need to be respected manually by the developers to ensure interoperability.

ASM-INTF-IMPL-070: Interface implementations **shall** be compliant with the WSDL.

Each of the WSDLs is accompanied by one or more XML Schema Definition (XSD) files which are standard XML schemas. These schemas define the detail of the structure of the inputs and outputs.

ASM-INTF-IMPL-080: Messages exchanged **shall** be compliant with the XML schemas.

2.3.2 Updating the WSDL

A WSDL and its schemas may change over time, whether to introduce new operations or new data types into the existing interfaces.

When using technologies supporting code generation this can be a reasonably straightforward process. Regenerated code can be used to replace the existing code and most incompatible changes will be highlighted automatically.

In cases where code generation is not available this process will require the XSDs to be completely re-evaluated manually to assess whether there are significant changes affecting the syntactic correctness of the system.

2.4 Information Definition

To supplement the WSDL the ASMtoASM service specification provides an 'Information Definition' section (ASMtoASM service specification, [RD 2], Section 2.7 Information definition). This describes the same messages and data structures defined by the WSDL and the XSD schemas but in plain language. This description gives more context to every element in the model to provide a greater understanding of the data being exchanged.

In addition, the Information Definition section highlights elements that are mandatory and those that are optional. It also highlights elements that vary depending on the operation being called, for instance server defined identifiers should never be set when requesting to create a new booking or mission for example.

Supplementing this further, the Information Definition is mapped to the AIRM through a semantic correspondence. This links all elements of the Information Definition to pre-existing elements of the AIRM.

2.5 Deployment of the operational interfaces

The final step of the implementation is the integration of the interfaces with the current system workflows. This requires development of test cases to allow validation of the interface implementation.

ASM-INTF-IMPL-090: Test cases **shall** be developed to test the functioning of the new interfaces and their integration within the rest of the system.

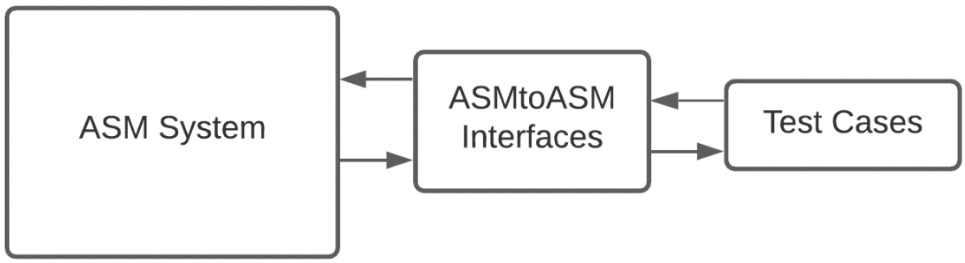

Figure 4 **Interface integration tests**

Once the test and validation activities have been completed successfully, the operational interfaces can be deployed.

Service consumers, the ASM actors originally identified, should be provided with a test platform to allow integration testing to be performed by the consumer, separate from the operational system. This also allows for some validation of the consumer application by the service provider to protect against an application overloading the services.

ASM-INTF-IMPL-100: A test system **should** be deployed to allow service consumers to validate their connections and interoperability.

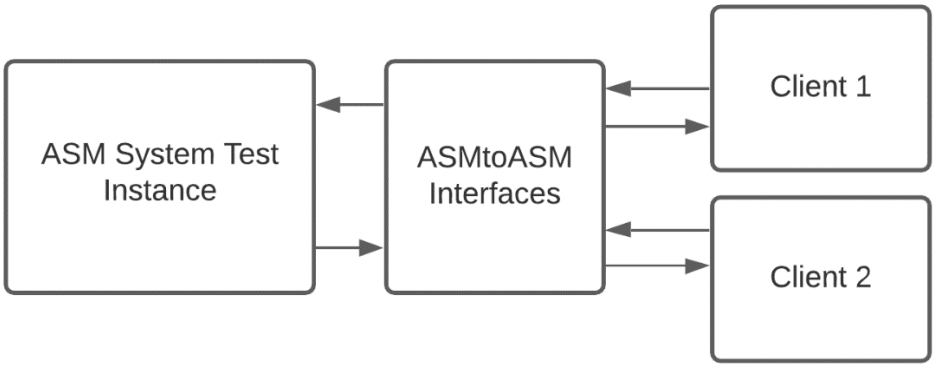

***Figure 5* Client integration tests**

Once these activities have been completed, service consumers can be allowed access to the operational services.

3. Guidance on functional requirements

3.1 Publish/Subscribe Behaviour

Subscriptions are managed through the Request/Reply based SubscriptionManagement interface. This interface is used to establish AMQP message queues which are used to fulfil the Publication interface.

Subscriptions are expected to follow the lifecycle of the client application. On start up a client application is expected to establish the subscriptions it requires, no more than one subscription per topic. The service provider should expect to maintain this subscription until the client deletes it or the client application terminates.

Subscriptions, however, are not expected to be persistent. In the case where the service needs to be taken offline, for maintenance for example, client applications should be expected to re-establish their own subscriptions when they reconnect.

A subscription will always relate to one AMQP message queue. One message queue may be related to more than one subscription belonging to the same client.

3.1.1 Connection Timeouts

The AMQP message broker should be configured to required keep alive messages to be sent by the client. A keep alive timeout of 60 seconds for the message broker should be reasonable in most situations.

AMQP client applications can define their own timeout and could request a shorter timeout interval. This should be discouraged; a very short timeout will demand additional resources from the broker which could be detrimental.

3.1.2 Message Timeouts

AMQP messages have a Time-To-Live (TTL) attribute defining the time in the future that the message will expire. This should be set for all message with a reasonable, relatively small value. Clients not wanting to process messages as soon as they become available should instead make use of the request/reply interfaces to access data when it is required.

Any messages reaching their TTL and expiring should cause all subscriptions linked to the same message queue to be deleted. In such a situation where the client is still available it will detect the deleted message queue and it can re-establish its subscriptions as appropriate and in the same way that it would, should the service go offline for maintenance.

The mechanism to detect message expiry may be dependent upon the AMQP implementation chosen. Some implementations allow for expired messages to be automatically moved to a ‘dead letter’ queue which the producer can monitor. Alternatively, other implementations provide extensive management APIs allowing for expiry to be notified as a message on a management message queue.

3.1.3 Client Acknowledgement

The ASMtoASM service interfaces allow access to potentially critical real-time data, particularly the Airspace Status interface. To be sure of reliable delivery of messages, service providers should encourage the use of the acknowledgement mechanism in the AMQP protocol.

AMQP implementations generally allow for an automatic or a manual acknowledgement process, allowing for the client to potentially perform some, if not all, processing of a message before it is removed from the queue following the manual acknowledgement. This approach should be encouraged so that clients failing to process messages can be disconnected following expiry before they become a problem.

3.1.4 Filtering

Filters may be provided to the ASMtoASM service interfaces when creating a subscription. Filters should be applied when possible to reduce the load on both the service provider and the consumers side.

The AMQP 1.0 protocol provides its own mechanisms for filtering. This mechanism must not be used as it will lead to the expiry of messages through their TTL which should lead to the deletion of subscriptions as described in Paragraph 3.1.2 above.

3.1.5 Publication

Publication of changed data should occur as soon as possible in order to notify clients in a timely manner. Any subscription topics which experience regular significant delays in publication should be documented.

3.2 Filter Behaviour

The ASMtoASM service specification [RD 2] defines a general filtering mechanism and specific filters. The interfaces are specified such that they allow for any filter or combination of them to be applied to any request and any subscription.

This section describes the expected behaviour of each filter regarding each service interface.

This section groups booking data, booking action data and booking conflict data under 'booking data', both actions and conflicts refer to one or more bookings and it is those bookings that should be used when applying filter criteria.

In case filters are not implemented, the complete set of data will be received as provided by the service provider.

3.2.1 AirspaceIDFilter

This filter allows for several airspace identifiers to be defined.

ASM-INTF-IMPL-110: If any one of the following airspace identifiers is found by the filter, the subject **shall** be retained by the AirspaceIDFilter.

- Static Data – Static data messages contain airspace definitions, the identifiers of these should be compared with the filter IDs.
- Activity Data – Each activity data instance references a specific airspace by the airspace identifier, this should be compared with the filter IDs.
- Activation Data – Each activation data instance references the airspace identifier it is for; this identifier should be compared with the filter IDs.
- Booking Data – Each booking instance references one or more airspace; these should be compared with the filter IDs.
- Proposal – The identifiers of the airspace referenced by the proposal should be compared with the filter IDs.
- Mission Data – While missions do not reference bookings in the service model, bookings do reference missions. The airspace identifiers from the bookings referencing the mission data should be compared with the filter IDs.
- Event – There are no links from an event to any airspace. An INVALID_INPUT message should be returned in response to such a filter.

3.2.2 ActivityIDFilter

This filter allows for a number of activity identifiers to be defined.

ASM-INTF-IMPL-120: If any one of the following activity identifiers is found by the filter, the subject **shall** be retained by the ActivityIDFilter.

- Static Data – No activity information is referenced from static data. An INVALID_INPUT message should be returned in response to such a filter.
- Activity Data – No activity information is referenced from activity data. An INVALID_INPUT message should be returned in response to such a filter.
- Activation Data – Each activation instance references several bookings which are causing the activation, these booking IDs should be compared with the filter IDs.
- Booking Data – The booking ID should be compared with the filter IDs.
- Proposal – The proposal ID should be compared with the filter IDs.
- Mission Data – While missions do not reference bookings in the service model, bookings do reference missions. The identifiers from the bookings referencing the mission data should be compared with the filter IDs.
- Event – The event ID should be compared with the filter IDs.

3.2.3 MissionIDFilter

This filter allows for a number of mission identifiers to be defined.

ASM-INTF-IMPL-130: If any one of the following mission identifiers is found by the filter, the subject **shall** be retained by the MissionIDFilter.

- Static Data – No mission information is referenced from static data. An INVALID_INPUT message should be returned in response to such a filter.
- Activity Data – No mission information is referenced from activity data. An INVALID_INPUT message should be returned in response to such a filter.
- Activation Data – Each activation instance references several bookings which are causing the activation, these bookings in turn reference associated missions, these mission IDs should be compared with the filter IDs.
- Booking Data – Each booking may reference several associated missions; these mission IDs should be compared with the filter IDs.
- Proposal – Each proposal instance references a booking which the proposal is for: the IDs of the missions associated to the original booking should be compared with the filter IDs.
- Mission Data – The mission ID should be compared with the filter IDs.
- Event – There are no links from an event to any mission. An INVALID_INPUT message should be returned in response to such a filter.

3.2.4 ChangePeriodFilter

This filter allows for a time period to be defined where both the start and end of the interval are defined.

ASM-INTF-IMPL-140: Any subject that has changed within the defined time interval **shall** be retained by the ChangePeriodFilter.

For all data elements, they should be returned if their definition was last modified within the given change interval.

3.2.5 InterestedIntervalFilter

This filter allows for a time period to be defined where both the start and end of the interval are defined.

ASM-INTF-IMPL-150: Any subject that exists within the defined time interval **shall** be retained by the InterestedIntervalFilter.

- Static Data – The AIXM lifetime should be compared with the filter interval.
- Activity Data – The lifetime of the associated airspace should be compared with the filter interval.
- Activation Data – The intervals defined by activation bands should be compared with the filter interval.
- Booking Data – The booked intervals defined by the booking should be compared with the filter interval, if one interval overlaps the filter interval the booking should be retained.
- Proposal – The booked intervals defined by the proposal should be compared with the filter interval, if one interval overlaps the filter interval the booking should be retained.
- Mission Data – Missions contain no time references. An INVALID_INPUT message should be returned in response to such a filter.
- Event – The event interval defined by its start and end times should be compared with the filter interval.

3.2.6 GeometryFilter

This filter allows for a GML geometry to be defined.

ASM-INTF-IMPL-160: Any subject that overlaps/intersects the defined geometry **shall** be retained by the GeometryFilter.

ASM-INTF-IMPL-170: The GeometryFilter **shall** apply as per the AirspaceID filter, however instead of comparing the referenced airspace IDs it should compare the geometry of the airspace of each applicable data type with that defined in the filter.

4. Guidance on non-functional requirements

4.1 Error Handling

The ASMtoASM service specification provides support for signalling that errors were encountered via the Reply message. This allows for a reply status to be defined with each response. These status codes and their meaning are defined in the specification.

Except for the 'OK' status, the status codes can all be accompanied by optional error messages to describe the problem in more detail. When possible the problematic identifier or field names should be provided in the description to support the client application in resolving the problem.

4.2 Service Quality

The ASMtoASM service specification document outlines several considerations that should be made in terms of service quality. These can be found in section 2.10 of the ASMtoASM service specification [RD 2].

4.3 Documentation

4.3.1 ASMtoASM Conformity

ASM-INTF-IMPL-180: Supporting documentation **shall** be provided covering the following elements:

- Identification of which service interfaces and requirements the system conforms to.
- Identification of any interface operations that have been implemented but do not conform to the ASMtoASM service specification [RD 2].
- Full details of all deviations from the ASMtoASM service specification [RD 2] including details of any elements of the data models that are not supported or additional restrictions that need to be placed on use of the model due to constraints of the ASM support system.
- Any permissions restrictions not managed by the service interfaces, for instance whether clients with read access to the Mission interface can expect to also have write access.

ASM-INTF-IMPL-190: The supporting documentation **shall** be made available to support the integration with any other ASM support system using the ASMtoASM services.

Before starting integration of two ASMtoASM enabled systems this documentation needs to be shared to ensure there are no significant conformity issues that may prevent the integration.

ANNEX A - Guidelines Update Procedures

It is necessary to periodically check this EUROCONTROL Guidelines for consistency with referenced material. The Guidelines is also expected to evolve following real project and field experience, as well as advances in technology.

The main objectives of a regular review are:

a) to improve the quality of the requirements (e.g. clarity, testability, etc.);
b) to verify that the level of detail published is adequate;
c) to ensure that design-oriented requirements, imposing unnecessary constraints to technical solutions, have been avoided;
d) to ensure that advances in technology are properly reflected;
e) to make all stakeholders, including industry, aware of the latest developments.

The update process for this EUROCONTROL Guidelines may be summarised as follows:

Stakeholders may provide change proposals either through existing working arrangements (e.g., established working groups) or by sending a formal Change Request (CR) to the generic email address: standardisation@eurocontrol.int

The CR needs to provide following minimum elements:

- Originator information (name, Organisation, contact details)
- Guidelines title, number and edition date
- Page, chapter, section (subsection) where the issue appears
- Description of the issue and reason for change
- Specific change proposal text (incl. potential alternatives, if any).

Main steps towards a revised version:

- Agency (Standardisation unit) will assess each CR in coordination with content owners, classify the urgency and establish the CR impact category (major, minor or editorial).
- Agency will then prepare resolution proposal(s) and, if needed, discuss those with the originator and/or relevant working arrangements. Note: CR will be grouped into “change packages” to consider reasonable update cycles.
- Agreed changes will be integrated into a revised version “Proposed Issue” including a summarised list of changes.
- Consultation will be performed in accordance with the CR impact category identified:
    - o Major changes need consultation at working layers (e.g., working group or Team)
    - o Editorial changes may be implemented directly at any stage though grouped with change packages.

Note: Identified errors which may cause potential problems when implementing, may be corrected directly via separate “Corrigendum”.

The Agency will apply this process in an objective and impartial way and will consult stakeholders as needed and in line with the formal Standards Development Process.

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