



ICAO

The Second Meeting of the Asia/Pacific Air Traffic Management Automation System Task Force (APAC ATMAS TF/2)

Video Tele-Conference, 14 - 16 September 2021

Agenda Item 4: ATM Automation System Implementation by States

4.3 System Design and Architecture

OPEN ATM – A NEW APPROACH TO FUTURE ATM SYSTEMS

(Presented by Singapore)

SUMMARY

This paper presents the likely trends in future ATM development that Singapore and the industry are working on and illustrates the benefits that the new approach is expected to bring to ATM operations.

1 INTRODUCTION

1.1 Singapore is currently in the process of investigating a novel approach to the development and implementation of an Air Traffic Management (ATM) system in collaboration with the industry.

1.2 The traditional ATM system is a monolithic deployment, meaning that the entire ATM system with all its functionalities is delivered as a single system.

1.3 However, such a monolithic approach to ATM system architecture presents several difficulties. Being monolithic, it is impossible to introduce any new functionality or new cybersecurity patches without revalidating the impact of the change to the entire system. This makes any change costly and time consuming.

1.4 The future ATM operating environment will necessitate adaptations and changes at greater pace. To ease modifications of future ATM systems, Singapore is exploring the concept of an Open ATM system

2 WHAT IS OPEN ATM?

2.1 The Open ATM concept is about the use of open standards and technologies to split the ATM system into several discrete components encapsulating individual functions of an ATM system.

2.2 This concept can be based on the industry model of microservices architecture. Microservices architecture seeks to structure an application into a collection of services that are loosely

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coupled, independently deployable, highly maintainable and testable, and potentially owned by separate entities.

2.3 Open ATM is envisioned to take advantage of open source technologies as well as Commercial Off-The-Shelf (COTS) products in its implementation.

3 BENEFITS OF OPEN ATM

3.1 The benefits that Open ATM can bring are as follows:

- a) Technology Heterogeneity – with a system composing of multiple collaborating services, each service can use different technologies, allowing for the selection of the right tool for the right requirement.
- b) Resilience – a key pillar of the microservices architecture is its “design for failure” paradigm, which prevents a failure of a service from cascading throughout the system, thus preserving overall integrity and functionality of the system.
- c) Scalability – microservices allow functions to scale independently and does not require the entire system to scale up at the same time.
- d) Ease of deployment – microservices architecture allow any service to be deployed independently of any other services, eliminating the need for any high-risk, large impact system level deployment.
- e) Composability – With microservices, functionalities can be consumed in different ways for different purposes
- f) Replaceability – with microservices architecture, each service is small in size. This makes replacing any service more easily implementable and less costly.
- g) Extensibility – Open ATM makes it easier to add new functionalities to keep pace with technological advancements and evolving requirements.

3.2 The outcome of adopting an Open ATM architecture is that the ANSP gains a system that is easily scalable and deployable. The system become more flexible, resilient and adaptable.

3.3 The composable and replaceable nature of Open ATM allows ANSPs to avoid a “big bang” approach when replacing the ATM system, thus reducing the impact and risks of traditional ATM system replacements and upgrades.

3.4 Technological heterogeneity would allow vendors the liberty to focus on selected functionalities of the ATM system instead of the entire ATM system, thereby lowering the barrier to entry into the ATM system market.

3.5 Open ATM also makes it easier for the ATM system to integrate with System Wide Information Management (SWIM) in order to support emerging operational concepts like Air Traffic Flow Management (ATFM), Flight and Flow Information for a Collaborative Environment (FF-ICE) and Trajectory Based Operations (TBO).

4 INITIATIVES IN OPEN ATM

4.1 Singapore is not alone in the exploration of Open ATM. There is at least one other initiative that is ongoing viz. Skyguide’s Virtual Centre initiative.

4.2 Skyguide has taken the Service Orientated Architecture (SOA) approach to incrementally migrate from their current monolithic ATM system into an Open ATM architecture that can be hosted in a virtual environment distributed across both of their air traffic control centres.

4.3 Singapore's Open ATM initiative centres around our collaboration with industry partners including Thales, Skyguide and Skysoft-ATM to create Open ATM prototypes.

4.4 Singapore has setup the Aviation Innovation and Research Laboratory (AIR Lab) together with THALES to explore Open ATM concepts and to create prototypes and proof-of-concepts applications to validate the Open ATM architecture.

4.5 At the same time, Singapore is collaborating with Skyguide's subsidiary Skysoft ATM to leverage on their experience with Skyguide's Virtual Centre initiative to also create an Open ATM prototype

4.6 With these parallel efforts, Singapore hopes to be able to contribute to the Open ATM discussion and validation.

4.7 Singapore will also leverage on industry partners to produce innovative services to be integrated with the Open ATM prototypes to explore different solutions for our ATM needs.

5 END GOAL

5.1 To actualize all the benefits of Open ATM as stated in Para 3, it is necessary to cultivate a self-sustaining Open ATM community.

5.2 We envisage this community to be made up of ANSPs and ATM vendors working towards fulfilling and supplying Open ATM requirements and components.

5.3 ANSPs will benefit from the open ATM community, with increased competition, and flexibility, they will be able to pick the services best suited to their needs and resources.

6 ACTION BY THE MEETING

6.1 The Meeting is invited to:

- a) Note the information contained in this paper;
- b) Consider adopting the Open ATM approach for their next version of the ATM system; and
- c) Consider participating in the Open ATM community in order to realize tangible benefits for all
