



ICAO

The Fifth Meeting of System Wide Information Management Task Force (SWIM TF/5)

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Agenda Item 9: State, Regional and Global SWIM Updates

EXPERIMENTAL TRIAL ON SURVEILLANCE DATA EXCHANGE IN SWIM ENVIRONMENT

(Presented by Korea Airports Corporation (KAC), Republic of Korea)

SUMMARY

This information paper presents ROK's experience on an experimental trial of surveillance data exchange in the SWIM environment. This paper describes motivation/requirements, system configuration /architecture, services, SWIM-enabled application and lesson learned.

1. INTRODUCTION

- 1.1 The Republic of Korea has been conducting the SWIM R&D project since 2016 following the National ATM Reformation and Enhancement(NARAE) master plan developed by the Ministry of Land, Infrastructure and Transport(MOLIT).
- 1.2 SWIM Testbed is located in Gimpo International Airport(GMP), Seoul. It is an implementation of the SWIM Concept (Doc. 10039), and uses commonly-used open standards(protocols), frameworks and COTS in Information Technologies(IT) industry.
- 1.3 There is both local and regional growing need and interest to share surveillance data. ICAO established Surveillance Study Group (SURSG) to study, identify and make recommendations on the possible and practical models for surveillance data sharing in SWIM in APAC (April 2021).

2. DISCUSSION

Motivation/Requirement

- 2.1 Stakeholders' requirements are important for implementation of SWIM services. Efforts have been made to collect stakeholders' needs and requirements through various methods such as SWIM seminars and workshops. And as a result, there has been a growing need and interest to share surveillance data.
- 2.2 Technical requirements were identified for system architecture implementation and SWIM service development to satisfy the needs as follows:

- Support low latency data distribution;
- Support high-availability and expandable scalability for large scale data;
- Provide Publish/Subscribe (MQ) and Request/Reply pattern (Web Service); and
- Implement basic and composed SWIM services for surveillance data;

System Configuration/Architecture

- 2.3 SWIM testbed consists of Information Processing Layer, Service Layer, Information Model Layer, Infrastructure Layer, Registry and SWIM-enabled Applications. Each part acts as a service provider/consumer, SWIM infrastructure, and registry operator. It receives standard (xNOTAM/AIXM, METAR/IWXXM, etc.) or legacy data (e.g., ASTERIX, FPL 2012) from different stakeholders (e.g., Airport Operators(AOs)), processes them to a standardized format if it is needed, and provides them via SWIM services.
- 2.4 Flight Plan(FPL) is collected from Air Traffic Center(ATC) in FPL 2012 format.
- 2.5 Surveillance data is collected from Air Traffic Center (ATC) and three airports in ASTERIX format. Surveillance data is divided into en-route track data and Airport Surface Detection Equipment(ASDE) data. The ASTERIX format is commonly-used format in the aviation industry that is designed for communication media with limited bandwidth (the smallest data load).
- 2.6 Information Processing Layer is based on Apache hadoop framework, and it uses NIFI, Storm, Spark, Hbase. This layer conducts conversion(mediation) from the legacy data to standardized data and fuses information. FPL is converted to the FIXM v4.1 format and custom JSON format (Figure1). And, surveillance data is converted to the custom JSON format (Figure 2).

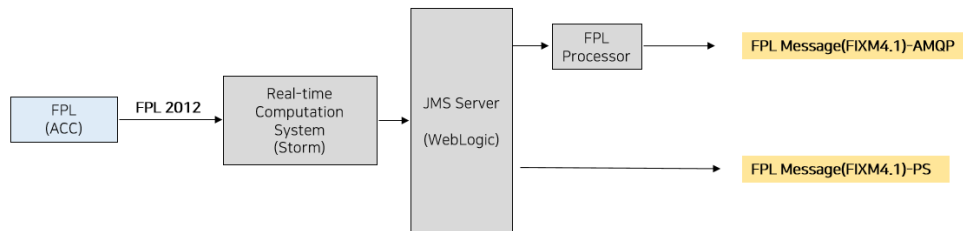


Figure 1 FPL Data Processing (FPL 2012 to FIXM v 4.1)

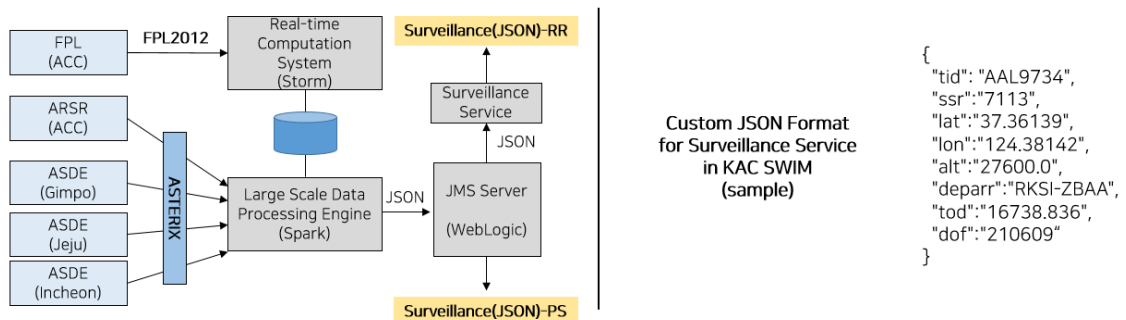


Figure 2 Surveillance Data Processing (ASTERIX to custom JSON)

2.7 As the FIXM core is not able to include surveillance data, a custom JSON format is designed following the users’ need. This includes TID, SSR code, latitude, longitude, departure aerodrome, arrival aerodrome, altitude, etc. In processing surveillance data, processor also tries to match surveillance data to FPL for data fusion as the value included in the ASTERIX format was insufficient to fill in the fields defined above.

Surveillance/Flight Services

2.8 Service layer in the SWIM testbed both provides messaging (JMS, AMQP) (publish-subscribe) and web services (request-reply).

2.9 Surveillance services consists of basic service and composed service (Table1):

- Basic Service: This gets data from information processing layer or infrastructure layer, and initially provides data to a service consumer or other SWIM service;
- Composed Service: This is derived from the execution of multiple basic services or composed services;

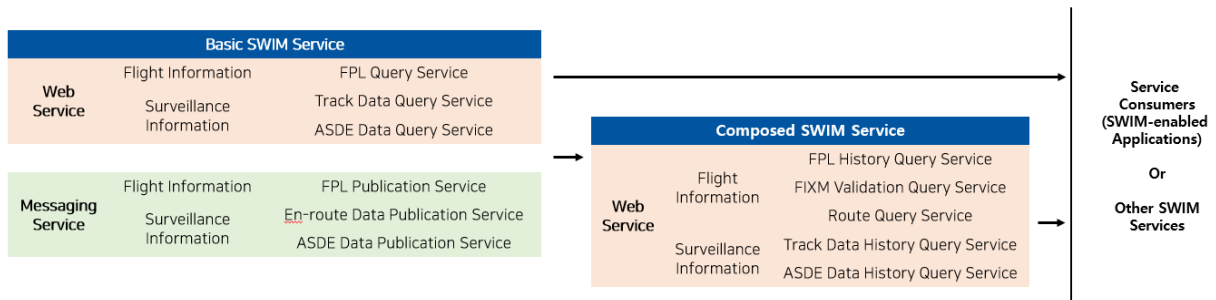


Figure 3 Basic and Composed Services

2.10 Validation of services and data is an important issue, and research on what to verify and how to do it is in progress.

SWIM-enabled Application

2.11 SWIM-enabled application is not included in the scope of SWIM, but to visualize information exchange through SWIM services for end-user, some SWIM-enabled applications have been developed. (e.g., FF-ICE/R1 application (client)) (Figure 5)

2.12 Trial operations of SWIM are in progress in the Republic of Korea with ATM stakeholders using the SWIM-enabled application mentioned in 2.10 as follows:

- [ASP] Air Traffic Management Office, Daegu (Nov. 20 ~)
- [ASP] Air Traffic Control Center, Incheon (Nov. 20 ~)
- [ANSP] Navaid Control Center, Seoul (Feb. 21 ~)
- [AOP] Operations Control Center, Seoul (Feb. 21 ~)



Figure 4 Surveillance Data in SWIM-enabled Application

3. LESSON LEARNED

- 3.1 SWIM could be the robust enabler to share surveillance information seamlessly
- 3.2 In the global implementation aspect, sharing surveillance information, which is visually visible, is a good starting point to implement regional SWIM following the "Bottom-Up" philosophy, especially in the current condition where the system-wide concept is not yet familiar enough
- 3.3 Legacy systems should be prepared to provide information in the SWIM environment, and open-source or COTS products in the IT industry could help information processing and distribution
- 3.4 ASTERIX is an efficient and commonly used format in the aviation industry, but an adaptation of ASTERIX to the SWIM environment may need a deep consideration
- 3.5 For information provisioning, member states and the region should discuss and define SWIM governance and architecture as follows;
 - o Roles of data originator, service provider, consumer, and SWIM operator;
 - o Who would convert legacy data;
 - o A coverage of sharing surveillance information; and
 - o A common reference to validate service and ensure the quality;

4. ACTION BY THE MEETING

- 4.1 The meeting is invited to:
 - a) note the information contained in this paper; and
 - b) discuss any relevant matter as appropriate
