



The European Organisation for Civil Aviation Equipment  
L'Organisation Européenne pour l'Équipement de l'Aviation Civile

## ARRIVAL SEQUENCE SERVICE PERFORMANCE STANDARD

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**ED-254**

June 2018

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## FOREWORD

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## EXECUTIVE SUMMARY

This document specifies the information service design of an Arrival Sequence Service in the context of extended arrival management (AMAN). This standard is based on earlier research and validation performed in the SESAR Programme. The resulting standard builds on the transversal EUROCONTROL SWIM standards [4][5][6]. This EUROCAE Standard together with the EUROCONTROL Specifications is a solid basis to implement SWIM Service instances for the Arrival Sequence Service. Those service instances would be on a very high level of interoperability as they follow common requirements on the business and technical levels.

This document can also be used as a blueprint for the standards of other information service designs. This document has been elaborated by an expert team representing Airports, Airspace Users, ANSPs, EASA, EUROCONTROL, Ground Industry and SJU.

As a starting point, a platform independent approach was taken to describe a service design “logically” to define the interfaces, operations, payloads, etc. of the service without pre-empting any technical solution. At a later stage the focus was on technical service designs, putting the emphasis on aspects related to the so-called SWIM TI Profiles and technical interfaces, such as messaging technology, protocol stack or data elements to be exchanged.

This document contains the standardised service design for the Arrival Sequence Service, which can be taken as a blueprint for further SWIM service standardisation activities.

This standardised service design has been elaborated taking on board the combined expertise of representatives from Airports, Airspace Users, ANSPs, EASA, EUROCONTROL, Ground Industry and SJU.

## CHAPTER 1

### PURPOSE AND SCOPE

#### 1.1 INTRODUCTION AND PURPOSE OF THE DOCUMENT

As a result of ATM modernization programs such as NextGen and SESAR, new concepts for the management of future air traffic needs have been developed.

These concepts are to be realized by the implementation of new technological solutions following an advanced architecture. One of the pillars of this advanced architecture is the introduction of a Service Oriented Architecture (SOA). The key enabler of this new paradigm is the exchange of information between systems via Services. The exchange of information using services is realised via the use of SWIM (System-Wide Information Management).

SWIM is frequently positioned as an enabler that facilitates interoperable information exchange in the European ATM system, in support of many operational improvements identified in the ATM Master Plan.

The definition of SWIM is as follows: “SWIM consists of standards, infrastructure and governance enabling the management of ATM information and its exchange between qualified parties via interoperable services”.

Within the SESAR programme, activities on SWIM have reached a maturity level so that the first SWIM services are ready for standardisation.

In the area of extending the horizon of Arrival management, a relevant SWIM service has been identified, designed and validated. The results of this particular SESAR activity have been used as a candidate to standardise the first SWIM service by a EUROCAE Working Group.

This document is standardising a SWIM Service in the context of the extended AMAN concept. The extended AMAN is a functional component of the Pilot Common Project mandated by Commission Implementing Regulation (EU) No 716/2014. The Service must be deployed in support of AMAN systems at 24 major European airports. In this standard, the mature part of the AMAN concept has been standardised and not the full AMAN concept.

The Implementing Regulation requires the upgrade of existing AMAN to provide connection with cooperative En-Route Air Traffic Service Units (ATSU) to coordinate the actions to be taken by the cooperative ATSUs to make the correct time adjustment to flights under their control, in order to get the best and most efficient arriving flight sequence at the relevant airports based on AMAN arriving planning tool.

One way to implement the necessary coordination between AMAN systems and cooperative ATSUs is to implement a dedicated SWIM service between these entities. The distribution of extended AMAN information (Sequence, TTL, ...) can be done without involvement of FDPS, whereas the AMAN itself which is not part of the current standardisation requires information from FDPS and other systems.

This SWIM service approach has the advantage of being independent of FDP upgrades and could be implemented with less risk than a major critical change in the ATM system that could take a longer time to achieve.

The document at hand is the standardised service description for the “Arrival Sequence Service”. This first SWIM Arrival Sequence Service Standard can be re-used as a blueprint for standardisation of other SWIM services in the future.

This service standard document is intended to constrain also the technical implementation of service interfaces providing and consuming arrival information in the context of the AMAN extended horizon, using SWIM. In this context the involved systems are e.g. AMAN-systems, FDPS (Flight Data Processing Systems), Controller Working Positions.

Consequently, it aims to address readers involved in change management processes or IT-projects to adapt those systems to be able to exchange Arrival Sequence information via SWIM in a standardised way.

This includes e.g. software engineers, software designer, system-engineers but also product managers of AMAN systems.

This document constitutes the normative deliverable that describes the performance standards of the Arrival Sequence Service. However, WG-104 produced a service model in UML format in order to complement the information included in this document. This service model deliverable should be seen as complementary, informative and non-normative. It should be noted that in case of misalignment between the normative and informative content, the normative content precedes.

## 1.2 SCOPE OF THE DOCUMENT

### 1.2.1 Concept summary

In order to optimize inbound traffic flows at major hubs, arrival flights will be managed well before the top of descent. The consequence is that metering and sequencing activities need to be shared between several ATS units and will start in the En-Route phase when flights are cruising.

This will allow absorbing tactical delay in line at a much higher altitude than the current holding or radar vectoring within the TMAs, and thus saving fuel and reducing CO2 emissions for Airspace Users.

When an Arrival Manager (AMAN) is available at an airport, its horizon is at present usually limited to the geographical scope of the terminal control centre. It is implicating that the view is not always time symmetrical from the runway and somehow blind at what's happening further out.

These shortfalls will be overcome by:

- Expanding the planning horizon of AMAN systems up to 200NM in order to include the economical Top of Descent (ToD).
- Providing Upstream ATS units with Arrival Management Information and so allowing cross border (be it system border, ATS unit border, ANSP border, State or Regional organization border) activities.

The provision of Arrival Information from Downstream ATSU to Upstream ATSU is communicated via SWIM for the pre-sequencing of the arrival stream.

The Arrival Information Management Service is derived from SESAR Solution pack - Extended Arrival Management (AMAN) Horizon [1].

Two main recipients for Arrival Sequence information are addressed:

- A stakeholder ATSU controlling a flight to the TMA in view of the AMAN implementation;
- A satellite airport which is a "nearby" airport having a departing flight to the concerned destination airport.

### 1.2.2 Operational requirements

The scope of this ED document is exposed in the following figure. The arrows "10 Arrival Management Information" and "50 Arrival Management Information" are representing the information flows addressed by this standard, starting from the Arrival Management System providing sequence information in the context of extended horizon to upstream ATSUs and/or to a Satellite Airport.

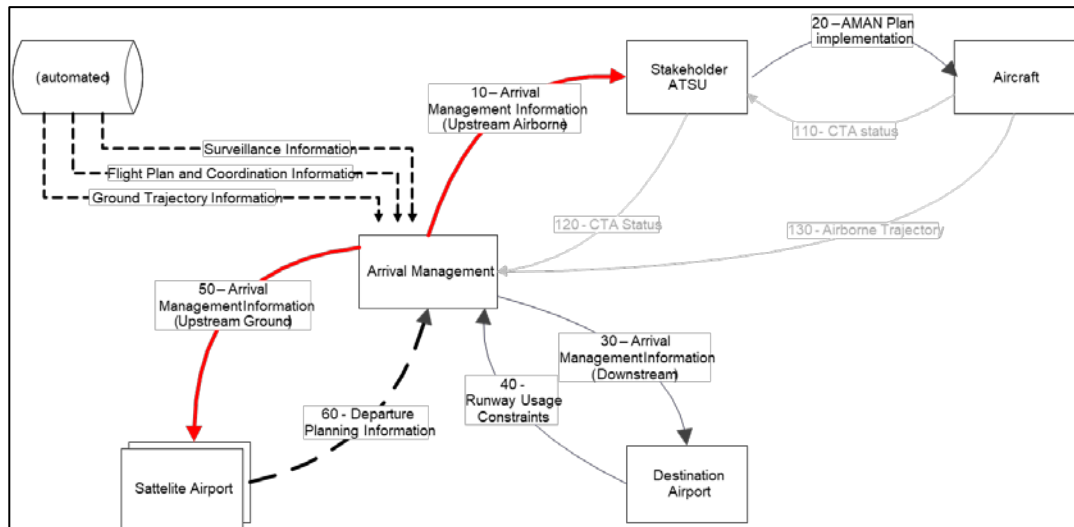


**FIGURE 1: SCOPE OF THE STANDARD**

In order to better understand the scope of the standard, the OSED operational requirements are listed below for reference purposes.

**REQ-05.06.04-OSED-0028.0070**

The system<sup>1</sup> may allow a downstream ATSU to provide the neighbouring upstream ATSUs with the level of arrival delay (Local implementation choice).

**REQ-05.06.04-OSED-0028.0240**

The system shall support a delay sharing according to the local working methods and agreements.

**NOTE:** *The delay sharing may consist in an apportionment of Arrival Management delay before/after metering point and or across individual sectors or units prior to the metering point.*

**REQ-05.06.04-OSED-0028.0250**

For every aircraft within the EH, the system shall calculate:

- APTO for the relevant metering point based on back calculation from the APTT<sup>2</sup>, delay sharing strategy (before/after the metering point) including runway planned over delivery (if employed).
- A delay at the metering point (calculated as the difference between the APTO and the ground system estimated time over the metering point).

Time/Delay advisories at metering point shall be derived from Time/Delay at runway including the optimised sequence order and delay sharing parameters.

**REQ-05.06.04-OSED-0028.0540**

The extension of the horizons beyond ATS AOR borders will require the capability to transmit sequence advisories (as described in requirements 0240) to en-route sectors concerned with an earlier stage of flight (or at a greater distance from the runway).

**REQ-05.06.04-OSED-0028.0550**

Appropriate two-way ground-ground coordination of information is needed over the extended Arrival Management area.

**NOTE:** *Ground-ground coordination of information: need for downstream unit coordinating with the upstream units, sending elements such as TTL/TTG/Sequence Number.*

<sup>1</sup> The "system" stands for AMAN System.

<sup>2</sup> Handled within this document as the AMAN Target Landing Time (ATLDT)

**REQ-05.06.04-OSD-0028.0260**

Based on the arrival management system computation, the concerned ATCOs shall be provided, as a minimum, with the following AMAN advisories:

- TTL/TTG at RWY and/or at MP

Optionally, where relevant, additional advisories and/or information may be considered, such as:

- Sequence Order
- Planned APTO/APTT
- Speed
- Route
- TOD.

**1.3 STRUCTURE OF THE DOCUMENT**

Chapter 1 provides an explanation of the scope and purpose of this document and introduces the SWIM Arrival Sequence Service.

Chapter 2 describes the approach and methodology aspects applied for the development of this Performance Standard.

Chapter 3 describes the minimum Service requirements (including non-functional requirements) needed for the service to support the operating concept in the applicable context.

Chapter 4 describes the Data Catalogue resulting from the logical service model payload.

Chapter 5 introduces the test procedures to verify the service performance.

APPENDIX A exposes implementation guidelines and examples for implementing an Arrival Sequence Service.

APPENDIX B contains the list of acronyms and the glossary of terms.

APPENDIX C explains how the data catalogue used in the Arrival Sequence Service standard satisfies the requirements of the EUROCONTROL Specification for SWIM Information Definition.

APPENDIX D shows the membership of the EUROCAE working group WG-104.

The form at the end of the document can be used as an Improvement Suggestion Form.

**1.4 REFERENCES**

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[13] ICAO Doc 4444 Air Traffic Management

[14] ICAO Doc 9965 Manual On Flight And Flow Information For Collaborative Environment

## CHAPTER 2

### APPROACH AND METHODOLOGY

#### 2.1 DOCUMENT DEVELOPMENT PROCESS

This document was developed using a process that is top-down in nature with an initial focus on the analysis of an existing operational context where the Arrival Sequence service is to be applied. Operational expertise is required to assess the operational aspects which are relevant for the subsequent steps.

Then the process moves from the operational perspective to a service-oriented one. Therefore expertise from service architects and designers are required to fully define the Arrival Sequence service and derive the list of requirements that constitute the main output of this standard document.

It is critical that all key experts are involved in all steps of the process, to ensure overall consistency and coherence of the work and material.

#### 2.2 METHODOLOGY

The definition of the operational concept (and its consequent validation, if applicable) is not within scope of this document. It is assumed that the operational needs which the Arrival Sequence Service aims to address have been defined prior to this standardisation activity.

Through the analysis of the operational context, Information Exchange Requirements (IER<sup>3</sup>) have been developed as a basis for the Arrival Sequence Service.

This work has been undertaken by the SESAR Project 5.6.4 and culminated in the definition of an OSED [3] which includes operational scenarios as well as the relevant IERs.

The operational experts of EUROCAE WG-104 have assessed the aspects of the OSED that are relevant for the subsequent steps of the process, including the operational actors, use cases, information exchanges and elements, and if possible, non-functional requirements related to safety or performance.

The overall method is composed of several steps that are to be performed in sequence. These steps are described in the following sections.

##### 2.2.1 Analysis of the operational context and Information Exchanges

The starting point for this process is the analysis of the operational context provided in section 1.2, using the use case “Long Range Cross-Border AMAN in En-Route Sectors” identified from the Operational Scenario 9 of SESAR deliverable P5.6.7 D15 “Update of P5.6.4 OSED – Step 1” [3].

The relevant part of the OSED has been partially reproduced in this document to provide the reader with context necessary to fully understand this document.

The output of this step is the identification of the subset of Information Exchange Requirements (IERs) of the OSED that are applicable to this particular use case. The IERs depict the source and target of the flow from a conceptual point of view, along with the attached elements. The complete list of the Information Exchange Requirements and Information Elements is provided and explained in the section 3.5.

##### 2.2.2 Definition of Service

The list of relevant Information Exchange Requirements is used as basis for the definition of the service from a logical/conceptual perspective. The roles of the service are identified (provider and consumer), as well as the interfaces, operations and payload.

The other relevant input for this step is the ArrivalManagementInformation Service Description Document (SDD) [2] produced by SESAR P08.03.10, which includes a logical service model provided within the Information Service Reference Model (ISRM).

---

<sup>3</sup> The IER have been taken from the OSED ‘as-is’. No IERs have been added.

This SDD contains the logical service design of the Arrival Sequence Service based on the aforementioned OSED.

The content of the SDD has been assessed by the operational and service experts for the purpose of elaborating this standard. New elements have been added where needed.

The outcome of this exercise was provided in the Unified Modelling Language (UML) format (also called the UML model of the Arrival Sequence Service). It is needed to be noted, that the provided UML model is just a supporting artefact for a better understanding of the service design. The relevant outputs of EUROCAE WG-104 are the service requirements provided within CHAPTER 3 of this document together with the data catalogue (CHAPTER 4).

As a starting point, a platform independent approach was taken to describe a service design “logically” to define the Interfaces, operations, payloads, etc. of the service without pre-empting any technical solution. At a later stage the focus was on the technical service design, putting the emphasis on aspects related to the so-called SWIM TI Profiles and technical interfaces, such as messaging technology, protocol stack or data elements to be exchanged. At this stage additional industrial stakeholders have been involved.

It is particularly important to highlight that the technical service design inevitably implies decisions regarding the concrete implementation of the service.

However, the intention of this document is not to impose a particular technical option, and not limit the providers' technical implementation options.

On the other hand, it was judged that providing only an empty template would decrease the value of this document. For this reason, it was decided to provide implementation guidelines and examples of machine-readable artefacts.

The potential providers of the service are free to choose the implementation they desire, as long as they comply with the SWIM TI Yellow Profile.

### 2.2.3 Identification of Service Requirements

As result of the previous steps, a minimum set of requirements has been identified. It includes on one hand the functional requirements that the Arrival Sequence Service should address in order to effectively answer the operational needs; and on the other hand, the non-functional requirements needed to guarantee a minimum level of performance in terms of safety, security, availability, response time, etc. as part of the overall quality of service.

## 2.3 SERVICE VALIDATION

Service providers claiming to have developed service instances which comply with the standard at hand need to demonstrate this towards the consumers of the service instance.

This can be achieved by verifying that the service formally fulfils the requirements of this standard and/or by validating or testing activities, which prove whether the expected behaviour and outcome of the service is achieved.

It is not in the remit of the standard at hand to define by which methods and means this will be done and which organisations or roles are involved. Nonetheless, every service requirement includes an indication on an appropriate method to prove whether the requirement has been met.

## CHAPTER 3

### SERVICE REQUIREMENTS

#### 3.1 INTRODUCTION

This chapter is containing the requirements to follow for the implementation of the ArrivalSequence Service. Those requirements are extracts from the relevant OSED [3] including also Non-Functional Requirements.

#### 3.2 ASSUMPTIONS

##### Pilot feedback on advisories implementation

When AMAN generates a Target Time Over (TTO) constraint at the Metering Point, the advisory information shall be passed to the flight crew of the aircraft (having in mind that the information flow is from the AMAN to the respective upstream-controller to the aircraft). The TTO is not a clearance but the pilots are expected to determine whether their aircraft trajectory is likely to change in order to comply with their TTO.

The current operational concept does not justify any pilot direct feedback, but an indirect feedback is ensured via AMAN interfaces with Surveillance Systems and FDPS. That Trajectory Prediction feedback loop will be improved with the introduction of I4D/CTA concepts enabling the Airborne Trajectory sharing between the Aircraft and the Ground Systems.

#### 3.3 EXCLUSIONS

Following the scope explained within chapter 1, the following information flows are excluded:

- Sequence and Arrival planning information from AMAN to downstream stakeholders.
- Any information received as input to the AMAN, e.g. Runway Usage Constraints from Destination Airport and Departure Planning Information from Satellite Airports to AMAN.
- The two-way ground-ground operational coordination (the only information coming from the upstream ATSUs to the Arrival Sequence service provider is regarding the status of the service, e.g. to communicate technical malfunctions or data validation related problems).

#### 3.4 RELEVANT STANDARDS AND SPECIFICATIONS

The EUROCAE Arrival Sequence Service standard at hand was created in alignment with the following specifications:

- EUROCONTROL Specification for SWIM Service Description, edition 1.0 [4]
- EUROCONTROL Specification for SWIM Information Definition, edition 1.0 [6]
- EUROCONTROL Specification for SWIM TI Yellow Profile, edition 1.0 [5].

#### 3.5 INFORMATION EXCHANGE REQUIREMENTS

The information exchange requirements (IER) for the ArrivalSequence Service have been extracted ('unchanged', nor adding any IERs) from the SESAR P5.6.7 D15 OSED (only the subset relevant for the Operational Scenario #9).

Concerning the operational context identified in section 1.2, the Information Exchange Requirements are listed below:

**TABLE 1: INFORMATION EXCHANGE REQUIREMENTS**

| SESAR Identifier         | Name                              | Issuer             | Intended Addressees | Information Element                        |
|--------------------------|-----------------------------------|--------------------|---------------------|--------------------------------------------|
| IER-5.6.4-IERS-0032-0010 | Arrival Management Information_US | Arrival Management | Stakeholder ATSU    | Arrival Management Information (see below) |

## 3.5.1

## Information Elements

TABLE 2: INFORMATION ELEMENTS

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SESAR Identifier</b> | IE-5.6.4-0032-0032                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Name</b>             | Arrival Management Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b>      | Information Record for a given flight subject to Arrival Management, as issued by the AMAN support tool                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Properties</b>       | <p>Contents of the record depend on the Information Exchange in question. I.e. 'required' items must always be present, whereas "optional" items can be omitted if not mandated for the operational purpose of a given Information Exchange</p> <p>Required</p> <ul style="list-style-type: none"> <li>Identifier (e.g. ARCID, ADEP, ADES, EOBT, &lt;EOBD&gt;) - ICAO defined</li> </ul> <p>Optional (Depends on local implementation)</p> <ul style="list-style-type: none"> <li>AMAN Planned Threshold Time (APTT)<sup>4</sup></li> <li>Runway assigned to flight</li> <li>Sequence Number</li> <li>Arrival Delay (Global)</li> <li>Delay Share assigned to recipient</li> <li>Time and delay at metering fix and other designated points on the trajectory</li> <li>Advisories (e.g. TTL/TTG, speed advisory, route advisory...) proposed by AMAN</li> <li>Aircraft performance characteristics (e.g. type of aircraft, wake turbulence category...)</li> <li>AMAN handling indicators</li> <li>Miles to fly to threshold</li> </ul> |
| <b>Value range</b>      | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Comments</b>         | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|                         |                                                                                                                                                                                                            |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SESAR Identifier</b> | IE-5.6.4-0032-0032                                                                                                                                                                                         |
| <b>Name</b>             | AMAN Planned Threshold Time                                                                                                                                                                                |
| <b>Description</b>      | <p>The time, calculated by the Arrival Manager tool, at which the aircraft is planned to cross the runway threshold</p> <p>This is also the landing time shown to the Controller on the AMAN timeline.</p> |
| <b>Properties</b>       | Runway / runway direction the time refers to. Defined by ICAO (see AIRM).                                                                                                                                  |
| <b>Value range</b>      | -                                                                                                                                                                                                          |
| <b>Comments</b>         | -                                                                                                                                                                                                          |

|                         |                          |
|-------------------------|--------------------------|
| <b>SESAR Identifier</b> | IE-5.6.4-0032-0032-PR001 |
| <b>Name</b>             | Sequence Number          |

<sup>4</sup> Within this document this will be handled as the AMAN Target Landing Time (ATLDT).

|                    |                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------|
| <b>Description</b> | The ordinal number describing the position of a flight in the temporal sequence of threshold crossings. |
| <b>Properties</b>  | -                                                                                                       |
| <b>Value range</b> | Integer > 0                                                                                             |
| <b>Comments</b>    | -                                                                                                       |

|                         |                                                                                                                                                                                                    |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SESAR Identifier</b> | IE-5.6.4-0032-0032-PR002                                                                                                                                                                           |
| <b>Name</b>             | Arrival Delay                                                                                                                                                                                      |
| <b>Description</b>      | For the purposes of the EXE-695, defined as the difference between time APTT and ETA as per the flight plan instance maintained by the flight data processing system used by the Sequence Manager. |
| <b>Properties</b>       | -                                                                                                                                                                                                  |
| <b>Value range</b>      | Numeric                                                                                                                                                                                            |
| <b>Comments</b>         | -                                                                                                                                                                                                  |

|                         |                                                                                                                                                                                  |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SESAR Identifier</b> | IE-5.6.4-0032-0024                                                                                                                                                               |
| <b>Name</b>             | Time To Gain / Time to Lose                                                                                                                                                      |
| <b>Description</b>      | An arrival management advisory in form of the amount of time that a flight is supposed to lose or gain to arrive at the Metering Fix to land at the AMAN planned threshold time. |
| <b>Properties</b>       | Metering Point the advisory refers to.                                                                                                                                           |
| <b>Value range</b>      | -                                                                                                                                                                                |
| <b>Comments</b>         | Abbreviation: TTL/TTG<br>Notice that this definition is aligned with ADEXP.                                                                                                      |

### 3.5.2

#### Non-Functional-Requirements

The Information Exchange Requirements identified above have the interaction rules and policies listed below (representing the Non-Functional-Requirements on the operational level):

**TABLE 3: NON-FUNCTIONAL REQUIREMENTS**

| SESAR Identifier         | Data                              | Interaction Type | Frequency                                                         | Maximum Time of Delivery                                     | Confidentiality | Safety Criticality |
|--------------------------|-----------------------------------|------------------|-------------------------------------------------------------------|--------------------------------------------------------------|-----------------|--------------------|
| IER-5.6.4-IERS-0032-0010 | Arrival Management Information_US | <One-way>        | Ad hoc (at each recalculation with significant impact of STA/STO) | < 1 s (Approach center, airport)<br>< 10 s (En-Route center) | <restricted>    | <minor>            |

### 3.6 SERVICE DESIGN

**NOTE:** *All nomenclature used in the Requirements hereafter is for reference purpose only. The names used are not imposed to the implementation of the service, i.e. other names of the service elements can be chosen. Any requirement on a specific naming of an implementation artefact to be stated explicitly.*

#### 3.6.1 Design decisions

##### 3.6.1.1 Service behaviour and non-functional requirements

###### Error Handling

Error handling is about describing the behaviour of a system or interface if there are technical problems.

Standardisation of error handling is indispensable to ensure interoperability of implementations. It does not mean full automation (not relying on safeguards only). For E-AMAN, a modest approach is recommended.

The logical service design has been enriched to implement error handling on the semantic level.

Nevertheless, the error handling is also linked to the technology that is used. A requirement on the technology was added to ensure that the used technology supports error handling in the subscription process.

###### Subscription / Un-subscription mechanisms

The service consumer shall be able to determine by a filtering mechanism which parts of the available sequence information it will subscribe to. The SWIM service standard at hand exposes only those filters which have to be implemented by the service provider. Additional filtering by the consumer is in the remit of the service consumer and not addressed by this standard.

The standard at hand does not presume, that a specific state model for the subscription is implemented by the provider (e.g. pausing of subscriptions, resuming of subscriptions, etc.).

As a minimum, the service provider has to implement a subscription mechanism, which allows to subscribe once per service consumer.

**NOTE:** *In accordance with ICAO Doc 10039 (Manual on System Wide Information Management Concept), the Service Provider and Consumer roles are in general applicable to organizations, person and applications. At technical view, these roles are played by SWIM enabled applications which consume or provide SWIM services using SWIM standards.*

*In the context of this standard, the term "service consumer" is intended as an Application which is provided (by the organization providing the service – name hereafter "Provider") with adequate mechanisms that allow it to be identified and authorized to consume the service. It is up to the Provider to define its preferred "policy" for allowing access to "service consumers". The "Provider" may allow or not multiple applications operated by the same organization to consume the service at the same time.*

*So, as an example, on the basis of the information included in a proper certificate, the "Provider" may allow service access per consumer's "System" (such that only one application within a given system will be able to consume the service) or may allow access per consumer applications (i.e. granting access to specific applications within a consumer's system) etc...*

*The term "Subscriber" has to be intended as a synonym of "Service Consumer" as it refers to a "Service Consumer" consuming a service (or a part of a service) which is provided through a publish/subscribe Message Exchange Pattern (MEP).*

## 3.6.1.2

Payload Design Considerations and DecisionsThe AMAN Strategy

Definition: The name of the set of operational rules and procedures underlying the AMAN tool optimization algorithm. The strategy implements the trade-off between the goals of equity, high throughput and trajectory efficiency, which was agreed between the stakeholders.

- The definition clearly suggests that the strategy would be set at the level of the sequence as a whole.
- At this level, the “AMAN Strategy” is closely related to the parameters that are used to configure the AMAN optimization algorithm, such as flow rate, spacing or set of TMA procedures applicable.
- This set of parameters would be subject to change, and could be defined in advance, and for a certain period of time.
- It could also consist of a variety of parameters that change on different time scales, e.g. a procedure set might be applicable during certain fixed times (noise abatement procedures...), while the flow rate could be set depending in traffic demand, and tactically be modified to account for any changes in the meteorological conditions.
- For a given flight, the AMAN would provide information on the set of parameters which applied for sequencing it.

These considerations led to the payload design captured in the current work model. It features

- A generic notion of “AMAN Strategy Identifier”. This was understood as a designator of a specific parameter setting for an AMAN optimizer input, e.g. an active runway configuration or a standard value of the flow rate.
- A “Time Sheet” structure at arrival sequence level i.e. a full data structure instance could be as described below:

**TABLE 4: AMAN STRATEGIES**

| StrategyIdentifier | Implied value     | startTime | endTime |
|--------------------|-------------------|-----------|---------|
| ConfigEast_1       | 25L-A/25C-M/25R-A | 0600      | 0700    |
| Flow_1             | A40/D10           | 0600      | 0800    |
| Flow_2             | A30/D30           | 0800      | 1000    |
| ConfigEast_2       | 25L-A/25C-D/25R-A | 0700      | 0900    |

- A list of the strategy parameters applied for a given flight. I.e. in the above example, a given flight with an AMANPlannedThresholdTime of 0830 would be annotated with the identifier set “Flow\_2/ConfigEast\_2”. A non-sequenced flight would be annotated with an empty instance of “FlightAMANStrategy”.

Flight Identification

Service consumers need to be able to correlate the sequence information with flight information from other services or systems, such as the FDPS. Therefore, a common identifier for flights is needed.

The payload descriptions of this service does not prescribe which data items shall be used as a common identifier to correlate flights between systems, as this is depending on local conditions. For the purpose of flight identification/correlation, since there are several alternatives conceivable, the following conditions have been set:

- The service shall be able to transmit the ARC ID (Aircraft Identifier), EOBT (Estimated Off Block Time), ADEP (Departure Aerodrome), ADES (Destination Aerodrome), EOBD (Estimated Off Block Date)
- The service shall be able to transmit a unique technical identifier created by the AMAN System (i.e. using an AMAN system generated unique internal flight identifier also external to the AMAN).
- If feasible, the service shall be able to transmit an IFPL ID in addition.

- d. If feasible, the service shall be able to transmit a GUF1 in addition.<sup>5</sup>
- e. If feasible, the service may transmit a MODE-S identification.

Arrival Delay versus Delay at point versus TTL

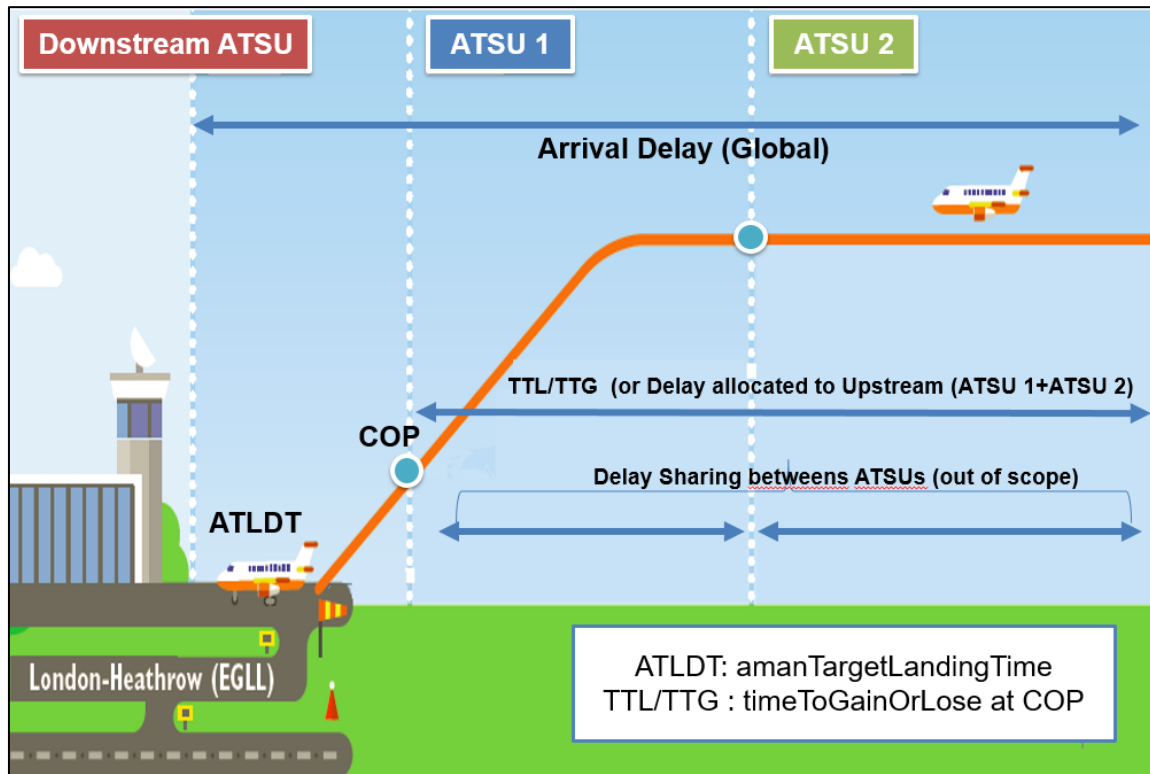


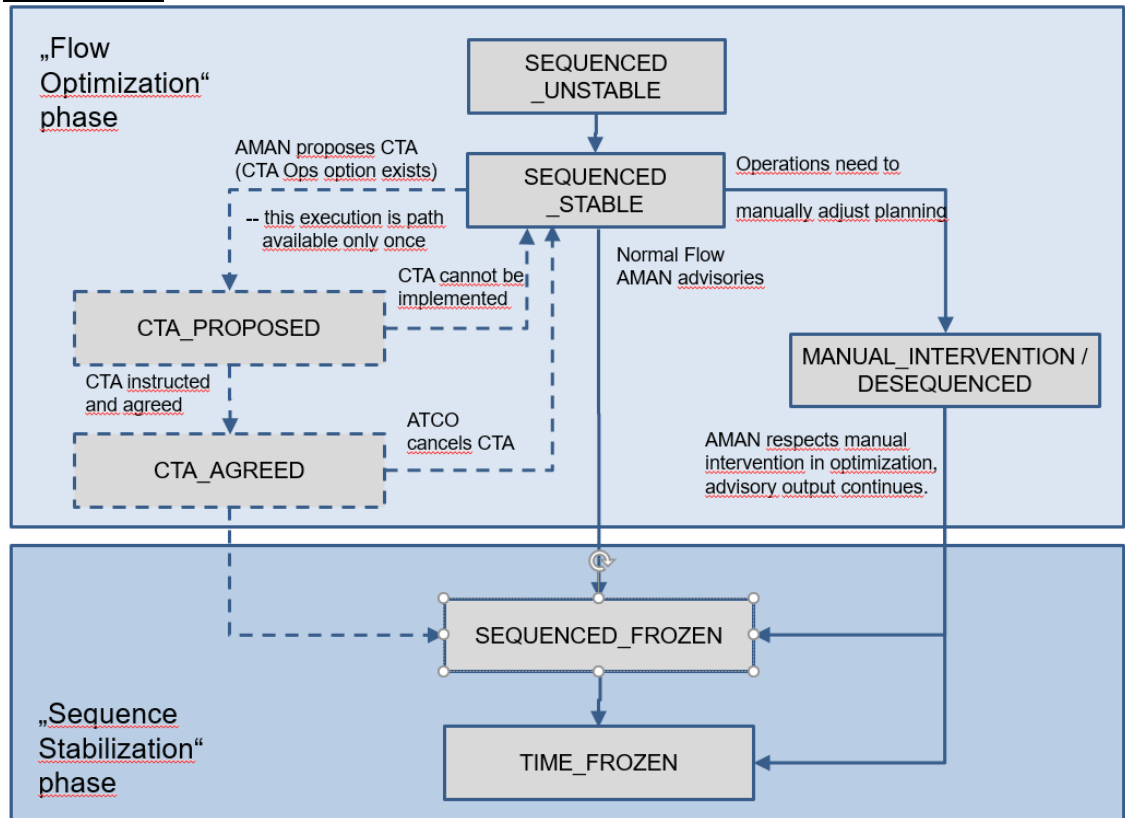
**FIGURE 2: DELAY AT POINT AND TTL**

For standardisation purposes it is crucial to reach a common understanding between the involved parties on the semantics of the different notions of delay. For a better understanding, some explanations are given here.

- The Arrival Delay refers to the landing threshold point and represents the difference between times ATLDT (i.e. time over landing threshold point calculated by the AMAN) and ETA (as per the latest available flight plan of the AMAN ATSU's FDPS).
- The Delay at Point is an AMAN requested total delay in seconds to be achieved at COP (in this example).
- The TTL is an advisory to an upstream ATSU to have absorbed a portion or the whole delay before reaching COP (in this example). It is provided in minutes.

As the principles of delay sharing have not been commonly agreed by the time of creating this document, this standard does not directly address these features. However, even without delay sharing the TTL can be just a portion of the whole Delay at Point as another portion can be absorbed within the TMA.

<sup>5</sup> For further information on the data items, please refer to the payload descriptions in chapter 4.

AMAN StatusFIGURE 3: AMAN STATUS<sup>6</sup>**(A) Normal Flow**

The “Normal Flow” starts with the sequence status “SEQUENCED\_UNSTABLE”, which indicates that the flight in view is pre-sequenced, but the information is not yet stable enough to act on the flight. The “SEQUENCED\_STABLE” status indicates that the sequence information on the flight in view is stable enough to act on the flight. When the flight is “SEQUENCED\_FROZEN”, the position within the sequence will not be altered anymore automatically by the AMAN system. With the status “TIME\_FROZEN”, the “APTT” of the flight will no longer be optimised automatically by the AMAN system. Any change of a status will trigger the generation of a new message to be submitted to the subscribers of the service.

**(B) CTA Stati**

This Status is for future use and not in the main focus of the standard at hand.

For CTA (Controlled Time of Arrival) operated airports, the AMAN algorithm will have to treat the CTA (please note that the CTA itself is not part of the Arrival Sequence Service Performance Standard) as a binding planning constraint. So it is key for the AMAN to also be able drop the constraint if it is not actually established or cancelled, because planning a sequence with a constraint that is non-existent is bound to result in a non-optimal sequence.

Therefore, doing E-AMAN operations in conjunction with CTA operations will require a back channel from upstream. The backchannel can be established via the Flight Object that at the time of establishing the CTA would be under control of upstream.

Which is to say that an AMAN claiming support for E-AMAN using CTA should implement two statuses (CTA\_PROPOSED and CTA\_AGREED), as the operational concept requires them.

<sup>6</sup> Detailed information on the above mentioned status fields can be found within the chapter on the data catalogue.

### (C) Manual intervention

Fundamentally the transition to MANUAL\_INTERVENTION says that someone downstream has entered an ad-hoc planning constraint or constraint change (including de-sequencing) on a flight that is in the STABLE part of the Arrival Sequence.

The output sequence may reflect this. For example, swapping the desired arrival order of two flights A and B (for whatever operational reason) could result in the AMAN suddenly proposing a speed advisory for flight B instead of A.

What an upstream ATCO will see is an abrupt change of an allegedly “STABLE” sequence, and/or “jumping” advisories. Therefore situational awareness and trustworthiness of the AMAN output requires that this behaviour be flagged as operationally valid. Therefore it is suggested to use a state engine reflecting this.

#### 3.6.1.3

#### Technical Service Design Recommendations

##### Service Interface Bindings

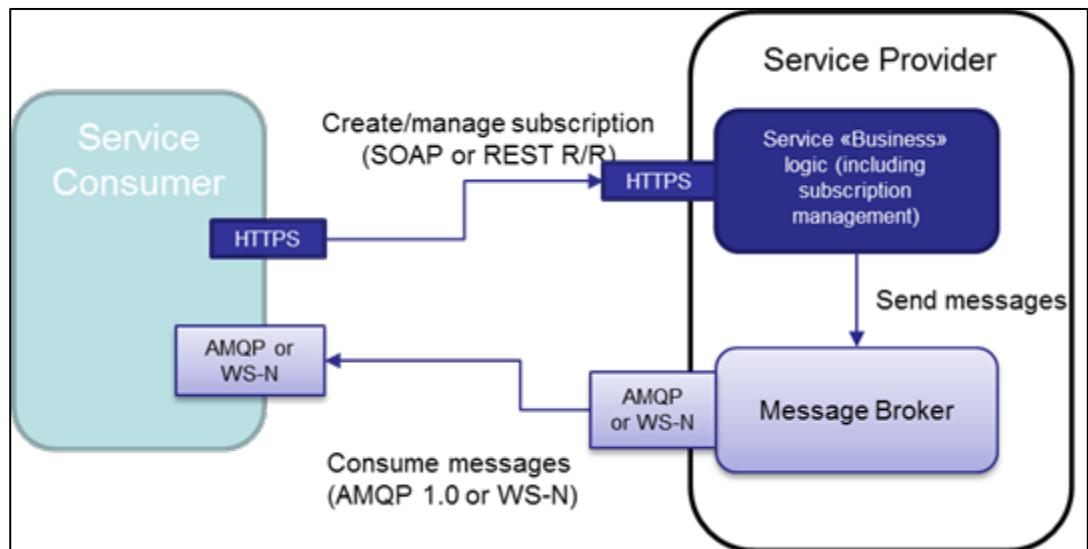


**FIGURE 4: DIFFERENT BINDINGS FOR SUBSCRIPTION AND PUBLICATION<sup>7</sup>**

For the management of the subscription a Request/Reply interface is recommended. This provides the ability to specify filtering conditions. The subscription interface can be implemented using a SOAP or HTTP (i.e. REST) “service binding” (as defined in [5]).

The publication of the sequence data can be realised using an AMQP or WS-N (Web Service Notification) binding (as defined in [5]).

The Rationale behind the choices highlighted before are the following:

- The Arrival Sequence service foresees the capability (for the Consumer) to indicate at subscription time a fairly rich set of filters that will later on, influence the content of the messages that the Provider will need to send to the Consumer (e.g. the Provider will send in the ArrivalSequence only “entries” that satisfy a given condition). Filtering is expected to be performed by the Provider side. This implies that there will need to be a 1 to 1 information exchange from the Provider to the Consumer.
- As a result, a fairly “natural” choice for implementing the ArrivalSequenceSubscriber interface is to rely on queues. Anyway, this is considered to be more easily realizable using the AMQP Binding rather than the WS-N (both defined in [5]).

<sup>7</sup> Additional Information on the technical implementation options is provided in the appendix.

- On the other side, SOAP (or REST) provides a “natural” choice for supporting request/reply exchange pattern which is the expected pattern behind the ArrivalSequencePublisher interface. Therefore subscription, unsubscription and “communicateProblem” operations may be offered using a SOAP (or REST) based interface.

### 3.6.2 Service interface description

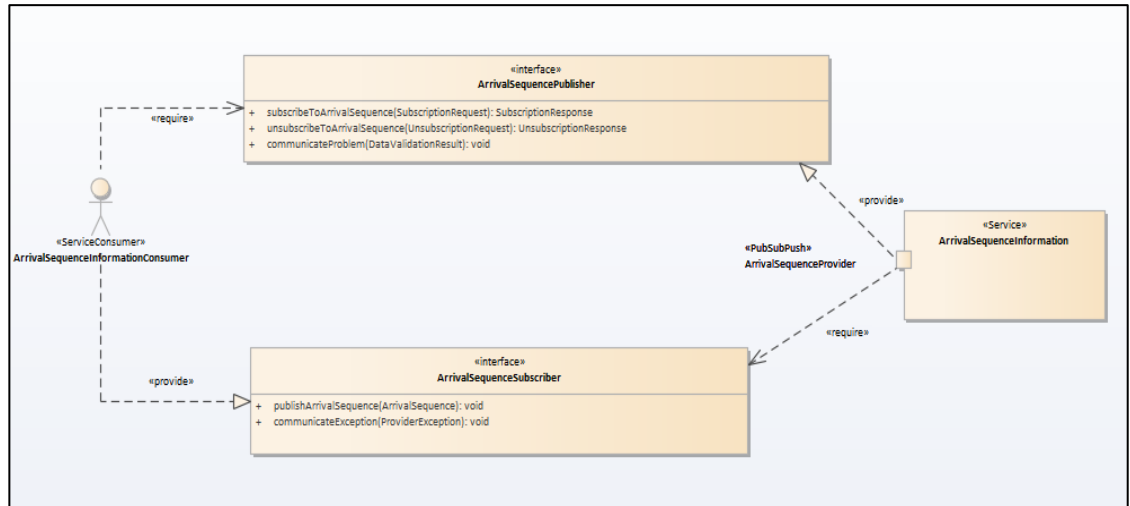


**FIGURE 5: SERVICE INTERFACES**

The diagram above illustrates the interfaces the provider and consumer have to implement.

By the naming of the interfaces it is intended that this service is based on a publish / subscribe message exchange pattern.

The service provider has to implement an Interface referenced hereafter as <ArrivalSequencePublisher>.

By means of this interface, the service consumer is able to subscribe and unsubscribe to the arrival sequence information and by using the same interface, the consumer is able to send problem reports.

The service consumer has to implement an Interface hereafter referenced as <ArrivalSequenceSubscriber> to enable the service provider to publish the arrival sequence data.

Via the same interface, the provider is able to post (to the consumer) any exceptions he encounters.

#### 3.6.2.1 Yellow Profile Conformance Requirements

| Identifier                                                                                         | Requirement Name   |
|----------------------------------------------------------------------------------------------------|--------------------|
| REQ 0171                                                                                           | TI Service Binding |
| The ArrivalSequence service implementation shall be conformant to the <b>SWIM TI YP Standard</b> . |                    |
| Rationale                                                                                          | Verification       |
| Requirement aims to ensure compliance with the EUROCONTROL Yellow Profile Specification            | Test               |

| Identifier                                                                                                                                        | Requirement Name   |
|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| REQ 0205                                                                                                                                          | TI Network Binding |
| The ArrivalSequence service implementation shall use at least the <b>IPv4 Unicast</b> Interface Binding included in the SWIM TI YP Specification. |                    |
| Rationale                                                                                                                                         | Verification       |
| Requirement aims to ensure compliance with the EUROCONTROL Yellow Profile Specification                                                           | Test               |

## 3.6.2.2

Service Interface Design Requirements (ArrivalSequencePublisher Interface)

| Identifier                                                                                                        | Requirement Name                   |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------|
| REQ 0110                                                                                                          | ArrivalSequencePublisher interface |
| The Provider of the Arrival Sequence shall provide an interface referenced hereafter as ArrivalSequencePublisher. |                                    |
| Rationale                                                                                                         | Verification                       |
| Service needs to have a well defined "Publisher" interface.                                                       | Review of design                   |

| Identifier                                                                                                                                | Requirement Name                       |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| REQ 0120                                                                                                                                  | subscribeToArrivalSequence operation 1 |
| The ArrivalSequencePublisher interface shall contain an operation referenced hereafter as subscribeToArrivalSequence.                     |                                        |
| Rationale                                                                                                                                 | Verification                           |
| Provider need to offer a specific operation to allow consumer to inform it about their interest in receiving ArrivalSequence Information. | Review of design                       |

| Identifier                                                                                     | Requirement Name                       |
|------------------------------------------------------------------------------------------------|----------------------------------------|
| REQ 0125                                                                                       | subscribeToArrivalSequence operation 2 |
| The subscribeToArrivalSequence operation shall allow to subscribe to the ArrivalSequence data. |                                        |
| Rationale                                                                                      | Verification                           |
| Requirement aims to clarify the intended scope of the operation                                | Review of design                       |

| Identifier                                                                                                                                                                                           | Requirement Name                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| REQ 0130                                                                                                                                                                                             | subscribeToArrivalSequence operation messages |
| The subscribeToArrivalSequence operation shall have an input message referenced hereafter as SubscriptionRequest message and an output message referenced hereafter as SubscriptionResponse message. |                                               |
| Rationale                                                                                                                                                                                            | Verification                                  |
| Structural requirement highlighting input and output values of the operation.                                                                                                                        | Review of design                              |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Requirement Name      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| REQ 0135                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Subscription response |
| As a response to a subscription request, the ArrivalSequenceProvider shall return the subscription status (hereafter referenced as subscriptionResult) and a subscription reference (hereafter referenced as subscriptionReference) by means of the SubscriptionResponse message.<br>The ArrivalSequenceProvider shall propagate the end date and time of the subscription by means of the SubscriptionResponse message (see also Requirements 0855 and 0860). |                       |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Verification          |
| Structural requirement highlighting what is the expected content of the operation's output value.                                                                                                                                                                                                                                                                                                                                                              | Review of design      |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Requirement Name     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| REQ 0140                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Subscription request |
| <p>The SubscriptionRequest message shall allow ArrivalSequenceConsumer to:</p> <ul style="list-style-type: none"> <li>(optionally) provide filtering criteria, at subscription time, by means of the relevant field referenced hereafter as subscriptionFilters.</li> <li>(optionally) inform the ArrivalSequenceProvider by means of the relevant field referenced hereafter as supplementaryData in respect of his need to receive (at publication time) extended information in the ArrivalSequence message.</li> </ul> |                      |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Verification         |
| Subscription interface needs to allow consumers to indicate filtering criteria to the publisher in order to constrain the information that will be received at publication time and their willingness to receive, in the message that will be published by the provider, extended information (if those are supported by the provider).                                                                                                                                                                                    | Review of design     |

| Identifier                                                                                                              | Requirement Name                         |
|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| REQ 0145                                                                                                                | unsubscribeToArrivalSequence operation 1 |
| The ArrivalSequencePublisher interface shall contain an operation referenced hereafter as unsubscribeToArrivalSequence. |                                          |
| Rationale                                                                                                               | Verification                             |
| Structural requirement highlighting the need for a specific operation.                                                  | Review of design                         |

| Identifier                                                                                                                                                                                                 | Requirement Name                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| REQ 0150                                                                                                                                                                                                   | unsubscribeToArrivalSequence operation messages |
| The unsubscribeToArrivalSequence operation shall have an input message referenced hereafter as UnsubscriptionRequest message and an output message referenced hereafter as UnsubscriptionResponse message. |                                                 |
| Rationale                                                                                                                                                                                                  | Verification                                    |
| Structural requirement highlighting input and output values of the operation.                                                                                                                              | Review of design                                |

| Identifier                                                                                                                                                 | Requirement Name                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| REQ 0155                                                                                                                                                   | unsubscribeToArrivalSequence operation 2 |
| The unsubscribeToArrivalSequence operation shall allow to unsubscribe from a previous subscription in order to stop reception of the ArrivalSequence data. |                                          |
| Rationale                                                                                                                                                  | Verification                             |
| Requirement aims to clarify the intended scope of the operation                                                                                            | Review of design                         |

| Identifier                                                                                                     | Requirement Name                |
|----------------------------------------------------------------------------------------------------------------|---------------------------------|
| REQ 0160                                                                                                       | communicateProblems operation 1 |
| The ArrivalSequencePublisher interface shall contain an operation referenced hereafter as communicateProblems. |                                 |
| Rationale                                                                                                      | Verification                    |
| Structural requirement highlighting the need for a specific operation.                                         | Review of design                |

| Identifier                                                                                                                                                                                                                                                         | Requirement Name                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| REQ 0165                                                                                                                                                                                                                                                           | communicateProblems operation 2 |
| The communicateProblems operation shall allow the ArrivalSequenceConsumer to inform the ArrivalSequenceProvider about data validation problems (if any) he found upon any message reception.                                                                       |                                 |
| Rationale                                                                                                                                                                                                                                                          | Verification                    |
| The consumer may use the communicateProblems operation to inform the provider (e.g.) about validation issues he found upon ArrivalSequence message reception or any other message (e.g. a response message to a subscription request) he received by the provider. | Review of design                |

| Identifier                                                                                                          | Requirement Name                      |
|---------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| REQ 0170                                                                                                            | communicateProblems operation message |
| The communicateProblems operation shall have an input message referenced hereafter as DataValidationResult message. |                                       |
| Rationale                                                                                                           | Verification                          |
| Structural requirement highlighting input and output values of the operation.                                       | Review of design                      |

| Identifier                                                                                                                                                                                                                | Requirement Name                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| REQ 0172                                                                                                                                                                                                                  | TI Service Binding for ArrivalSequencePublisher |
| The ArrivalSequencePublisher interface shall be instantiated using one of the following Service Interface Bindings included in the SWIM TI YP Specification:                                                              |                                                 |
| <ul style="list-style-type: none"> <li>• WS-LIGHT</li> <li>• WS-SOAP</li> </ul>                                                                                                                                           |                                                 |
| Rationale                                                                                                                                                                                                                 | Verification                                    |
| Requirement aims to ensure Request / Reply pattern for the ArrivalSequencePublisher interface and restricts the available implementation options with respect to those included in the ECTL Yellow Profile Specification. | Review of Design                                |

| Identifier                                                                                                                                          | Requirement Name                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| REQ 0173                                                                                                                                            | TI Profile – subscription persistency |
| The ArrivalSequence service shall provide subscription persistency across reboot and crash when the Publish/Subscribe MEP is used. (SWIM-TIYP-0110) |                                       |
| Rationale                                                                                                                                           | Verification                          |
| TI Requirement to ensure the NFR “Subscription persistency”                                                                                         | Test                                  |

| Identifier                                                                                                                                     | Requirement Name                 |
|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| REQ 0174                                                                                                                                       | TI Profile – message persistency |
| The ArrivalSequence service shall provide message persistency across reboot and crash when the Publish/Subscribe MEP is used. (SWIM-TIYP-0111) |                                  |
| Rationale                                                                                                                                      | Verification                     |
| TI Requirement to ensure the NFR “Message persistency”                                                                                         | Test                             |

## 3.6.2.3

Service Interface Design Requirements (ArrivalSequenceSubscriber Interface)

| Identifier                                                                                                                                                   | Requirement Name                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| REQ 0115                                                                                                                                                     | ArrivalSequenceSubscriber interface |
| The Consumer of the ArrivalSequence service shall provide an interface referenced hereafter as ArrivalSequenceSubscriber.                                    |                                     |
| Rationale                                                                                                                                                    | Verification                        |
| In order to fulfill the intended collaborative interaction across actors (consumers and provider), service consumer needs to offer a well-defined interface. | Review of design                    |

| Identifier                                                                                                         | Requirement Name                   |
|--------------------------------------------------------------------------------------------------------------------|------------------------------------|
| REQ 0175                                                                                                           | publishArrivalSequence operation 1 |
| The ArrivalSequenceSubscriber interface shall contain an operation referenced hereafter as publishArrivalSequence. |                                    |
| Rationale                                                                                                          | Verification                       |
| Structural requirement highlighting the need for a specific operation.                                             | Review of design                   |

| Identifier                                                                                                                                           | Requirement Name                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| REQ 0180                                                                                                                                             | publishArrivalSequence operation 2 |
| The publishArrivalSequence operation shall allow the ArrivalSequenceProvider to transmit the ArrivalSequence message to the ArrivalSequenceConsumer. |                                    |
| Rationale                                                                                                                                            | Verification                       |
| The requirement clarifies the aim of the operation.                                                                                                  | Review of design                   |

| Identifier                                                                                                       | Requirement Name                 |
|------------------------------------------------------------------------------------------------------------------|----------------------------------|
| REQ 0185                                                                                                         | communicateException operation 1 |
| The ArrivalSequenceSubscriber interface shall contain an operation referenced hereafter as communicateException. |                                  |
| Rationale                                                                                                        | Verification                     |
| Structural requirement highlighting the need for a specific operation.                                           | Review of design                 |

| Identifier                                                                                                                                                                   | Requirement Name                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| REQ 0190                                                                                                                                                                     | communicateException operation 2 |
| The communicateException operation shall allow the ArrivalSequenceProvider to inform the ArrivalSequenceConsumer about problems occurring, at service run-time, on its side. |                                  |
| Rationale                                                                                                                                                                    | Verification                     |
| The operation allows the provider to inform the consumer about issues on its back-end system that may impact service behaviour or make provided information not trustworthy. | Review of design                 |

| Identifier                                                                                                         | Requirement Name                       |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| REQ 0195                                                                                                           | communicateException operation message |
| The communicateException operation shall have an input message referenced hereafter as ProviderExceptions message. |                                        |
| Rationale                                                                                                          | Verification                           |
| Structural requirement highlighting input and output values of the operation.                                      | Review of design                       |

| Identifier                                                                                                                                                                                                                       | Requirement Name                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| REQ 0200                                                                                                                                                                                                                         | TI Service Binding for ArrivalSequenceSubscriber |
| The ArrivalSequenceSubscriber interface shall be instantiated using one of the following Service Interface Bindings included in the SWIM TI YP Specification: <b>AMQP Messaging, WS-N</b>                                        |                                                  |
| Rationale                                                                                                                                                                                                                        | Verification                                     |
| Requirement aims to ensure Publish / Subscribe pattern for the ArrivalSequenceSubscriber interface and to restrict the available implementation options with respect to those available in the ECTL Yellow Profile Specification | Test                                             |

### 3.6.3

#### Service Payload Description

This chapter provides requirements on the structure of the service payload, it does not contain requirements concerning the actual content of the payload. Those requirements are exposed within chapter 4, the “Data Catalogue”.

#### 3.6.3.1

##### Service Payload Structural Design Requirements

| Identifier                                                                                                                                                                                                        | Requirement Name        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| REQ 0700                                                                                                                                                                                                          | Mandatory Data Entities |
| Mandatory data entities represent the core payload of the service and <b>shall</b> be provided by the service provider. If a mandatory entity is not provided, it shall be considered a run time error condition. |                         |
| Rationale                                                                                                                                                                                                         | Verification            |
| Mandatory entity fields must be provided to accomplish the business purpose of the service.                                                                                                                       | Review of design        |

| Identifier                                                                                                                                                                                                                                                                                                                                                                     | Requirement Name       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| REQ 0705                                                                                                                                                                                                                                                                                                                                                                       | Optional Data Entities |
| Optional payload elements are described by optional requirements. They are part of the core payload with cardinality [0..1] or [0..n].<br>Optional data entities <b>shall</b> be provided by the service provider, if the appropriate data is available. The provider has to declare up front if and which parts of the optional data entities he/she will be able to provide. |                        |
| Rationale                                                                                                                                                                                                                                                                                                                                                                      | Verification           |
| This requirement provides clarity on the semantics of optionality versus inability to provide.                                                                                                                                                                                                                                                                                 | Review of design       |

| Identifier                                                                                                                                                                                 | Requirement Name |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| REQ 0710                                                                                                                                                                                   | Extensions       |
| Entities described as part of the extension <b>may</b> be provided on a voluntary basis. The provider has to declare up front if and which parts of extensions it will be able to provide. |                  |
| Rationale                                                                                                                                                                                  | Verification     |
| This requirement provides clarity on the semantics of extensions versus optional payload elements.                                                                                         | Review of design |

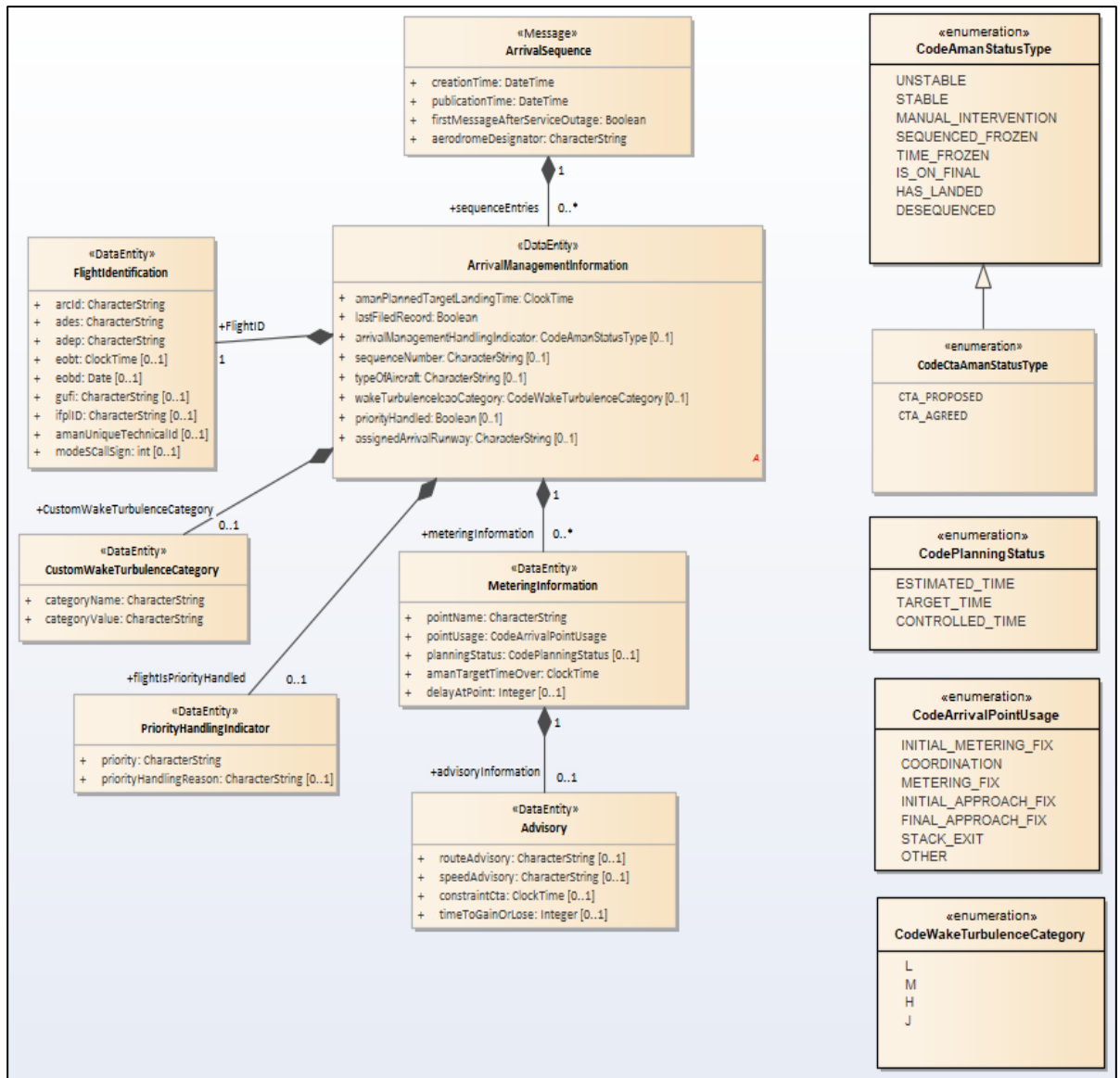


FIGURE 6: OVERVIEW OF THE CORE SERVICE PAYLOAD

| Identifier                                                                                             | Requirement Name       |
|--------------------------------------------------------------------------------------------------------|------------------------|
| REQ 0005                                                                                               | ArrivalSequenceMessage |
| The AMAN payload shall consist of one instance of the Message referenced hereafter as ArrivalSequence. |                        |
| Rationale                                                                                              | Verification           |
| This composes the core payload of the service.                                                         | Review of Design       |

| Identifier                                                                                                                           | Requirement Name                         |
|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| REQ 0010                                                                                                                             | ArrivalManagementInformation data entity |
| The ArrivalSequence shall encapsulate zero or many instances of the Data Entity referenced hereafter as ArrivalManagementInformation |                                          |
| Rationale                                                                                                                            | Verification                             |
| Data entity of the main payload.                                                                                                     | Review of Design                         |

| Identifier                                                                                                                                     | Requirement Name                |
|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| REQ 0015                                                                                                                                       | MeteringInformation data entity |
| The ArrivalManagementInformation shall encapsulate zero, one or many instances of the Data Entity referenced hereafter as MeteringInformation. |                                 |
| Rationale                                                                                                                                      | Verification                    |
| Data entity of the main payload.                                                                                                               | Review of Design                |

| Identifier                                                                                                                       | Requirement Name                 |
|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| REQ 0020                                                                                                                         | FlightIdentification data entity |
| The ArrivalManagementInformation shall encapsulate one instance of the Data Entity referenced hereafter as FlightIdentification. |                                  |
| Rationale                                                                                                                        | Verification                     |
| Data entity of the main payload.                                                                                                 | Review of Design                 |

| Identifier                                                                                                                                       | Requirement Name                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| REQ 0025                                                                                                                                         | CustomWakeTurbulenceCategory data entity |
| The ArrivalManagementInformation shall encapsulate zero or one instance of the Data Entity referenced hereafter as CustomWakeTurbulenceCategory. |                                          |
| Rationale                                                                                                                                        | Verification                             |
| Data entity of the main payload.                                                                                                                 | Review of Design                         |

| Identifier                                                                                                                                    | Requirement Name                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| REQ 0030                                                                                                                                      | PriorityHandlingIndicator data entity |
| The ArrivalManagementInformation shall encapsulate zero or one instance of the Data Entity referenced hereafter as PriorityHandlingIndicator. |                                       |
| Rationale                                                                                                                                     | Verification                          |
| Data entity of the main payload.                                                                                                              | Review of Design                      |

| Identifier                                                                                                          | Requirement Name     |
|---------------------------------------------------------------------------------------------------------------------|----------------------|
| REQ 0035                                                                                                            | Advisory data entity |
| The MeteringInformation shall encapsulate zero or one instance of the Data Entity referenced hereafter as Advisory. |                      |
| Rationale                                                                                                           | Verification         |
| Data entity of the main payload.                                                                                    | Review of Design     |

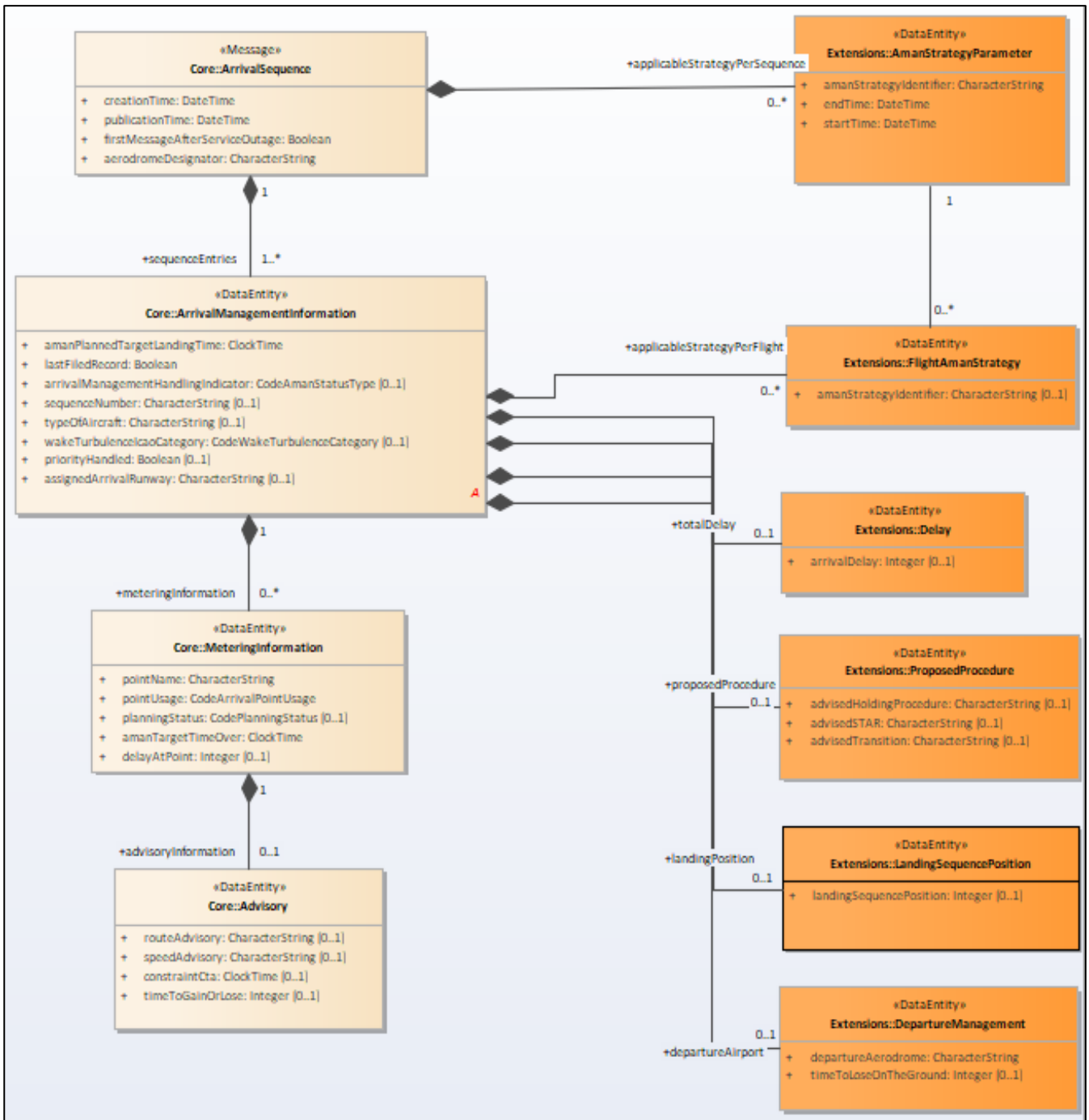


FIGURE 7: OVERVIEW ON THE EXTENSIONS DATA ENTITIES

**NOTE:** The extension is marked by orange coloration. It is shown in its relation to the core payload.

| Identifier                                                                                                                                                         | Requirement Name                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| REQ 0040                                                                                                                                                           | AmanStrategyParameter data entity |
| The ArrivalSequence may encapsulate zero, one or many instances of the Data Entity referenced hereafter as AmanStrategyParameter as part of the payload extension. |                                   |
| Rationale                                                                                                                                                          | Verification                      |
| Data entity of the payload extension                                                                                                                               | Review of Design                  |

| Identifier                                                                                                                                                             | Requirement Name               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| REQ 0045                                                                                                                                                               | FlightAmanStrategy data entity |
| The AmanStrategyParameter may be linked to zero, one or many instances of the Data Entity referenced hereafter as FlightAmanStrategy as part of the payload extension. |                                |
| Rationale                                                                                                                                                              | Verification                   |
| Data entity of the payload extension                                                                                                                                   | Review of Design               |

| Identifier                                                                                                                           | Requirement Name                 |
|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| REQ 0050                                                                                                                             | FlightAmanStrategy data entity 2 |
| The ArrivalManagementInformation may encapsulate zero, one or many instances of FlightAmanStrategy as part of the payload extension. |                                  |
| Rationale                                                                                                                            | Verification                     |
| Data entity of the payload extension                                                                                                 | Review of Design                 |

| Identifier                                                                                                                                               | Requirement Name  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| REQ 0055                                                                                                                                                 | Delay data entity |
| The ArrivalManagementInformation may encapsulate zero or one instance of the Data Entity referenced hereafter as Delay as part of the payload extension. |                   |
| Rationale                                                                                                                                                | Verification      |
| Data entity of the payload extension                                                                                                                     | Review of Design  |

| Identifier                                                                                                                                                           | Requirement Name              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| REQ 0060                                                                                                                                                             | ProposedProcedure data entity |
| The ArrivalManagementInformation may encapsulate zero or one instance of the Data Entity referenced hereafter as ProposedProcedure as part of the payload extension. |                               |
| Rationale                                                                                                                                                            | Verification                  |
| This extension is a useful feature.                                                                                                                                  | Review of Design              |

| Identifier                                                                                                                                                                 | Requirement Name                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| REQ 0065                                                                                                                                                                   | LandingSequencePosition data entity |
| The ArrivalManagementInformation may encapsulate zero or one instance of the Data Entity referenced hereafter as LandingSequencePosition as part of the payload extension. |                                     |
| Rationale                                                                                                                                                                  | Verification                        |
| This extension is a useful feature. It provides a standardised sequence numbering.                                                                                         | Review of Design                    |

| Identifier                                                                                                                                                             | Requirement Name                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| REQ 0070                                                                                                                                                               | DepartureManagement data entity |
| The ArrivalManagementInformation may encapsulate zero or one instance of the Data Entity referenced hereafter as DepartureManagement as part of the payload extension. |                                 |
| Rationale                                                                                                                                                              | Verification                    |
| This extension is an upstream feature for satellite airports (an airport within the AMAN horizon from where aircrafts are departing and are sequenced by the E-AMAN).  | Review of Design                |

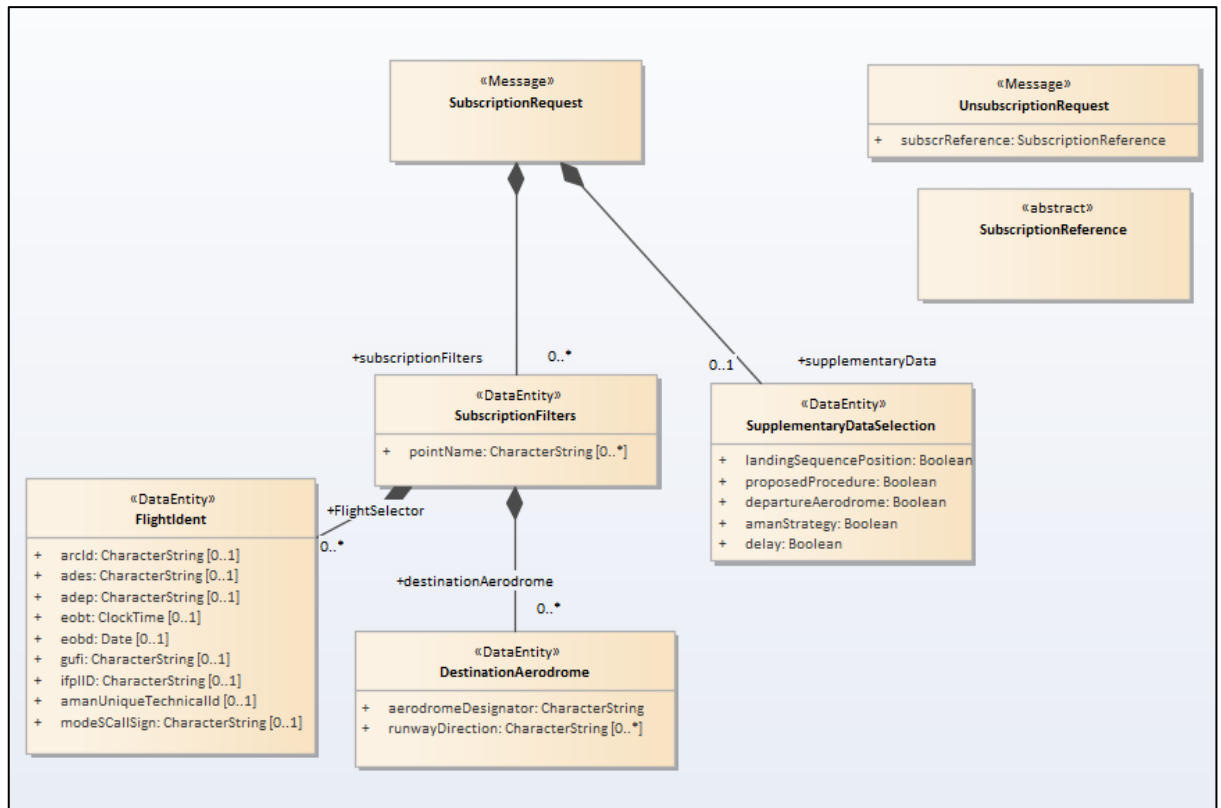


FIGURE 8: OVERVIEW ON THE SUBSCRIPTION DATA ENTITIES

| Identifier                                                                                                      | Requirement Name            |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------|
| REQ 0075                                                                                                        | SubscriptionRequest message |
| The SubscriptionRequest message shall encapsulate zero or many instance of the Data Entity SubscriptionFilters. |                             |
| Rationale                                                                                                       | Verification                |
| Message composing the operation parameter for the subscription.                                                 | Review of Design            |

| Identifier                                                                                                                                                                                                                                                | Requirement Name                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| REQ 0076                                                                                                                                                                                                                                                  | Subscription Filters Multiplicity |
| The ArrivalSequenceServiceProvider shall determine and communicate to the service consumers a limit on the number of allowed SubscriptionFilters.                                                                                                         |                                   |
| Rationale                                                                                                                                                                                                                                                 | Verification                      |
| A cardinality of 0 to n could lead to the transmission of numerous filter instances which might negatively influence the availability or response time of the service. Therefore the provider is asked to specify the number of allowed filter instances. | Review of Design                  |

| Identifier                                                                                                                             | Requirement Name                 |
|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| REQ 0080                                                                                                                               | DestinationAerodrome.data entity |
| The SubscriptionFilters shall encapsulate zero, one or many instances of the Data Entity referenced hereafter as DestinationAerodrome. |                                  |
| Rationale                                                                                                                              | Verification                     |
| Data entity composing the subscription message                                                                                         | Review of Design                 |

| Identifier                                                                                                                      | Requirement Name        |
|---------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| REQ 0085                                                                                                                        | FlightIdent data entity |
| The SubscriptionFilters shall encapsulate zero or one or many instances of the Data Entity referenced hereafter as FlightIdent. |                         |
| Rationale                                                                                                                       | Verification            |
| Data entity composing the subscription message                                                                                  | Review of Design        |

| Identifier                                                                                                                          | Requirement Name                       |
|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| REQ 0090                                                                                                                            | SupplementaryDataSelection data entity |
| The SubscriptionRequest may encapsulate zero or one instance of the Data Entity referenced hereafter as SupplementaryDataSelection. |                                        |
| Rationale                                                                                                                           | Verification                           |
| Data entity composing the subscription message                                                                                      | Review of Design                       |

| Identifier                                                                                                                                                                                                                                                                                                  | Requirement Name       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| REQ 0091                                                                                                                                                                                                                                                                                                    | Subscription Reference |
| The ArrivalSequence shall provide a mechanism to identify the subscription.                                                                                                                                                                                                                                 |                        |
| Rationale                                                                                                                                                                                                                                                                                                   | Verification           |
| The requirement intends to prescribe, without explicitly specify which mechanism should be used, that the provider must define a way to understand if a given subscriber already requested subscription to the service as only 1 subscription is allowed for a given subscriber (e.g. a given application). | Test                   |

| Identifier                                                                                                    | Requirement Name        |
|---------------------------------------------------------------------------------------------------------------|-------------------------|
| REQ 0092                                                                                                      | Number of subscriptions |
| One subscriber shall be allowed to have only one subscription.                                                |                         |
| Rationale                                                                                                     | Verification            |
| The number of subscriptions is a constraint to save system resources and not overburden the service provider. | Test                    |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Requirement Name         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| REQ 0095                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Subscription reference 2 |
| The ArrivalSequenceProvider shall rely on a subscription reference to uniquely associate an ArrivalSequenceConsumer with the subscription such actor requested beforehand.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                          |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Verification             |
| Once an ArrivalSequenceConsumer will decide to unsubscribe, he will need to provide the subscriptionReference he received upon subscription to the ArrivalSequenceProvider in order to let him understand which is the right "subscription" to terminate. Please note that the "subscriptionReference" definition is on purpose left abstract. It might be "implicit" (e.g. as only 1 subscription is allowed per subscriber, such reference could coincide with the subscriber's identity, so there would be no need for the provider to actually return an explicit reference) or be "explicit" (e.g. a string, like a UUID, representing a subscription identifier ) | Review of Design         |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                          | Requirement Name    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| REQ 0070                                                                                                                                                                                                                                                                                                                                                                                                            | Filter conditions 1 |
| If multiple attributes within the "subscriptionFilters" data entity are provided, they shall be considered as AND conditions.                                                                                                                                                                                                                                                                                       |                     |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                           | Verification        |
| The requirement clarifies how the information included in the structure holding the filtering criteria needs to be interpreted by the publisher. The interpretation applies recursively to all the attributes included in structured elements within "subscriptionFilters". Therefore, also to the attributes included in "flightId" and "destinationAerodrome" (classes "FlightIdent" and "DestinationAerodrome"). | Test                |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                          | Requirement Name    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| REQ 0080                                                                                                                                                                                                                                                                                                                                                                                                            | Filter conditions 2 |
| If, for a given attribute (filtering criterion) within the "subscriptionFilters" data entity multiple values are provided, they shall be considered as OR conditions.                                                                                                                                                                                                                                               |                     |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                           | Verification        |
| The requirement clarifies how the information included in the structure holding the filtering criteria needs to be interpreted by the publisher. The interpretation applies recursively to all the attributes included in structured elements within "subscriptionFilters". Therefore, also to the attributes included in "flightId" and "destinationAerodrome" (classes "FlightIdent" and "DestinationAerodrome"). | Test                |

| Identifier                                                                                                                                                                                                                                | Requirement Name     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| REQ 0081                                                                                                                                                                                                                                  | Filtering Criteria 1 |
| If "subscriptionFilters" are provided at subscription time by a given ArrivalSequenceConsumer, the ArrivalSequenceProvider shall include in the ArrivalSequence "message" only the "sequenceEntries" that fulfill the filtering criteria. |                      |
| Rationale                                                                                                                                                                                                                                 | Verification         |
| The consumer only needs to receive the partial information that he is interested in.                                                                                                                                                      | Test                 |

| Identifier                                                                                                                                                                                                                                                                                                              | Requirement Name              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| REQ 0085                                                                                                                                                                                                                                                                                                                | SupplementaryData data entity |
| The SubscriptionRequest message shall allow the ArrivalSequenceConsumer to (optionally) request to the publisher inclusion of supplementary data (hereafter referenced as supplementaryData) in the Arrival Sequence data (hereafter referenced as ArrivalSequence message) via the ArrivalSequencePublisher interface. |                               |
| Rationale                                                                                                                                                                                                                                                                                                               | Verification                  |
| The requirement clarifies through which part of the input message of the subscribe operation the consumer may indicate to the publisher if and which "supplementary" information (i.e. parts of the extension added to the "normal" Arrival Sequence) he wants to receive.                                              | Test                          |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Requirement Name                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| REQ 0086                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Supplementary data switch interpretation |
| <p>The attributes included in the supplementaryData "data entity" shall be treated as follows:</p> <ul style="list-style-type: none"> <li>- amanStrategy: if "true", AmanStrategyParameter and ExtFlightAmanStrategy "data entities" shall be included in the ArrivalSequence "message" by the ArrivalSequenceProvider</li> <li>- departureAerodrome: if "true", ExtDepartureManagement "data entity" shall be included in the ArrivalManagementInformation "data entity" by the ArrivalSequenceProvider</li> <li>- proposedProcedure: if "true", ProposedProcedure "data entity" shall be included in the ArrivalManagementInformation "data entity" by the ArrivalSequenceProvider</li> <li>- landingSequencePosition: if "true", LandingSequencePosition "data entity" shall be included in the ArrivalManagementInformation "data entity" by the ArrivalSequenceProvider</li> <li>- delay: if "true", ExtDelay "data entity" shall be included in the ArrivalManagementInformation "data entity" by the ArrivalSequenceProvider</li> </ul> |                                          |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Verification                             |
| This requirement clarifies the relationships among the "switches" included in the "supplementaryData" entity in the SubscriptionRequest and the extended information to be included by the "ArrivalSequenceProvider" in the actual ArrivalSequence it will later on send to the "ArrivalSequenceConsumer".                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Review of design                         |

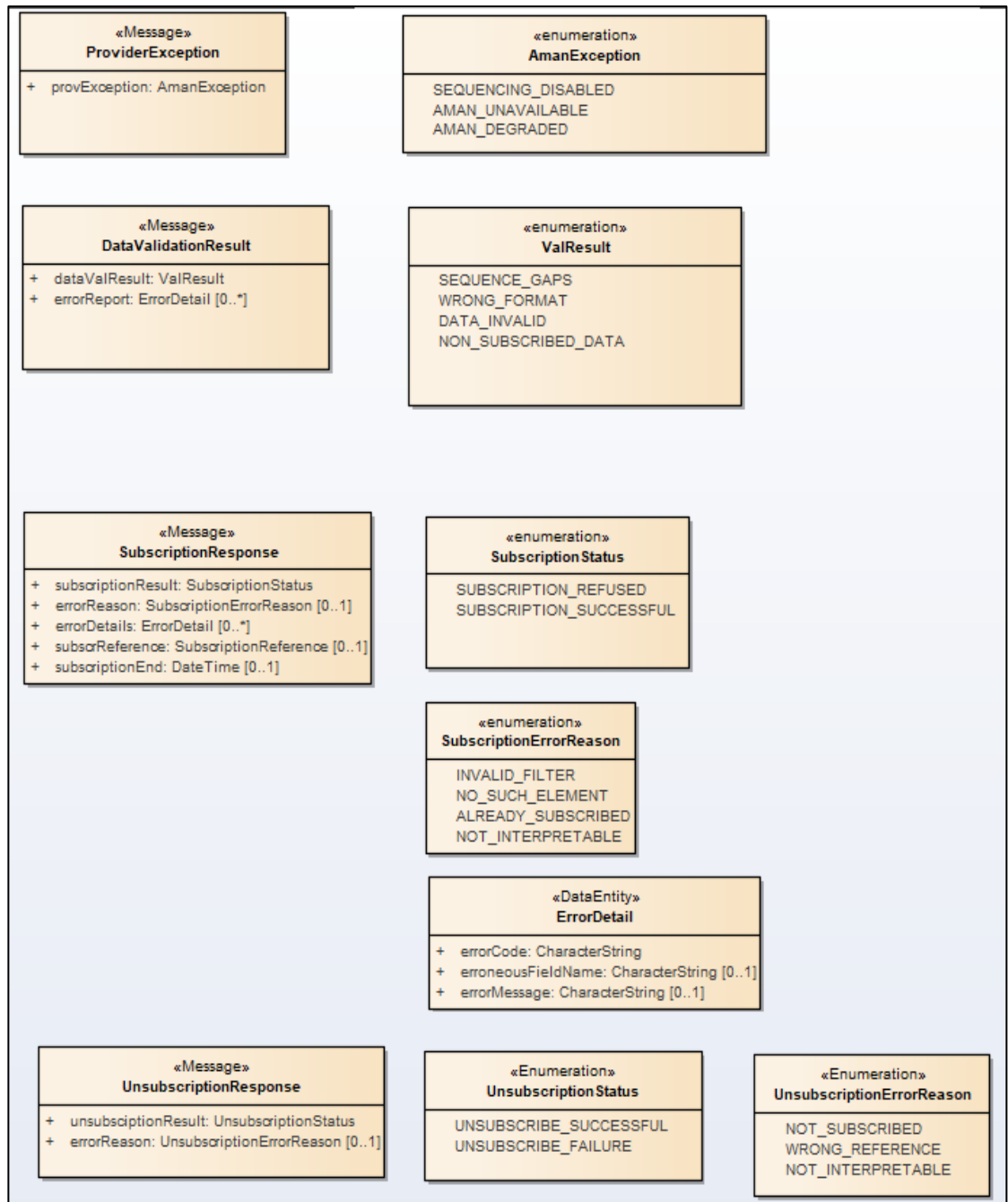


FIGURE 9: OVERVIEW ON THE SERVICE ERROR HANDLING ENTITIES

| Identifier                                                                                                                                                                                                                 | Requirement Name             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| REQ 0090                                                                                                                                                                                                                   | ProviderExceptions message 1 |
| The service payload shall contain a message hereafter referenced as ProviderExceptions.                                                                                                                                    |                              |
| Rationale                                                                                                                                                                                                                  | Verification                 |
| The ProviderExceptions message shall allow the ArrivalSequenceProvider to inform the ArrivalSequenceConsumer about problems occurred on his side by means of the relevant attribute referenced hereafter as provException. | Review of design             |

| Identifier                                                                                                                                                              | Requirement Name             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| REQ 0095                                                                                                                                                                | DataValidationResult message |
| The service payload shall contain a message hereafter referenced as DataValidationResult.                                                                               |                              |
| Rationale                                                                                                                                                               | Verification                 |
| The DataValidationResult shall allow the ArrivalSequenceConsumer to inform the ArrivalSequenceProvider about the kind of data validation error he found on any message. | Review of design             |

| Identifier                                                                                                                                        | Requirement Name              |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| REQ 0100                                                                                                                                          | UnsubscriptionRequest message |
| The service payload shall include a message hereafter referenced as UnsubscriptionRequest message and it shall include the subscriptionReference. |                               |
| Rationale                                                                                                                                         | Verification                  |
| The subscriptionReference is a unique reference that allows to refer to an existing subscription.                                                 | Review of design              |

| Identifier                                                                                                                                                                                                    | Requirement Name               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| REQ 0105                                                                                                                                                                                                      | UnsubscriptionResponse message |
| As a response to an unsubscription request, the ArrivalSequenceProvider shall return the unsubscription status (hereafter referenced as unsubscriptionResult) by means of the UnsubscriptionResponse message. |                                |
| Rationale                                                                                                                                                                                                     | Verification                   |
| The consumer needs to be informed about current shortfalls of the service.                                                                                                                                    | Review of design               |

### 3.6.4 Service Behaviour

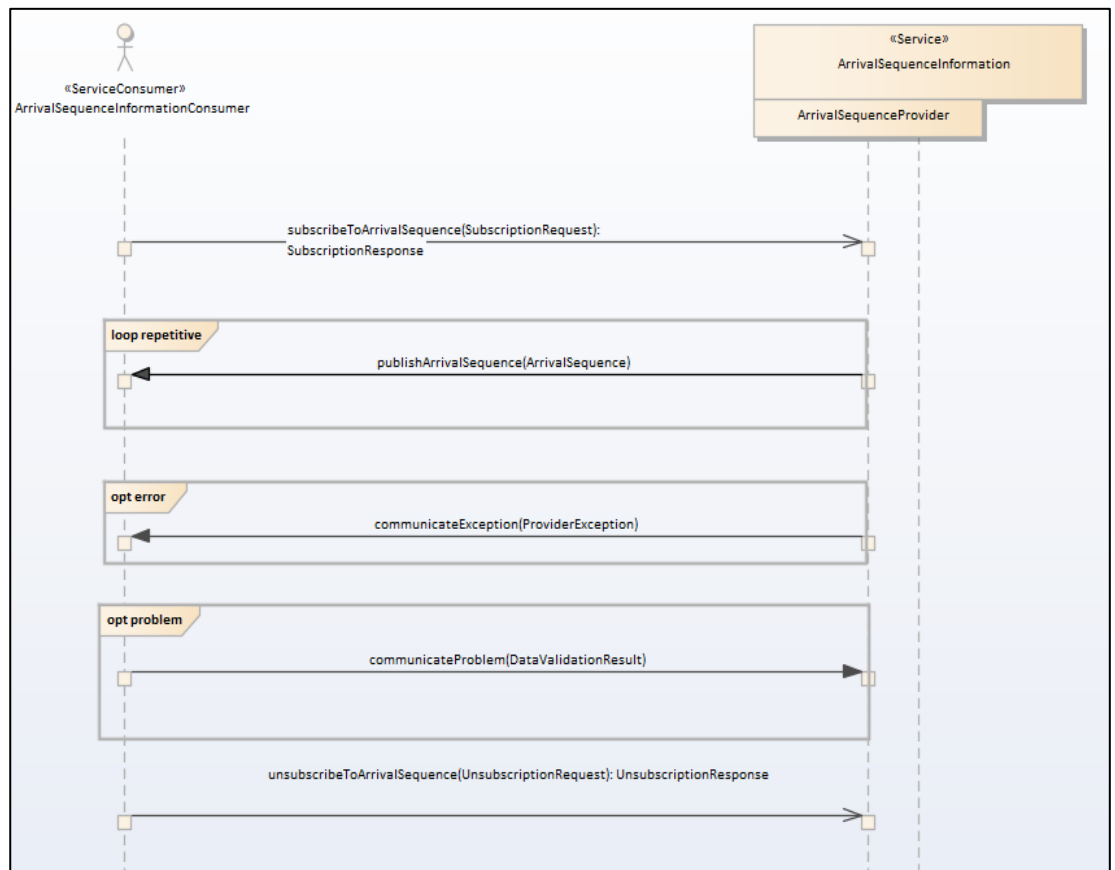


**FIGURE 10: SERVICE BEHAVIOURAL VIEW**

The diagram shows a typical publish/subscribe pattern on the logical level (no technology specifics, e. g. no indication of the usage of a message broker is shown).

#### 3.6.4.1 Requirements on the nominal Service Behaviour (Interface “ArrivalSequencePublisher”)

| Identifier                                                                        | Requirement Name       |
|-----------------------------------------------------------------------------------|------------------------|
| REQ 0400                                                                          | Subscription filtering |
| The ArrivalSequenceConsumer may provide SubscriptionFilters at subscription time. |                        |
| Rationale                                                                         | Verification           |
| SubscriptionFilters is an optional DataEntity of the SubscriptionRequest.         | Test                   |

| Identifier                                                                               | Requirement Name             |
|------------------------------------------------------------------------------------------|------------------------------|
| REQ 0405                                                                                 | Supplementary data selection |
| The ArrivalSequenceConsumer may provide SupplementaryDataSelection at subscription time. |                              |
| Rationale                                                                                | Verification                 |
| SupplementaryDataSelection is an optional DataEntity of the SubscriptionRequest.         | Test                         |

| Identifier                                                                                                                                                             | Requirement Name      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| REQ 0410                                                                                                                                                               | Subscription response |
| Upon reception of a SubscriptionRequest message, the ArrivalSequenceProvider shall enforce message validity checks and return accordingly with a SubscriptionResponse. |                       |
| Rationale                                                                                                                                                              | Verification          |
| Subscription requests are accepted or not according to identified validity checks.                                                                                     | Test                  |

| Identifier                                                                                                                                                                                                                                                                                                                                                                         | Requirement Name |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| REQ 0415                                                                                                                                                                                                                                                                                                                                                                           | Filter validity  |
| The ArrivalSequenceProvider shall enforce the following SubscriptionRequest message validity checks: <ul style="list-style-type: none"> <li>- (when provided) SubscriptionFilters validity.</li> <li>- (when provided) SupplementaryDataSelection validity.</li> <li>- Duplicated subscriptions (requester already subscribed)</li> <li>- Input message format validity</li> </ul> |                  |
| Rationale                                                                                                                                                                                                                                                                                                                                                                          | Verification     |
| Validity checks of filters are essential.                                                                                                                                                                                                                                                                                                                                          | Test             |

| Identifier                                                                                                                                                                                                                          | Requirement Name                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| REQ 0420                                                                                                                                                                                                                            | Subscription filter validity checks 1 |
| The ArrivalSequenceProvider shall enforce validity checks on SubscriptionFilters according to "Additional Constraints" applicable to SubscriptionFilters' attributes as defined in the Data Catalogue (Chapter 4 of this document). |                                       |
| Rationale                                                                                                                                                                                                                           | Verification                          |
| Validity checks of filters are essential.                                                                                                                                                                                           | Test                                  |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Requirement Name                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| REQ 0425                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Subscription filter validity checks 2 |
| If the Subscription Filters validity check fails, the ArrivalSequenceProvider shall reject the SubscriptionRequest by returning a SubscriptionResponse message with SUBSCRIPTION_REFUSED as status, INVALID_FILTER as errorReason and, optionally, providing additional error details via "errorDetails" attribute (e.g. which is the filter causing the error and which specific error occurred - the specific "Error Codes" to provide are defined Data Catalogue (Chapter 4 of this document). |                                       |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Verification                          |
| Definition of what to do if a validity check fails. This also includes the case, when the number of filter instances exceeded the allowed maximum (see requirement REQ 0076).                                                                                                                                                                                                                                                                                                                     | Test                                  |

| Identifier                                                                                                                                                                                                                                                                                                                                                                            | Requirement Name                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| REQ 0077                                                                                                                                                                                                                                                                                                                                                                              | Exceeding the limit on the subscription filters |
| If the number of "SubscriptionFilters" exceeds the limit defined by the service provider, the subscription will be refused, sending a "SubscriptionResponse" message with a "subscriptionResult" which equals "SUBSCRIPTION_REFUSED" and an "errorDetail" which includes an errorCode "LOGIC_VIOLATION" and an "errorMessage" which equals "number of subscription filters exceeded". |                                                 |
| Rationale                                                                                                                                                                                                                                                                                                                                                                             | Verification                                    |
| An unambiguous error message needs to be provided to the consumer, to raise awareness of the fact that the subscription needs to be adapted.                                                                                                                                                                                                                                          | Review of Design                                |

| Identifier                                                                                                                                                                                                                                   | Requirement Name                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| REQ 0430                                                                                                                                                                                                                                     | Supplementary data selection validity checks |
| If the SupplementaryDataSelection validity check fails, the ArrivalSequenceProvider shall reject the SubscriptionRequest by returning a SubscriptionResponse message with SUBSCRIPTION_REFUSED as status and NO_SUCH_ELEMENT as errorReason. |                                              |
| Rationale                                                                                                                                                                                                                                    | Verification                                 |
| Definition of what to do if a validity check fails.                                                                                                                                                                                          | Test                                         |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                   | Requirement Name                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| REQ 0435                                                                                                                                                                                                                                                                                                                                                                                                                     | Supplementary data selection validity |
| The ArrivalSequenceProvider shall consider "valid" the SupplementaryDataSelection if it is able to provide the additional information requested via such selection. The ArrivalSequenceProvider shall reject the subscription otherwise. The ArrivalSequenceProvider may provide details about which "additional information" it is not able to provide by including the relevant information in the errorDetails attribute. |                                       |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                    | Verification                          |
| Definition of when to consider a supplementary data selection valid.                                                                                                                                                                                                                                                                                                                                                         | Test                                  |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Requirement Name                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| REQ 0440                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Duplicated subscriptions validity check |
| If the Duplicated subscriptions validity check fails, the ArrivalSequenceProvider shall reject the SubscriptionRequest by returning a SubscriptionResponse message with SUBSCRIPTION_REFUSED as status and ALREADY_SUBSCRIBED as errorReason.                                                                                                                                                                                                                                                                                                                 |                                         |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Verification                            |
| <p>The requirement clarifies the expected behaviour in case the same consumer asks for multiple subscriptions. As the rule is to allow to have only 1 subscription per consumer, if this consumer wants to update its subscription (e.g. to add or modify filtering criteria) it first needs to unsubscribe and then re-start the subscription process.</p> <p>If the Subscriber needs to change the filtering criteria (therefore, equivalent to update a previous subscription), it will first need to unsubscribe and then request a new subscription.</p> | Test                                    |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                             | Requirement Name              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| REQ 0445                                                                                                                                                                                                                                                                                                                                                                                                                                               | Input message format validity |
| If the input message format validity check fails, the ArrivalSequenceProvider shall reject the SubscriptionRequest by returning a SubscriptionResponse message with SUBSCRIPTION_REFUSED as status and NOT_INTERPRETABLE as errorReason. "Format" validity checks on the SubscriptionRequest message consist in checking well formedness of the message received with respect to a reference format (e.g. correspondence with a reference XML Schema). |                               |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                              | Verification                  |
| This requirement defines what to do if the input format validity check for the subscription request fails.                                                                                                                                                                                                                                                                                                                                             | Test                          |

| Identifier                                                                                                                                                                                                                                                                                                                                                            | Requirement Name     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| REQ 0450                                                                                                                                                                                                                                                                                                                                                              | Subscription refused |
| If all the validity checks are successfully enforced but any additional error occur while processing the SubscriptionRequest message, the ArrivalSequenceProvider shall reject the SubscriptionRequest by returning a SubscriptionResponse message with SUBSCRIPTION_REFUSED status and, optionally, providing additional error details via "errorDetails" attribute. |                      |
| Rationale                                                                                                                                                                                                                                                                                                                                                             | Verification         |
| This requirement defines what to do on any other error while processing the subscription request message.                                                                                                                                                                                                                                                             | Test                 |

| Identifier                                                                                                                                                                                                                                                                              | Requirement Name        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| REQ 0455                                                                                                                                                                                                                                                                                | Subscription successful |
| If all the validity checks are successfully enforced and no additional errors occur while processing the SubscriptionRequest message, the ArrivalSequenceProvider shall accept the SubscriptionRequest by returning a SubscriptionResponse message with SUBSCRIPTION_SUCCESSFUL status. |                         |
| Rationale                                                                                                                                                                                                                                                                               | Verification            |
| This requirement defines which status to choose when a subscription is considered successful.                                                                                                                                                                                           | Test                    |

| Identifier                                                                                                                                                                                                                                 | Requirement Name                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| REQ 0460                                                                                                                                                                                                                                   | No provision of subscription filters |
| If a successfully subscribed ArrivalSequenceConsumer did not provide SubscriptionFilters at subscription time, the ArrivalSequenceProvider shall notify it with ArrivalSequence without enforcing any filtering.                           |                                      |
| Rationale                                                                                                                                                                                                                                  | Verification                         |
| Information is distributed via the ArrivalSequenceSubscriber:publishArrivalSequence.<br>"Successfully subscribed" consumers are those that successfully completed the subscription request AND did not yet submit the unsubscribe request. | Test                                 |

| Identifier                                                                                                                                                                                                                                  | Requirement Name              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| REQ 0465                                                                                                                                                                                                                                    | Subscription filters provided |
| If a successfully subscribed ArrivalSequenceConsumer did provide SubscriptionFilters at subscription time, the ArrivalSequenceProvider shall notify it with ArrivalSequence by enforcing provided consumer-specific filtering criteria.     |                               |
| Rationale                                                                                                                                                                                                                                   | Verification                  |
| Information are distributed via the ArrivalSequenceSubscriber:publishArrivalSequence.<br>"Successfully subscribed" consumers are those that successfully completed the subscription request AND did not yet submit the unsubscribe request. | Test                          |

| Identifier                                                                                                                                                                                                                                  | Requirement Name                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| REQ 0470                                                                                                                                                                                                                                    | No supplementary data selection |
| If a successfully subscribed ArrivalSequenceConsumer did not provide SupplementaryDataSelection at subscription time, the ArrivalSequenceProvider shall notify it with ArrivalSequence without including any supplementary data.            |                                 |
| Rationale                                                                                                                                                                                                                                   | Verification                    |
| Information are distributed via the ArrivalSequenceSubscriber:publishArrivalSequence.<br>"Successfully subscribed" consumers are those that successfully completed the subscription request AND did not yet submit the unsubscribe request. | Test                            |

| Identifier                                                                                                                                                                                                                                  | Requirement Name             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| REQ 0475                                                                                                                                                                                                                                    | Supplementary data selection |
| If a successfully subscribed ArrivalSequenceConsumer did provide SupplementaryDataSelection at subscription time, the ArrivalSequenceProvider shall notify it with ArrivalSequence including selected supplementary data.                   |                              |
| Rationale                                                                                                                                                                                                                                   | Verification                 |
| Information are distributed via the ArrivalSequenceSubscriber:publishArrivalSequence.<br>"Successfully subscribed" consumers are those that successfully completed the subscription request AND did not yet submit the unsubscribe request. | Test                         |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Requirement Name |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| REQ 0480                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Sequence Gaps    |
| Upon reception of an ArrivalSequence message, if the ArrivalSequenceConsumer discovers some "unexpected gaps" in the sequence (i.e. the sequence does not contain a sequenceEntry related to a flight for which, in the latest previously received ArrivalSequence message, the "lastFiledRecord" attribute was set to "false"), it may notify the problem to the ArrivalSequenceProvider by providing a DataValidationResult message (through the communicateProblem operation) with SEQUENCE_GAPS as dataValResult and providing the information about the missing entries via the errorReport attribute. |                  |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Verification     |
| As an example, if the consumer discover that the 2nd entry (related to flight LH123) in the sequence disappeared, he might fill the errorReport as follows:<br><ul style="list-style-type: none"> <li>- erroneousFieldName: "ArrivalManagementInformation.sequenceEntries@2"</li> <li>- errorCode: LOGIC_VIOLATION</li> <li>- errorMessage: "flight LH123 unexpectedly disappeared from the arrival sequence"</li> </ul>                                                                                                                                                                                    | Test             |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                              | Requirement Name               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| REQ 0485                                                                                                                                                                                                                                                                                                                                                                                                                                                | Wrong format validation result |
| Upon reception of any message (e.g. ArrivalSequence or a response message), if the ArrivalSequenceConsumer does not recognize the format of the message, it may notify the problem to the ArrivalSequenceProvider by providing a DataValidationResult message (through the communicateProblem operation) with WRONG_FORMAT as dataValResult and (optionally) providing additional information about the specific problem via the errorReport attribute. |                                |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                               | Verification                   |
| E.g. the consumer receives an ArrivalSequence which is encoded in JSON instead of XML as per provider interface definition. In this case, he might provide additional information about the error by filling the errorReport as follows:<br><ul style="list-style-type: none"> <li>- errorCode: BAD_FORMAT</li> <li>- errorMessage: "Not well-formed (invalid token) at Line 1"</li> </ul>                                                              | Test                           |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Requirement Name               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| REQ 0490                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Data invalid validation result |
| <p>Upon reception of any message (e.g. ArrivalSequence or a response message), if the ArrivalSequenceConsumer finds an error in the message, it may notify the problem to the ArrivalSequenceProvider by providing a DataValidationResult message(through the communicateProblem operation) with DATA_INVALID as dataValResult and (optionally) providing additional information about the specific problem via the errorReport attribute. The error conditions to be checked are defined in the Data Catalogue (Chapter 4 of this document).</p> |                                |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Verification                   |
| <p>E.g. the consumer receives an ArrivalSequence which includes an attribute with a wrong enumerative value. In this case, he might provide additional information about the error by filling the errorReport as follows:</p> <ul style="list-style-type: none"> <li>- erroneousFieldName: "ArrivalManagementInformation.sequenceEntries@1.arrivalManagementHandlingIndicator"</li> <li>- errorCode: WRONG_ENUM_VALUE</li> <li>- errorMessage: "CTA_NOT_ISSUED value is not included among known enum values"</li> </ul>                          | Test                           |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Requirement Name                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| REQ 0495                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Not subscribed data validation result |
| <p>Upon reception of an ArrivalSequence message, if the ArrivalSequenceConsumer finds "supplementaryData" that he did not request at subscription time or he finds sequenceEntries that should have been filtered out according to the subscriptionFilters provided at subscription time, he may notify the problem to the ArrivalSequenceProvider by providing a DataValidationResult message (through the communicateProblem operation) with NOT_SUBSCRIBED_DATA as dataValResult and (optionally) providing additional information about the specific problem via the errorReport attribute.</p>     |                                       |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Verification                          |
| <p>As an example, the consumer discovers that the 2nd entry (related to flight LH123) should have been filtered out according to the filtering conditions he defined at subscription time. In this case, he might provide additional information about the error by filling the errorReport as follows:</p> <ul style="list-style-type: none"> <li>- erroneousFieldName: "ArrivalManagementInformation.sequenceEntries@2"</li> <li>- errorCode: LOGIC_VIOLATION</li> <li>- errorMessage: "sequenceEntry 2 [for flight LH123] should have been filtered out according to filtering condition"</li> </ul> | Test                                  |

| Identifier                                                                                                                                                                          | Requirement Name                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| REQ 0500                                                                                                                                                                            | Unsubscription request validity checks |
| <p>Upon reception of an UnsubscriptionRequest message, the ArrivalSequenceProvider shall enforce message validity checks and return accordingly with an UnsubscriptionResponse.</p> |                                        |
| Rationale                                                                                                                                                                           | Verification                           |
| Unsubscription requests are accepted or not according to identified validity checks.                                                                                                | Test                                   |

| Identifier                                                                                                                                                                                                                                                                        | Requirement Name                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| REQ 0505                                                                                                                                                                                                                                                                          | UnsubscriptionRequest message validity checks |
| <p>The ArrivalSequenceProvider shall enforce the following UnsubscriptionRequest message validity checks:</p> <ul style="list-style-type: none"> <li>- subscription status</li> <li>- coherence of the unsubscription request</li> <li>- input message format validity</li> </ul> |                                               |
| Rationale                                                                                                                                                                                                                                                                         | Verification                                  |
| To ensure the transmission of correct output data the provider needs to validate the input data.                                                                                                                                                                                  | Test                                          |

| Identifier                                                                                                                                                                                                                                    | Requirement Name                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| REQ 0510                                                                                                                                                                                                                                      | Rejection of the unsubscription request |
| If the subscription status validity check fails, the ArrivalSequenceProvider shall reject the UnsubscriptionRequest by returning an UnsubscriptionResponse message with UNSUBSCRIBE_FAILURE as unsubstatus and NOT_SUBSCRIBED as errorReason. |                                         |
| Rationale                                                                                                                                                                                                                                     | Verification                            |
| Consequence of subscription status validity check failure                                                                                                                                                                                     | Test                                    |

| Identifier                                                                                                                                                             | Requirement Name                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| REQ 0515                                                                                                                                                               | Subscription validity check failed |
| The ArrivalSequenceProvider shall consider the subscription status validity check as failed when the requesting ArrivalSequenceConsumer does not result as subscribed. |                                    |
| Rationale                                                                                                                                                              | Verification                       |
| Clarification of the scope of "subscriptionstatus" validity check..                                                                                                    | Test                               |

| Identifier                                                                                                                                                                                                                                        | Requirement Name                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| REQ 0520                                                                                                                                                                                                                                          | Wrong reference for unsubscription |
| If the "coherence of the unsubscription" check fails, the ArrivalSequenceProvider shall reject the UnsubscriptionRequest by returning a UnsubscriptionResponse message with UNSUBSCRIBE_FAILURE as unsubstatus and WRONG_REFERENCE as errorReason |                                    |
| Rationale                                                                                                                                                                                                                                         | Verification                       |
| Unsubscription can only be proceeded when a correct subscription reference is provided.                                                                                                                                                           | Test                               |

| Identifier                                                                                                                                                                                                                                                                                                                                                                  | Requirement Name               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| REQ 0525                                                                                                                                                                                                                                                                                                                                                                    | Subscription Reference unknown |
| The ArrivalSequenceProvider shall consider the "coherence of the unsubscription" check as failed when the requesting ArrivalSequenceConsumer provides a subscriptionReference that is unknown or does not correspond to a subscription associated to the requesting ArrivalSequenceConsumer.                                                                                |                                |
| Rationale                                                                                                                                                                                                                                                                                                                                                                   | Verification                   |
| This requirement defines when to consider the unsubscription as failed. The subscriptionReference is an abstract concept. This implies that the requirements can be fulfilled differently depending on how such "subscriptionReference" is substantiated (e.g. could be represented by the service consumer identity, could be represented by an explicit identifier etc..) | Test                           |

| Identifier                                                                                                                                                                                                                                        | Requirement Name                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| REQ 0530                                                                                                                                                                                                                                          | Unsubscription message not interpretable |
| If the "input message format" validity check fails, the ArrivalSequenceProvider shall reject the UnsubscriptionRequest by returning a UnsubscriptionResponse message with UNSUBSCRIBE_FAILURE as unsubstatus and NOT_INTERPRETABLE as errorReason |                                          |
| Rationale                                                                                                                                                                                                                                         | Verification                             |
| If the unsubscription message cannot be read, the provider returns a corresponding message.                                                                                                                                                       | Test                                     |

| Identifier                                                                                                                                                                                                                                                      | Requirement Name                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| REQ 0535                                                                                                                                                                                                                                                        | Subscription reference format unknown |
| The ArrivalSequenceProvider shall consider the "input message format" validity check as failed when the requesting ArrivalSequenceConsumer provides a subscriptionReference whose format is unknown or not respecting the expected format (e.g. an XML schema). |                                       |
| Rationale                                                                                                                                                                                                                                                       | Verification                          |
| Subscription reference format unknown                                                                                                                                                                                                                           | Test                                  |

| Identifier                                                                                                                                                                                                                                                                                            | Requirement Name          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| REQ 0540                                                                                                                                                                                                                                                                                              | Successful unsubscription |
| If all the validity checks are successfully enforced and no additional errors occur while processing the unsubscriptionRequest message, the ArrivalSequenceProvider shall accept the unsubscriptionRequest by returning an UnsubscriptionResponse message with UNSUBSCRIBE_SUCCESSFUL as unsubStatus. |                           |
| Rationale                                                                                                                                                                                                                                                                                             | Verification              |
| Successful unsubscription                                                                                                                                                                                                                                                                             | Test                      |

| Identifier                                                                                                                                                                                                                                                              | Requirement Name                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| REQ 0545                                                                                                                                                                                                                                                                | Log of consumer validation errors |
| Upon reception of a DataValidatonResult message, the ArrivalSequenceProvider shall log the provided error information including the indication of the particular ArrivalSequenceConsumer informing about the problem and the date/time of the reception of the message. |                                   |
| Rationale                                                                                                                                                                                                                                                               | Verification                      |
| The provider needs to trace (and possibly react on) the errors communicated by the consumer.                                                                                                                                                                            | Test                              |

| Identifier                                                                                                                                                                                      | Requirement Name               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| REQ 0560                                                                                                                                                                                        | Error reaction of the provider |
| The ArrivalSequenceProvider should define and agree with the ArrivalSequenceConsumer(s) a policy regarding the analysis and follow up of the errors provided by the ArrivalSequenceConsumer(s). |                                |
| Rationale                                                                                                                                                                                       | Verification                   |
| The provider needs to agree with the consumers on if/how to react on the errors communicated by the consumer.                                                                                   | Review of Design               |

## 3.6.4.2

### Requirements on the nominal Service Behaviour (Interface "ArrivalSequenceSubscriber")

| Identifier                                                                                                                                                                                                                                                                                                           | Requirement Name                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| REQ 0565                                                                                                                                                                                                                                                                                                             | Communicate exceptions by the provider |
| If the "back-end" system providing arrival sequencing (e.g. a local AMAN system) fails due to any operational or technical reasons, the ArrivalSequenceProvider shall notify it to the ArrivalSequencenInformationConsumer by means of the "communicateException" operation containing a ProviderExceptions message. |                                        |
| Rationale                                                                                                                                                                                                                                                                                                            | Verification                           |
| The provider needs to inform the consumer about any service outage or shortfalls.                                                                                                                                                                                                                                    | Test                                   |

| Identifier                                                                                                                                                                                                                                                                            | Requirement Name    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| REQ 0570                                                                                                                                                                                                                                                                              | Sequencing disabled |
| If the "back-end" system providing arrival sequencing (e.g. a local AMAN system) is disabled for operational reasons, the ArrivalSequenceProvider shall notify it to the ArrivalSequenceConsumer by means of a ProviderExceptions message with SEQUENCING_DISABLED enumeration value. |                     |
| Rationale                                                                                                                                                                                                                                                                             | Verification        |
| The provider has to communicate the specific problems to the service consumers with the corresponding value of the message.                                                                                                                                                           | Test                |

| Identifier                                                                                                                                                                                                                                                                                                | Requirement Name |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| REQ 0575                                                                                                                                                                                                                                                                                                  | Aman unavailable |
| If the "back-end" system providing arrival sequencing (e.g. a local AMAN system) is unavailable due to technical or infrastructure problems, the ArrivalSequenceProvider shall notify it to the ArrivalSequenceConsumer by means of a ProviderExceptions message with AMAN_UNAVAILABLE enumeration value. |                  |
| Rationale                                                                                                                                                                                                                                                                                                 | Verification     |
| The provider has to communicate the specific problems to the service consumers with the corresponding value of the message.                                                                                                                                                                               | Test             |

| Identifier                                                                                                                                                                                                                                                                                                                                | Requirement Name |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| REQ 0580                                                                                                                                                                                                                                                                                                                                  | Aman degraded    |
| If the "back-end" system providing arrival sequencing (e.g. a local AMAN system) functionality cannot be fully guaranteed and the content transferred might not be trustworthy, the ArrivalSequenceProvider shall notify it to the ArrivalSequenceConsumer by means of a ProviderExceptions message with AMAN_DEGRADED enumeration value. |                  |
| Rationale                                                                                                                                                                                                                                                                                                                                 | Verification     |
| The provider has to communicate the specific problems to the service consumers with the corresponding value of the message.                                                                                                                                                                                                               | Test             |

| Identifier                                                                                                                                                                                                                                                                                                                                                                                                              | Requirement Name                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| REQ 0585                                                                                                                                                                                                                                                                                                                                                                                                                | Distribution of sequence information |
| The ArrivalSequenceProvider shall evaluate at least every 30 seconds if the content of the ArrivalSequence message differs from the last distribution (the attributes "creationTime" and "publicationTime" are not in scope of this comparison).<br>If the content is different, the Arrival Sequence message (taking into account filtering criteria) shall be distributed, otherwise the distribution may be omitted. |                                      |
| Rationale                                                                                                                                                                                                                                                                                                                                                                                                               | Verification                         |
| The provider has to publish the required arrival sequence information to the subscribed consumers, according to the information contained in the request.                                                                                                                                                                                                                                                               | Test                                 |

| Identifier                                                                                                                                                                                                                                                                                          | Requirement Name                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| REQ 0590                                                                                                                                                                                                                                                                                            | Restart of sequence transmission |
| The distribution of the ArrivalSequence messages shall be interrupted whenever the ArrivalSequenceProvider notifies any provider exceptions by means of communicateExceptions operation. The transmission of data shall immediately be continued right after the announced problem has been solved. |                                  |
| Rationale                                                                                                                                                                                                                                                                                           | Verification                     |
| The provider stops distributing information once any provider exceptions has been identified.                                                                                                                                                                                                       | Test                             |