

Supporting
European
Aviation



SWIM in support of ATM Automation

APAC Seminar on ATM Automation

27 Oct 2020

Pedro Fernandez



Overview



Context



Approach



Results



10 years supporting European automation with SWIM

Context



Trends, opportunities, challenges...

Industry trends

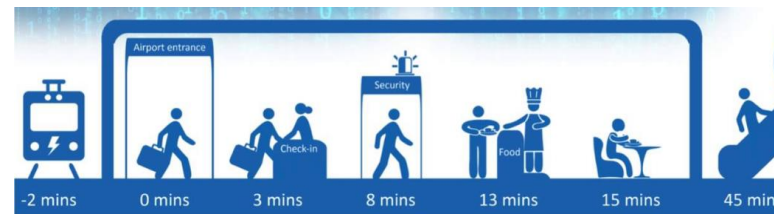
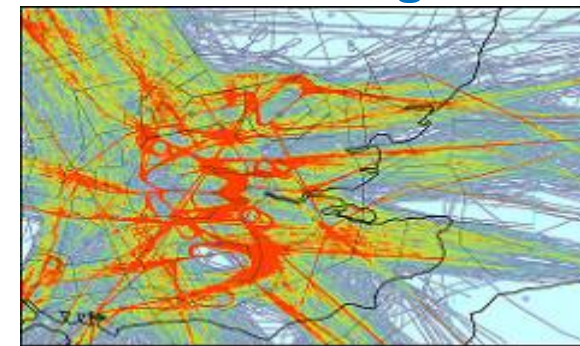
Autonomous systems



Augmented Reality

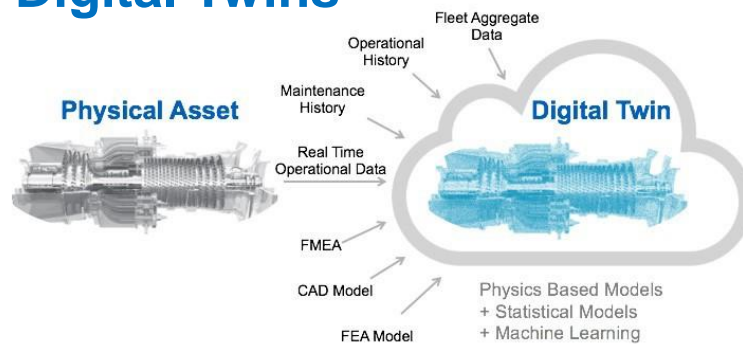


Artificial Intelligence



Smart Spaces

Digital Twins



IoT

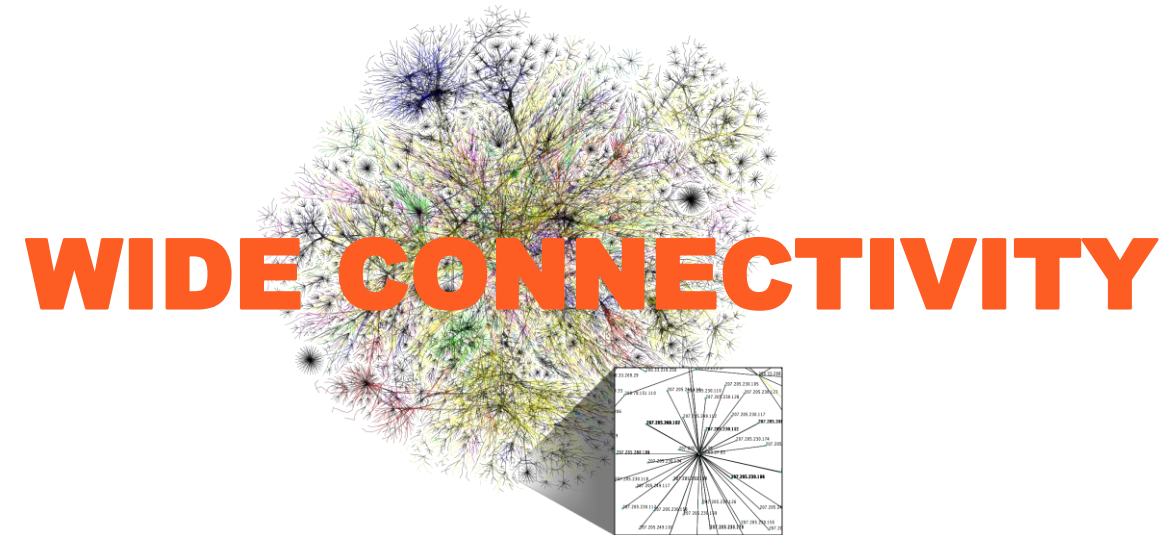




Data explosion

- 2.5 quintillion bytes of data a day
- 90% worlds data created the last few years

Source: IBM

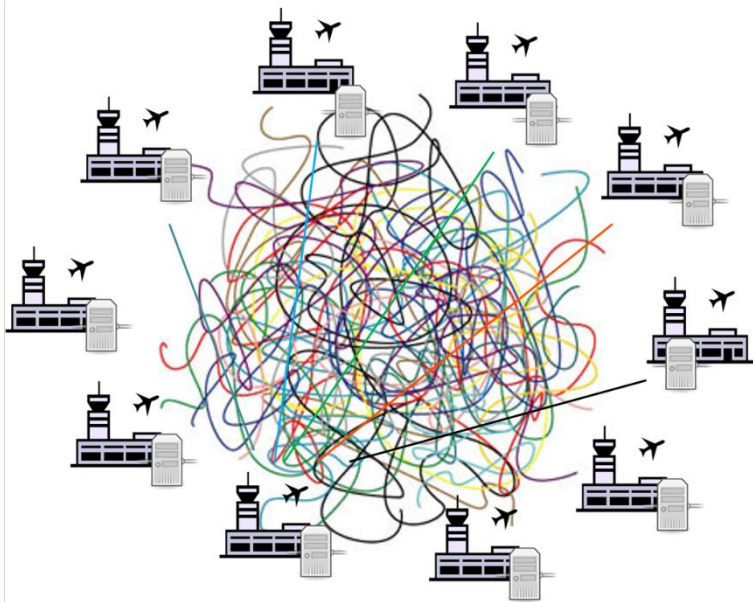


Interconnectivity growth

- 2000: 1B users
- 2018: 23B things
- 2025: 75B things

Source: Statista

Challenges



- Many actors
- Heterogenous capabilities
- ATM legacy systems
- Conservative safety approach
- ...

Approach to SWIM

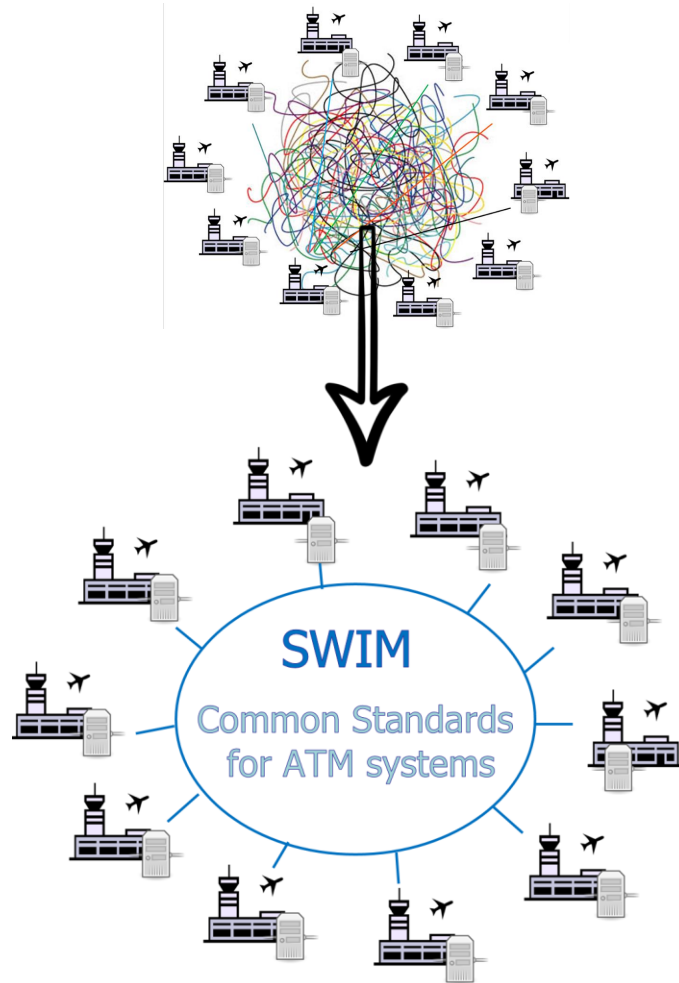


Standardization, SOA, Mainstream Technology,..

Enabling transformation

SWIM

Helping organizations manage ATM-related information and its exchange with other organizations through interoperable services.



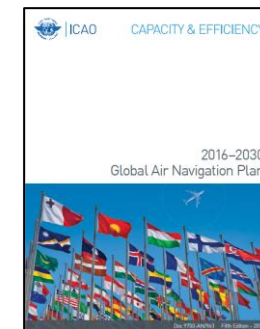
Simpler systems

Lowering maintenance costs

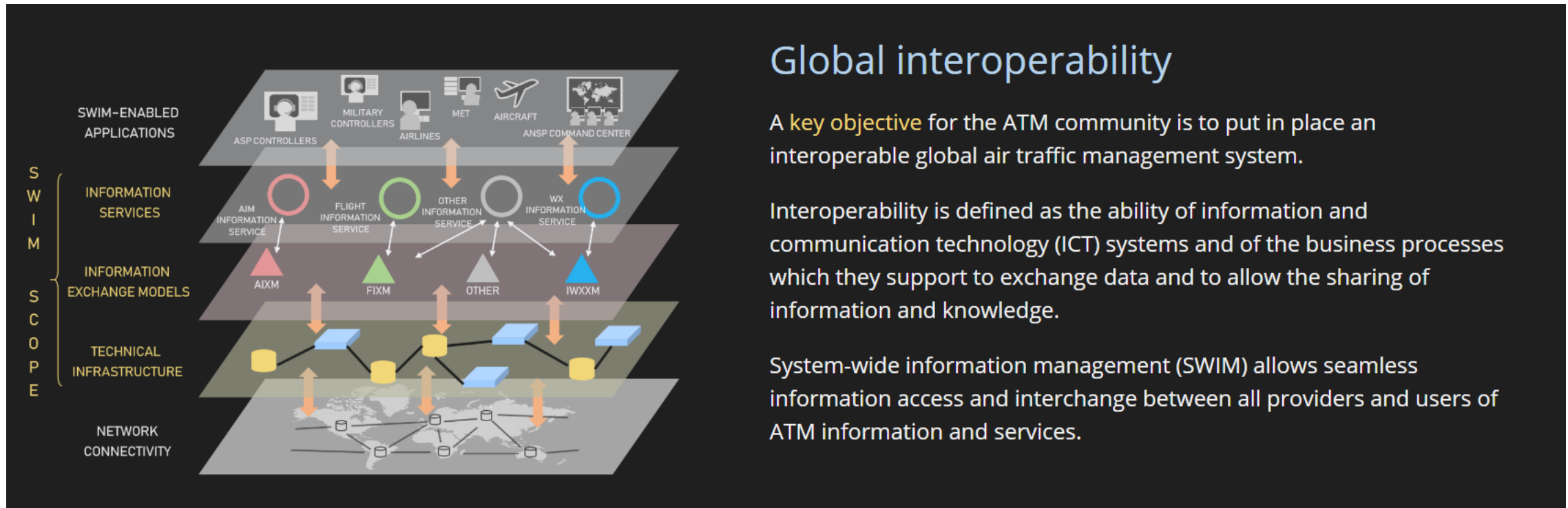
Enhancing architectural flexibility

Lowering integration cost

Part of:



SWIM is about...global interoperability



*Interoperability: semantic syntactic technical

SWIM is about...common standards



Common standards

The **AIRM** (ATM Information Reference Model) is the reference vocabulary for defining air traffic management information.

Information exchange models such as **AIXM**, **FIXM** and **IWXXM** provide syntax and semantics. These are elements which are key to allowing interoperability.

In addition, the **EUROCONTROL SWIM Specifications** provide a framework for the development and assessment of SWIM services.



The logo for AIXM (ATM Information Exchange Model) consists of the letters "AIXM" in a blue, outlined, sans-serif font.



The logo for IWXXM (Information Exchange Model) features the letters "IWXXM" in a yellow, outlined, sans-serif font, with a small yellow starburst above the "I".



The logo for FIXM (Flight Information Exchange Model) features the letters "FIXM" in a white, outlined, sans-serif font, with a blue airplane icon integrated into the letter "X". Below "FIXM" is the text "Flight Information Exchange Model" in a smaller, white, sans-serif font.

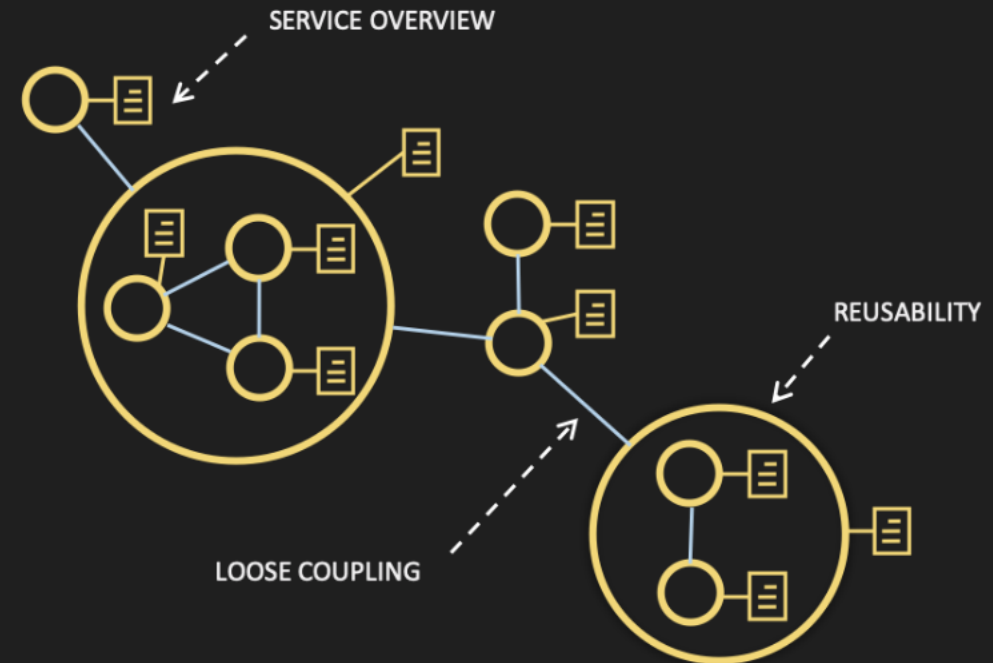
SWIM is about...**service orientation**

Service orientation

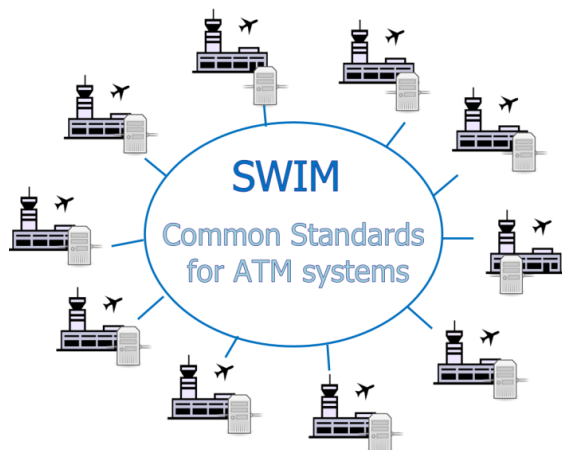
Service orientation brings modularity, reusability and other best practices from the ICT world to ATM.

Whilst there is no formally agreed definition of SOA (service-oriented architecture), partitioning of functionality into unassociated, self-contained and therefore reusable services which can be discovered by potential consumers is considered to be a key feature which discriminates SOA from more traditional architectural paradigms.

The SOA paradigm has been used successfully in many industries, including manufacturing, banking, health care, and merchandise retailing.



SWIM Standards



Foundational Standards
Applicable to all information exchanges



Service Specific Standards
Applicable to all information exchanges

EUROCONTROL Specification SWIM Service Description



- Provides requirements for describing information services.
- For a service consumer to discover a service, consider using a service, or implement a service consuming client
- Defines the minimum set of elements a service description has to contain to make it searchable and useful.

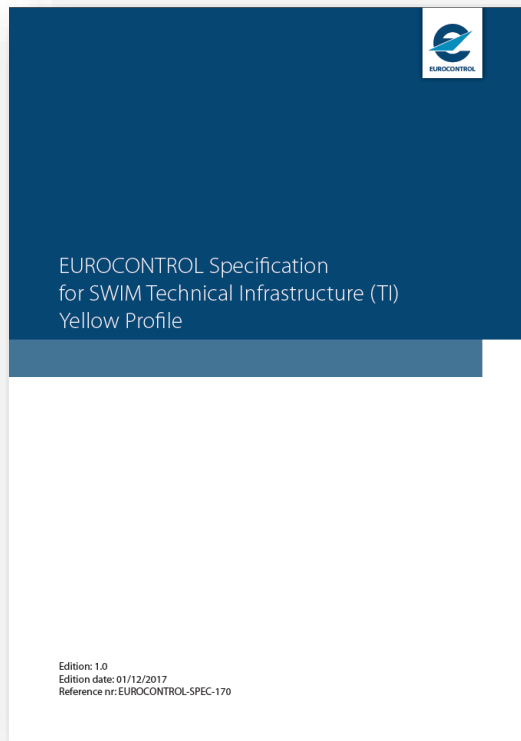
FF-ICE/1 Filing Service Description	
Service Description Identification	
<i>Title</i>	FF-ICE/1 Filing Service Description
<i>Edition</i>	0.02
<i>Reference date</i>	23/06/2017
Service Identification	
<i>Service Name</i>	Flight Filing Service
<i>Service Version</i>	1.0.0
<i>Service Abstract</i>	The Flight Filing Service is provided by an FF-ICE capable ATM Service Provider (eASP) and allows the service consumers (i.e. FF-ICE capable Airspace Users also known as eAU) to file, amend, cancel or retrieve a filed flight plan and to receive acknowledgement and error conditions.
Service Provider	
<i>Organisation</i>	Yellow Ice, the upcoming SWIM service company
<i>Points of Contact</i>	To request access to the service: http://www.yellow-ice.aero/swim/service-request For Incidents on services in operation, contact the Service desk [24/7]: +32 555 50 01 service-desk@yellow-ice.aero
Service Category	
<i>ATM information</i>	flight information
<i>Flight phase</i>	pre-flight (more specifically, Medium/Short Term Planning)
<i>Intended consumer</i>	Airspace Users (more specifically, FF-ICE capable Airspace Users also known as eAU)
<i>ATM capability</i>	Service Delivery Management

EUROCONTROL Specification SWIM Information Definition

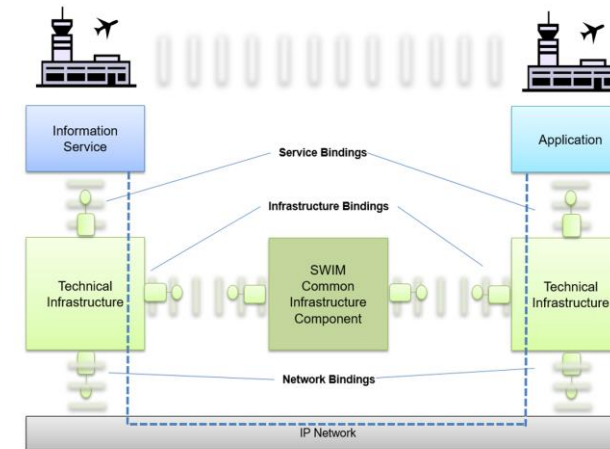


- Provides requirements for information exchange definitions conform the semantics of the ATM Information Reference Model (AIRM)
 - www.airm.aero
- Contributes to the semantic interoperability of information.

EUROCONTROL Specification SWIM Technical Infrastructure Yellow Profile



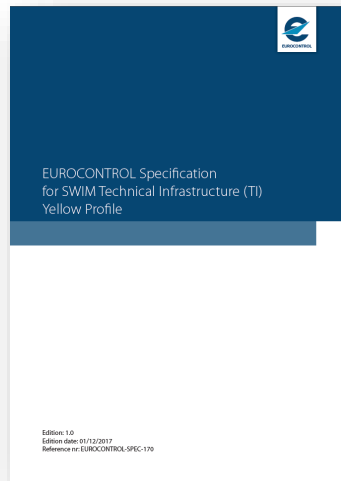
- Provides requirements for IT infrastructure capabilities and interfaces
- Facilitates the reliable, secure and efficient exchange of information. Contributes to technical interoperability.



SWIM TIYP Requirements

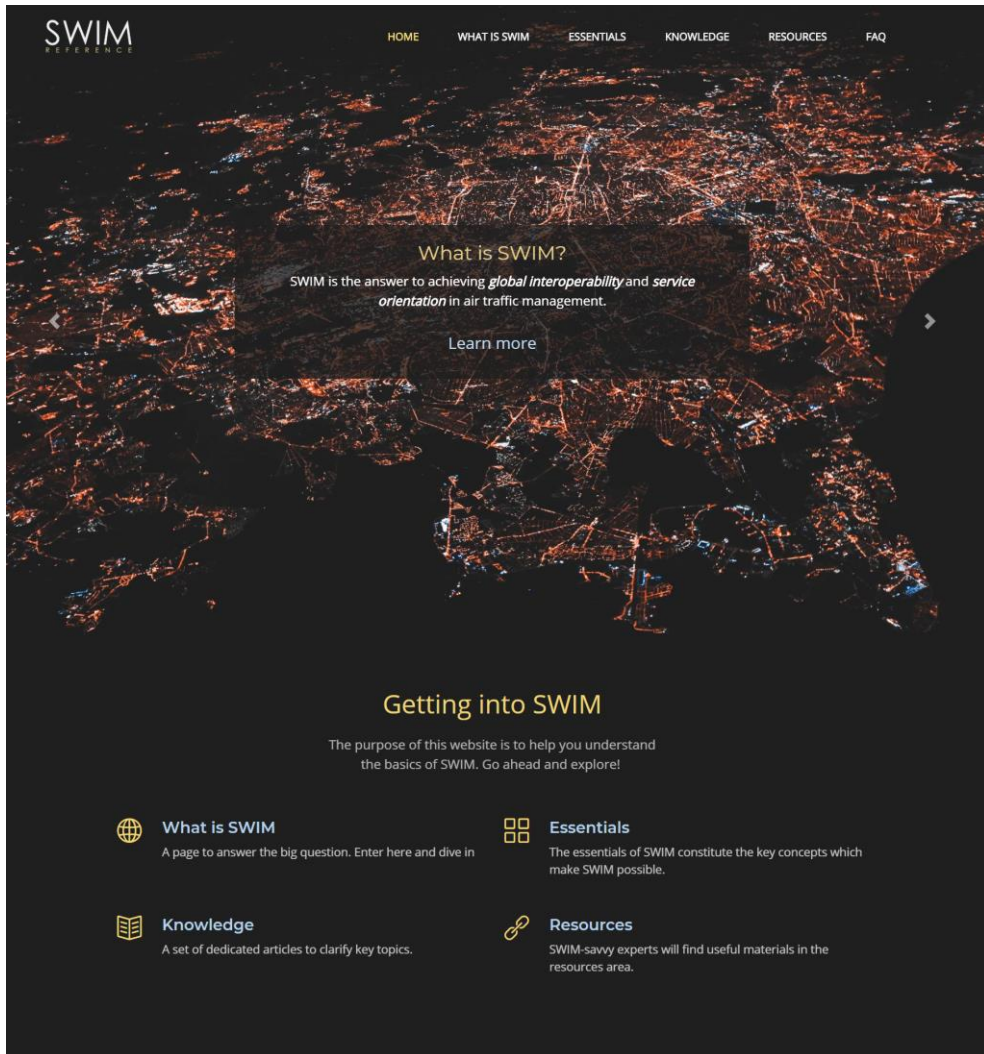
Interoperability Requirements One size does not fit all

Infrastructure Requirements Minimum + Optional



	MEP		Performance		Security			Binding
	Pattern Supported ¹	Pattern Specified	Messaging QoS Capability	Bandwidth Efficiency	Confidentiality	Integrity	Authentication	
HTTP	R/R	R/R	No	++	Transport	Transport	Transport (X.509 Server or X.509 Mutual)	WS Light
SOAP WS	R/R	R/R	Yes	+	Transport	Transport	Transport (X.509 Server or X.509 Mutual)	WS SOAP
					Transport	Transport	Transport (X.509 Server or X.509 Mutual) Message (Username/Password)	WS SOAP with Basic Message Security
					Message (Optional)	Message	Message (X.509)	WS SOAP with Message Security
					Message (Optional)	Message	Message (X.509 or SAML)	WS SOAP with Federated Security
SOAP WS-N	P/S	P/S	Yes	+	Transport	Transport	Transport (X.509 Server or X.509 Mutual)	WS-N SOAP
					Transport	Transport	Transport (X.509 Server or X.509 Mutual) Message (Username/Password)	WS-N SOAP with Basic Message Security
					Message Optional	Message	Message (X.509)	WS-N SOAP with Message Security
					Message Optional	Message	Message (X.509 or SAML)	WS-N SOAP with Federated Security
AMQP	(a)R/R, P/S, FF	FF	Yes	+++	Transport	Transport	Transport (X.509 Server with SASL Client or X.509 mutual)	AMQP Messaging





SWIM REFERENCE

HOME WHAT IS SWIM ESSENTIALS KNOWLEDGE RESOURCES FAQ

What is SWIM?

SWIM is the answer to achieving *global interoperability* and *service orientation* in air traffic management.

Learn more


Getting into SWIM

The purpose of this website is to help you understand the basics of SWIM. Go ahead and explore!

- What is SWIM**
A page to answer the big question. Enter here and dive in
- Essentials**
The essentials of SWIM constitute the key concepts which make SWIM possible.
- Knowledge**
A set of dedicated articles to clarify key topics.
- Resources**
SWIM-savvy experts will find useful materials in the resources area.

What is SWIM?

SWIM is the answer to achieving *global interoperability* and *service orientation* in air traffic management.



Global interoperability

A key objective for the ATM community is to put in place an interoperable global air traffic management system.

Interoperability is defined as the ability of information and communication technology (ICT) systems and of the business processes which they support to exchange data and to allow the sharing of information and knowledge.

System-wide information management (SWIM) allows seamless information access and interchange between all providers and users of ATM information and services.

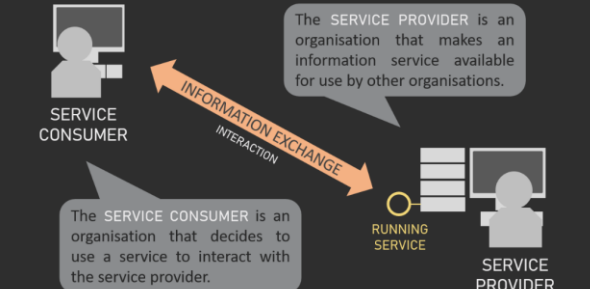
Service orientation

Service orientation brings modularity, reusability and other best practices from the ICT world to ATM.

Whilst there is no formally agreed definition of SOA (service-oriented architecture), partitioning of functionality into unassociated, self-contained and therefore reusable services which can be discovered by potential consumers is considered to be a feature which discriminates the SOA paradigm from other architectures.

Services aligned to the business

Information services allow organisations to align their interactions with other organisations in accordance with their business goals and activities.



The **SERVICE PROVIDER** is an organisation that makes an information service available for use by other organisations.

The **SERVICE CONSUMER** is an organisation that decides to use a service to interact with the service provider.

The two organisations exchange information through the **INFORMATION SERVICE** to achieve business goals.

Information

Information is the result of the assembly, analysis, formatting, and documenting of data, to make the data useful in an ATM context.

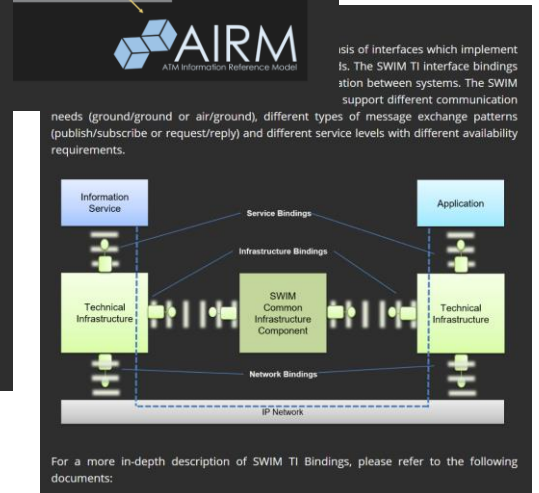
Interoperability at the level of the information service payloads –the assembly of information exchanged using an information service– is essential in the evolving ATM network. This is a key objective of system-wide information management (SWIM).

Information service providers/consumers should have a common understanding of:

- the meaning of the information in an information service payload; and
- the encoding of the data in an information service payload.

INFORMATION DEFINITION

TITLE	EDITION	DATE
CEPT		
TYPE		
CONFIDENCE		



AIRM
ATM Information Reference Model

is of interfaces which implement is. The SWIM TI interface bindings station between systems. The SWIM support different communication needs (ground/ground or air/ground), different types of message exchange patterns (publish/subscribe or request/reply) and different service levels with different availability requirements.

For a more in-depth description of SWIM TI Bindings, please refer to the following documents:

SWIM Implementations



Service Registry, NM B2B Services,...

SWIM Registry



- The SWIM Registry is a directory of information that supports the discovery of SWIM services.
- The SWIM Registry uses a formal registration process to store, catalogue and manage information about services.

SWIM Services in the Registry



Services Documents

Discovery of ATM Service Information

The SWIM Registry is a directory of information that supports the discovery of SWIM services. It uses a formal registration process to store, catalogue and manage information about services

Service Descriptions

The registry provides information about upcoming or implemented information services by service providers in SWIM. It provides all information required by service consumers to identify and implement interfaces to information services.

Service Definitions

The registry provides also information about service definitions, that are provider agnostic and reusable descriptions of services that facilitate alignment and interoperability in the implementation of services.

Co-financed by the Connecting Europe Facility of the European Union

Services Documents

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ASM to ASM Service

Version: 1.0
Organisation: EUR_ORG_1

The ASMtoASM service enables the complete set of ASM functions necessary for the interactions between ASM Support Systems or ASM Support System and External Users in the process of airspace management. It supports data exchange between an ASM...

Geofencing Information Service

Version: 0.0.1
Organisation: EUROCONTROL

This document specifies the Geofencing Information Service describing how UTM Service Providers are required to exchange UAS Zone information with consuming systems to enable the implementation of geofencing capabilities. The document specifies the...

Arrival Sequence Service

Version: 1.0
Organisation: EUR_ORG_1

Service Definition of the SWIM Arrival Sequence Service defined in EUROCAE ED-254.

FlightFilingService

Version: 23.5.0
Organisation: EUR_ORG_1

FlightFilingService is intended to provide requests aimed at filing flight plan messages.

Donlon TOBT Setting Service (c...)

Version: 1.0.0
Organisation: EUR_ORG_1

The TargetOffBlockTimeSetting service supports the Airport CDM concept and its implementation by allowing A-CDM Partners, typically aircraft operators and ground handlers, with the capability to set the Target Off-Block Time (TOBT) that indicates...

CCS CoordinationAndTransferMan...

Version: 1.0.0
Organisation: DSNAMENAV

This Service is part of Coflight Cloud Services (CCS), which are primarily designed to support the Virtual Centre concept. As such, these CCS Services support the interactions between the CCS ATM Data Service Provider (ADSP) and Virtual Centre Air...

OpenATM

Version: 1.0
Organisation: EUROCONTROL_SLOVENIA_CONTROL

The OpenATM service decouples the ATM data service provider (ADSPs) from the air traffic service units (ATSUs) through an open and standardised service interfaces to foster ADSP/ATSU cross-vendor interoperability. Its aim is to provide ATSUs with an...

CCS FlightDataManagement

Version: 1.0.0
Organisation: DSNAMENAV

This Service is part of Coflight Cloud Services (CCS), which are primarily designed to support the Virtual Centre concept. As such, these CCS Services support the interactions between the CCS ATM Data Service Provider (ADSP) and Virtual Centre Air...

CCS FlightDataDistribution

Version: 1.0.0
Organisation: DSNAMENAV

This Service is part of Coflight Cloud Services (CCS), which are primarily designed to support the Virtual Centre concept. As such, these CCS Services support the interactions between the CCS ATM Data Service Provider (ADSP) and Virtual Centre Air...

Services Documents

Home / Services / Geofencing Information Service

Geofencing Information Service 0.0.1

Abstract
This document specifies the Geofencing Information Service describing how UTM Service Providers are required to exchange UAS Zone information with consuming systems to enable the implementation of geofencing capabilities. The document specifies the interfaces required for the automated exchange of information between systems, including technical infrastructure protocols and data formats.

Service Type

SERVICE DEFINITION
Geofencing Information Service

PERSPECTIVE
EUROCONTROL

Business Activity Area
AIRSPACE ORGANISATION/LAND MANAGEMENT

Member Community
CIVIL AIRSPACE USER

Information Exchange Category
No Information Provided

Application Message Exchange Pattern
PUSH-SUBSCRIPTION WITH PULL-SUBSCRIPTION

Associated CDM Control Interface
No Information Provided

FRS/CDM Location Indicator
No Information Provided

Service CDM Interoperability Labels
No Information Provided

Information Description

No Information Provided

Provider
EUROCONTROL

EUROCONTROL is an intergovernmental organisation with 41 Member and 2 Comprehensive Agreement States.

Managing Body
VIRTUAL CENTRE MANAGER

Contact
No Information Provided

Point of Contact
No Information Provided

General Information Technical Interfaces References

Operational Needs Operational Need 1
Operational Need

Functionality The implementation of Geofencing Information Service is required to ensure the safe operation of drones, enabling the implementation of geofencing capabilities preventing drones from entering into certain areas of the airspace.

Access and Use

Quality of Service This information service aims to address the implementation of the Article 13 of EU UAS Implementing Act 2019/047.

Validation

Abbreviations

Revision Dates (New) Wed, 05/03/2020 - 14:51

Revision Number 02271

The service description is currently in "DRAFT" status. The organisation editor is currently updating its content.

Regulatory History

- Set to service registration_draft on Friday, December 4, 2019 - 13:02 by eurorg\editor

Current state Draft

Change to: Draft

Revision log message

Briefly describe the changes you have made.

Validation Report

eurorg\editor - Monday, January 20, 2020 - 10:21 - Validation has failed and the service state is returned back to service registration_draft. The following fields are mandatory for Definition service type: Information Definition

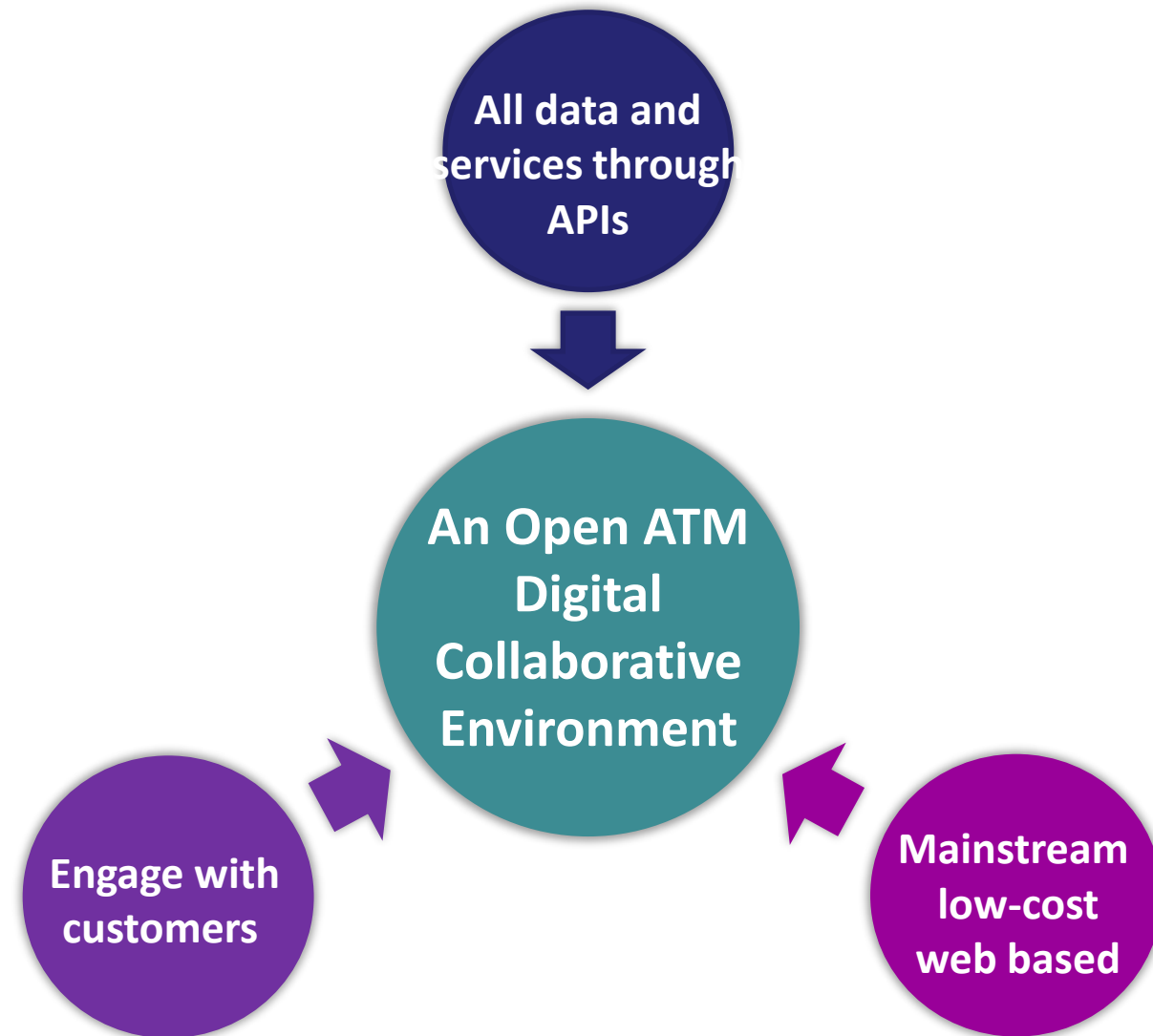
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[Publish Draft](#)
[Edit Draft](#)
[Cancel Draft](#)

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Services Documents

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NM Interoperability Vision and Strategy



NM B2B Services

FIXM

Flight

FlightPreparation

validateFlightPlan
proposeRoutes

FlightFiling

fileNewFlightPlan
fileFlightPlanUpdate
fileFlightPlanCancellation
fileFlightDelay
fileFlightDeparture
fileFlightArrival
retrieveFilingStatus

FlightManagement

queryFlightPlans
queryFlightsByKeys
queryFlightsByAircraftOperator
queryFlightsByAerodrome
queryFlightsByAerodromeSet
queryFlightsByAirspace
queryFlightsByPoint
queryFlightsByTrafficVolume
queryFlightsByMeasure
queryFlightsByHotspot
queryFlightsByAircraftRegistrationMark
retrieveFlight
submitEarlyDPI
submitTargetDPITarget
submitTargetDPISequenced
submitAtcDPI
submitCancelDPI
submitPredictedDPI
submitFlightUpdate
submitTargetTakeOffAPI
submitTargetTimeOverAPI
submitGeneralAPI

FlightSafety

replaceACC3AccreditationList
replaceTCOAuthorisationList
updateTCOAuthorisationList

Flow

TrafficCounts

queryTrafficCountsByPoint
queryTrafficCountsByAerodrome
queryTrafficCountsByAerodromeSet
queryTrafficCountsByAirspace
queryTrafficCountsByAircraftOperator
queryTrafficCountsByTrafficVolume

Measures

queryRegulations
createRegulation
updateRegulation
cancelRegulation
queryRegulationProposals
fileRegulationProposal
updateRegulationProposal
revokeRegulationProposal
queryReroutings
createRerouting
updateRerouting
cancelRerouting
queryMCDMOnly
createMCDMOnly
updateMCDMOnly
cancelMCDMOnly
retrieveMeasureOpLog
updateFlightsInMeasure
retrieveATFCMSituation
retrieveNetworkImpactAssessment

Mcdm

queryMCDM
updateMCDM
retrieveMCDMMessages
updateMCDMState

TacticalUpdates

retrieveSectorConfigurationPlan
updateSectorConfigurationPlan
retrieveCapacityPlan
updateCapacityPlan
retrieveTrafficVolumeActivationPlan
updateTrafficVolumeActivationPlan
retrieveOTMVPlan
updateOTMVPlan
retrieveRunwayConfigurationPlan
updateRunwayConfigurationPlan
queryHotspots
updateHotspots



Airspace

AIXM

AirspaceAvailability

retrieveAUPChain
retrieveAUP
createAUP
updateAUP
validateAUP
deleteAUP
expandRSAAllocations
getAUPServiceConfiguration
retrieveEAUPChain
retrieveEAUPCDRs
compareEAUPCDRs
retrieveEAUPRSAs
compareEAUPRSAs
getManageableRoutesForAMC
getManageableRouteSegmentsForAMCAndRoute

AirspaceStructure

queryCompleteAIXMDatasets
queryIncrementalAIXMDatasets

General Information

AIMs

queryAIMs
retrieveAIMs

NMB2BInfo

queryNMB2BReferenceManuals
queryNMB2BWSDLs
queryNMB2BScenarios
queryNMB2BAddendaErrata
retrieveNMRReleaseInformation

Pub/Sub

SubscriptionManagement

createSubscription
pauseSubscription
resumeSubscription
deleteSubscription
listSubscriptions
retrieveSubscription
subscriptionHistory

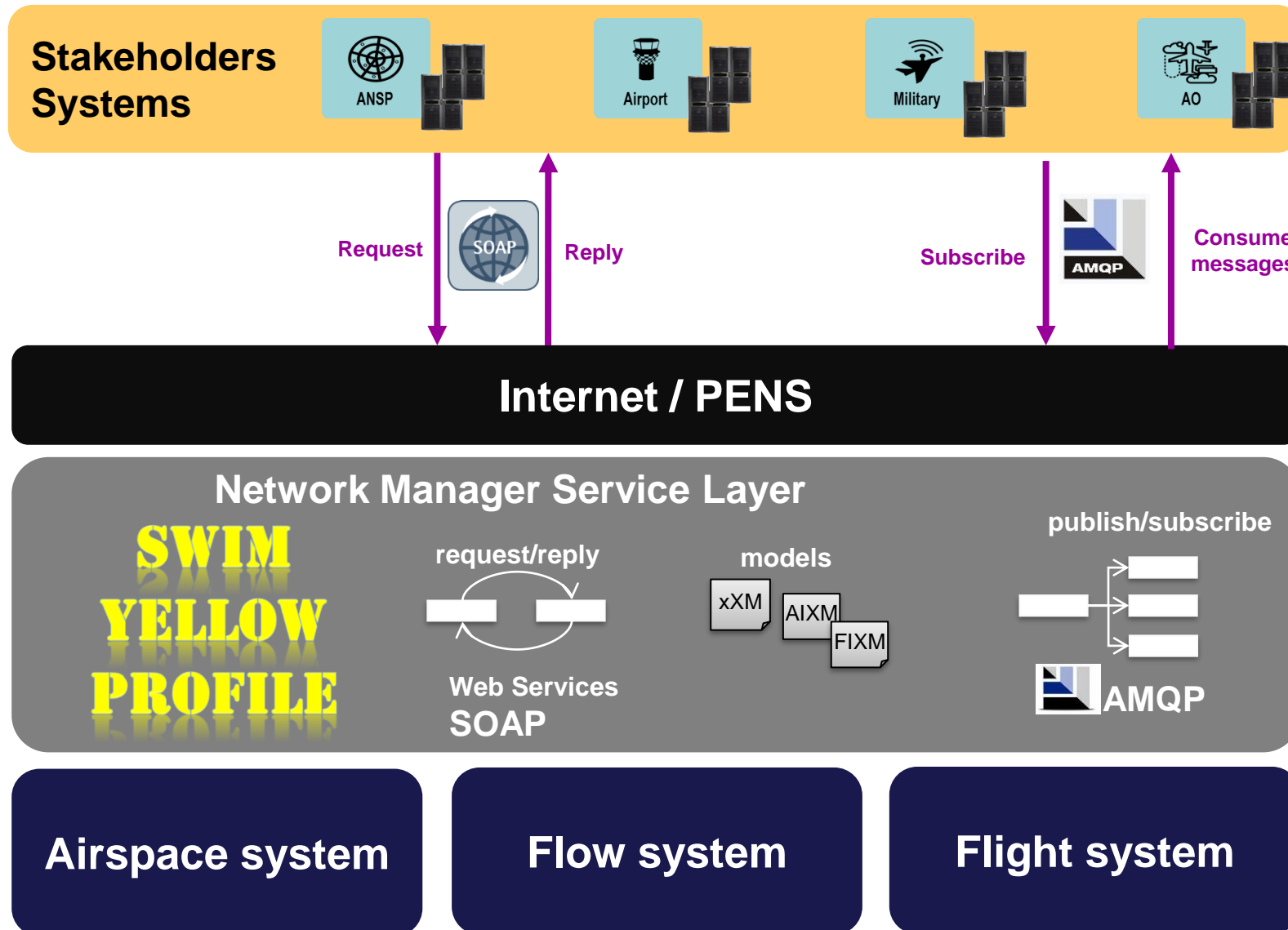
Messaging

pullMessages

Subscription Topics

AIXM_DATASETS
ATM_INFORMATION
EAUP
FLIGHT_PLANS
FLIGHT_DATA
FLIGHT_FILING_RESULT
REGULATIONS

NM B2B Architecture



Examples of ANSP OPS rooms using NM B2B



4Me @ DSNA (Reims): on all CWP's in all French ACCs, used for XMAN, tactical ATFM, NM data

Powered by NM B2B

SALTO @ DSNA (Paris): main tool for FMP in all French ACCs



Examples of Airport OPS rooms using NM B2B

Powered by NM B2B



A-CDM tool @ Copenhagen Airport

A-CDM tool @ Nice Airport



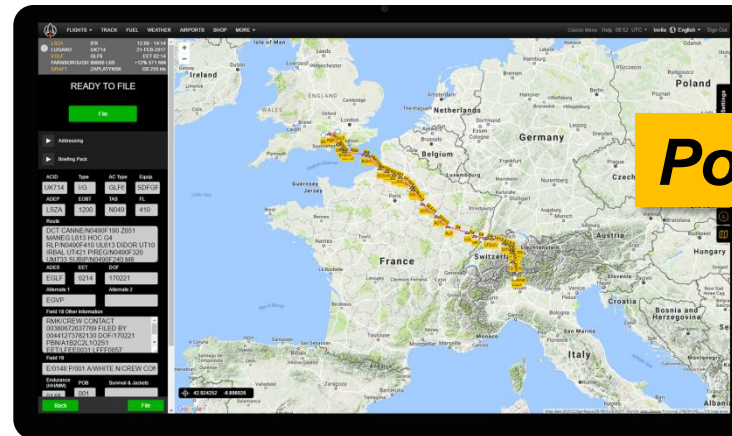
Innovation @ RocketRoute based on NM B2B

Flight Status for BP Fuel Management

Departures | Arrivals | EGLL 16:30 (GMT+00:00) UTC

FitNo	Type	FRType	From	EOBT	Delay	C/ATOT	Status	ETA	Arrive	Track
MEA203	A320	S	Belrut OLBA	15:35	15:57	AIRBORNE	20:11	20:19		
AFL2584	A321	S	Moscow UUEE	16:50	17:00	CANCELLED	20:13			
THA916	B77W	S	Bangkok VTBS	06:20	06:48	AIRBORNE	18:53	19:17		
EWG1ZB	A319	S	Berlin EDDT	16:30	16:41	FILED	18:01			
CHH421	B789	S	Changsha ZGHA	05:35	05:36	AIRBORNE	17:02	16:56		
EWG5PK	A319	S	Hamburg EDDH	16:55	17:14	ACTIVE	18:15	18:21		
CPA239	B77W	S	Hong Kong VHHH	04:05	04:15	CANCELLED	16:32			
AAR521	A359	S	Seoul RKSI	05:50	06:11	AIRBORNE	17:10	17:28		
EWGIAT	A319	S	Dusseldorf EDDL	17:10	17:23	ACTIVE	18:16	18:16		

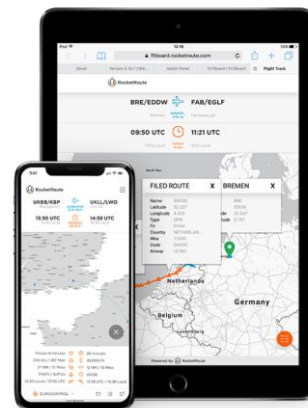
Showing 1 to 25 of 210 entries



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Flight Plan Filing

Apps for pilots



Flight Board for airports and handlers



Flight Board for general aviation



Have a successful SWIM Implementation

swim@eurocontrol.int