



Final Project Report

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Abstract

This project has defined the SWIM functional decomposition and depicted the SWIM technical architecture design. These functions/services have been grouped for a given set of technical constraints/requirements in different SWIM Profiles. It has also supported transversal coordination according to its federating role.

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Acronyms

Acronym	Definition
ATM	Air Traffic Management
DS	Data Set
SCG	SWIM Coordination Group
SOA	Service Oriented Architecture
SoS	System of Systems
SPD	SWIM Profile Descriptor
SWIM	System Wide Information Management
SWIM-TI	SWIM Technical Infrastructure
TAD	Technical Architecture Design
WMS	Working Method of Services
WP	Work Package

1 Project Overview

SWIM, System Wide Information Management, has been identified in SESAR as one of the four main changes in the ATM Target Concept that impact the European ATM System architecture for the long-term. SWIM aims at ensuring the inter-operability of ATM Systems by standardizing and implementing external interfaces with common services. SWIM will enhance the availability of the information to the end-user applications and allows finding the most appropriate source of information when needed.

SWIM is further decomposed in its Operational Aspect (SWIM) and in its Technical Aspect (SWIM-TI, Technical Infrastructure). Both Operational and Technical aspects of SWIM aim at enabling a net-centric architecture following a SOA approach in order to inter-connect the different ATM systems and exchange value added services amongst them.

SWIM-TI is a set of software components distributed over a network infrastructure providing functions enabling collaboration among ATM systems.

This Project has focused in SWIM Technical Infrastructure and it has defined the middleware functional decomposition and depicted the technical architectural design. These functions/services have been grouped for a given set of technical constraints/requirements in different SWIM Profiles. The guidelines, recommendations and rationale for this grouping have been also produced by this project. Project 14.01.03 has also assumed the Federating Role for SWIM-TI matters.

1.1 Project progress and contribution to the Master Plan

According to the European ATM Master Plan (ref. [2]), SWIM, (Operational Improvements IS-0901-A, IS-0901-B and IS-0901-C) was set to introduce a complete change in how information is managed throughout its lifecycle across the whole European ATM system.

This project aimed at defining SWIM-TI design in terms of organisation of the software, its structural elements and the interfaces by which SWIM is composed.

SWIM-TI is a set of software components distributed over a network infrastructure providing functions enabling collaboration among ATM systems.

Given the breadth of SWIM, across all systems, data domains, and flight (planning, execution, post-execution) phases, it is not expected that one solution¹ and certainly not one technology will suit all. Different stakeholders, based on their business needs, may not have the same requirements for SWIM. The high-level architecture of SWIM in the SoS is based on the SOA architectural style.

The SWIM TI provides functions/services for the higher level layer ATM Application and relies itself on the lower level layer Network and technology interoperability is the essential purpose.

The overall work on the design has been performed in several iterations.

The initial iteration was focused on architecture foundation: it aimed at building a framework and at generating common understanding on the overall architecture establishing an early model of the SWIM Prototype.

The following iterations tried to consolidate and to refine the ground/ground and air/ground architecture including additional information that was more technology driven until reaching the maturity level expected.

In parallel, maintenance task had been performed to ease fine tuning of the architecture where was required due to limitations in software components development and after receiving feedback from validation assessments.

¹ The word “solution” covers technology choices; architectural patterns; designs

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According to its federating role, Project 14.01.03 has managed the SWIM-TI contribution to the Integrated Roadmap / Master Plan and supported the contribution of the architectural model to EATMA. This Project has also contributed to Initial SWIM SESAR Solution 2(#46).

Furthermore, this project has been also involved in different transversal activities like Working Method of Services (WMS), SWIM Coordination Group (SCG), Data Sets (DS) definition among others.

This project has also been working very close together with Project 14.01.04 to ensure coherence, consistency and alignment between the different artefacts produced within WP14 (Technical Architecture Design, Profiles, Technical Specification, Prototypes, etc.)

P14.01.03 has mainly contributed to the OI Step IS-0901-A (SWIM for Step1).

On the basis of this functional architecture, project P14.01.03 allocated capabilities to the functional blocks where it expected the primary projects to develop corresponding technical requirements, and also allocated enablers to other system primary projects, proposing solutions for any potential conflicting scopes.

P14.01.03 has worked in the alignment of enablers with primary project activities, dealing with the impact of enablers on the functional decomposition and managing their alignment with the operational improvements

1.2 Project achievements

Project 14.01.03 has provided high level view of SWIM-TI architecture and presented an analysis on the different elements and topics that an enabler for a distributed SoS needs to address

The Technical Architecture Design produced by Project 14.01.03 supported the coordination between WP14 primary projects by allocating technical functionalities to the functional blocks in the functional view, providing a technical view where additional building blocks/technical functions are identified and showing some deployment options in a deployment view. Thereby it enabled a consistent basis upon which the various technical specifications were developed.

This project has also provided background information on the motivations for SWIM Profiles definition, structure and design which is crucial in case of developing new profiles in the future.

Project 14.01.03 has contributed to the SWIM technical architecture component of EATMA, which describes the functional architecture of the system in terms of its constituent functional blocks and their inter-connection with other Systems and Capability Configurations. Furthermore, the impact of each of the master plan enablers on the functional architecture is described by identifying the functional blocks that support the enabler. This linking between the different models brings together the various views (technical, system, deployment, etc.) of the enterprise architecture and allows navigation between them.

The project has maintained the master plan enablers for SWIM, ensuring they remain aligned with the operational improvements and the validation progress, and identifying gaps and coordinating their plugging.

1.3 Project Deliverables

The following table presents the relevant deliverables that have been produced by the project.

Reference	Title	Description
2	The SESAR solution pack related to the iSWIM solution (#46)	is being validated at the time of writing this report. Therefore the corresponding SESAR solution pack is currently in a preliminary state. More information is available at http://www.sesarju.eu/sesar-solutions/enabling-aviation-infrastructure/initial-system-wide-information-management-swim

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D20	Initial SWIM design concepts V1.0	This deliverable provides a high level view of SWIM architecture and presents an analysis on the different elements and topics that SWIM infrastructure, as an enabler for a distributed System of Systems, needs to face
D22	External Coordination	This deliverable is a report detailing the coordination efforts that have been undertaken by WP14 in order to provide support and inputs for SWIM-TI to others WPs
D30	SWIM (GG AG) Architectural Definition - Final	This deliverable is the final in a cycle of TAD documents produced during the life of the project and presents the SWIM Technical Infrastructure functional view and its architectural options.
D39	SWIM Profiles - Final	<p>This deliverable provides background information on the motivations for SWIM Profiles definition, structure and design.</p> <p>This deliverable also include the SPD - Final. This technical note provides the definition of the SWIM Profile Descriptor (SPD)</p>

1.4 Contribution to Standardisation

P14.01.03 has played a key role by developing SWIM Systems Engineering deliverables (Technical Architecture Document and SWIM Profiles) that are key inputs to SWIM standardisation.

It is expected that those deliverables will be translated into EUROCONTROL standards as they are already "binding" at SESAR Deployment level

1.5 Project Conclusion and Recommendations

The SWIM-TI architecture described in the TAD is a generic model that has been developed for the purpose of achieving consistency and coherence of the technical specifications. This document assisted the coordination between system primary projects by allocating technical and operational requirements into the functional blocks and modelling the collaboration of functional blocks, thereby facilitating a consistent basis upon which the various technical specifications were developed. Allocating operational requirements to functional blocks and modelling their interactions and reviewing technical specifications against the functional architecture eased the consolidation of requirements.

The mapping of master plan enablers onto functional blocks might assist in the planning of system evolutions by localising the change within the architecture.

It is possible that in a foreseeable future, some stakeholders would decide to create a set of specifications to perform information sharing in order to fulfil their needs. This would lead to high fragmentation decreasing the reusability and the transparency.

SWIM profile is a coherent, appropriately-sized grouping of middleware functions/services for a given set of technical constraints/requirements that permit a set of stakeholders to realize Information sharing. It will also define the mandated open standards and technologies required to realize this coherent grouping of middleware functions/services.

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Project 14.01.03 recommends to follow the guidelines produced in D39 - SWIM Profiles and SPD [17] before considering to create new profiles and to check previously if there is any existing profile which fulfil the need.

One of the main value of profiling at the level of the SWIM TI lies in cost reduction, risk mitigation and risk avoidance in term of specification, development, testing and interoperability.

2 References

- [1] SESAR Programme Management Plan, Edition 03.00.01
- [2] [European ATM Master Plan](#)
- [3] Multilateral Framework Agreement ("MFA") signed between the SJU, EUROCONTROL and its 15 selected members on August 11, 2009, amended on 14 June 2010, 19 October 2010 and 2 July 2012
- [4] P14.01.03-D20 Initial SWIM design concepts V1.0, Edition 00.02.00, 17/11/2011
- [5] P14.01.03-D22 External Coordination, Edition 00.01.00, 13/06/2016
- [6] P14.01.03-D30 SWIM (GG AG) Architectural Definition - Final, Edition 00.01.00, 10/06/2016
- [7] P14.01.03-D31 SWIM (GG AG) Architectural Definition for Step 2 - Iteration 2.0, Edition 00.01.00, 28/02/2013
- [8] P14.01.03-D32 SWIM Profiles for Step 2 - Iteration 2.0, Edition 00.02.51, 15/04/2013
- [9] P14.01.03-D33 SWIM (GG AG) Architectural Definition for Step 2 - Iteration 2.1, Edition 00.02.00, 14/03/2014
- [10] P14.01.03-D34 SWIM Profiles for Step 2 - Iteration 2.1, Edition 00.02.00, 14/03/2014
- [11] P14.01.03-D35 SWIM (GG AG) Architectural Definition for Step 3 - Iteration 3.0, Edition 00.01.01, 23/02/2015
- [12] P14.01.03-D36 SWIM Profiles for Step 3 - Iteration 3.0, Edition 00.01.00, 09/12/2014
- [13] P14.01.03-D36 SPD v3.0, Edition 00.01.00, 09/12/2014
- [14] P14.01.03-D37 SWIM (GG AG) Architectural Definition for Step 3 - Iteration 3.1, Edition 00.02.00, 23/02/2016
- [15] P14.01.03-D38 SWIM Profiles for Step 3 - Iteration 3.1, Edition 00.01.00, 17/12/2015
- [16] P14.01.03-D38 SPD v3.1, Edition 00.01.00, 17/12/2015
- [17] P14.01.03-D39 SWIM Profiles and SPD - Final, Edition 00.01.00, 10/06/2016
- [18] B.01 D83, Integrated Roadmap - DS15 Release Note, Edition 00.01.00, 21/12/2015

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