International Civil Aviation Organization

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

Video Tele-conference, 9 – 11 August 2021.

Agenda Item 9: State, Regional and Global SWIM Updates

RESEARCH OF AIR-GROUND SYSTEM WIDE INFORMATION MANAGEMENT IN CHINA

(Presented by China)

SUMMARY

This paper presents the research progress and plans of Air-Ground SWIM in China. An air-ground information exchange model is proposed. And based on the new IT concepts and technologies, this paper proposes a new SWIM architecture.

1. INTRODUCTION

1.1 With the development of the civil aviation industry and the advancement of information technology, air traffic management will enter an era of complex scenarios and diversified data. The information sharing needs to change from a fixed data transmission mode to a flexible data transmission mode to cope with such situation.

1.2 China has established a regional SWIM platform, which is designed and constructed around the data collection, storage processing, fusion analysis, subscription publishing, and monitoring management for air traffic management decision-making applications.

1.3 The implementation of SWIM can be divided into two steps: Ground-Ground SWIM and Air-Ground SWIM. Air Traffic Management Bureau (ATMB) of CAAC plans to carry out the verification of the Air-Ground SWIM in 2021-2023.

1.4 SWIM system regards each system as a node, integrates the information of the previously fragmented systems with digital barriers in a unified format, and publishes information in a predetermined format, which achieves the interconnection and intercommunication of the systems.

1.5 Based on the above, the SWIM system expands into the air, which seems like expand the original two-dimensional plane data sharing to the three-dimensional space. Each aircraft is regarded as an independent node in the system, and the aircraft is a parallel and independent system that produces information and uses information from other sources.

1.6 In addition, based on the SWIM service, Air-Ground information exchange services are developed to meet ground-air communications needs and complete ground-air data sharing.

1.7 The effective information ratio of the RIXM is low, which cannot make full use of ground-to-air data link. The system uses a new air-ground information exchange model to complete the transmission.

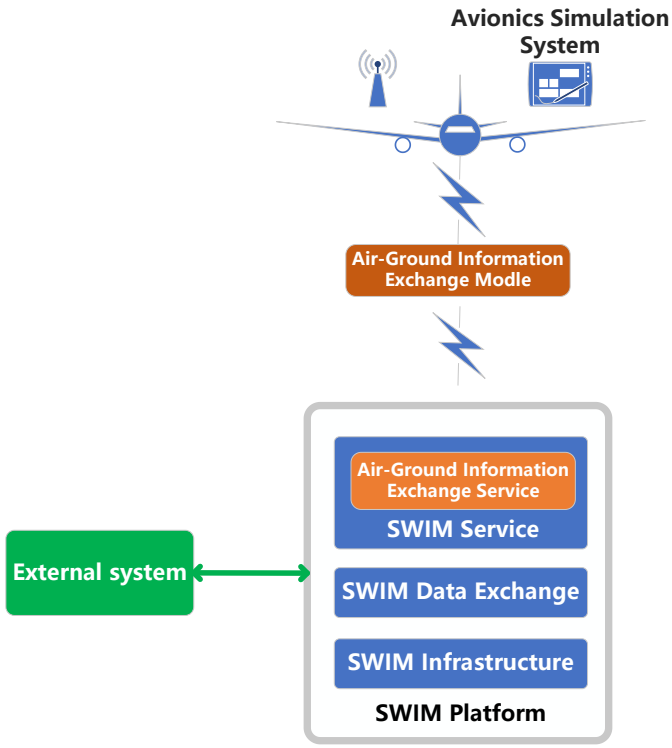

Figure 1 Air-Ground SWIM System

2. DISCUSSION

2.1 Air-Ground Information Exchange model

a) Considering the current data formats adopted by SWIM (such as FIXM, AIXM, IWXXM, etc.), drawing on the XML, which includes a large amount of format information, and the effective information ratio is low. During the transmission of SWIM on the ground, the consistent data format is flexible and efficient. However, in the Air-Ground SWIM data transmission, too much format information will make the information transmission inefficient, so it is necessary to reformulate the air-ground SWIM data format.

b) Air-Ground SWIM in China plans to adopt a data model of "identity verification information + data information + verification information". Identity verification information is used to ensure the authenticity of the information source. The data information is intended to be transmitted in the form of key-value pairs. At present, the data format of the ground SWIM refers to the XML format, which can be easily converted with key-value pairs. At the same time, to ensure the integrity of the inspection information, a hash check is added after the data to verify the integrity of the received data.

Figure 2 FIXM convert to Air-Ground Information Exchange model

2.2 Apply new technologies to establish SWIM architecture

a) With the continuous development of IT concepts and technologies, SWIM construction might apply the latest concepts and technologies. ATMB has verified a new system architecture: Kafka is used to implement data exchange, and a microservice cluster is built to implement various SWIM services.

b) Such an architecture not only makes use of Kafka's efficient and reliable data exchange, but also the microservice architecture can realize the rapid iterative development of the system, which improves the flexibility and scalability of the system.

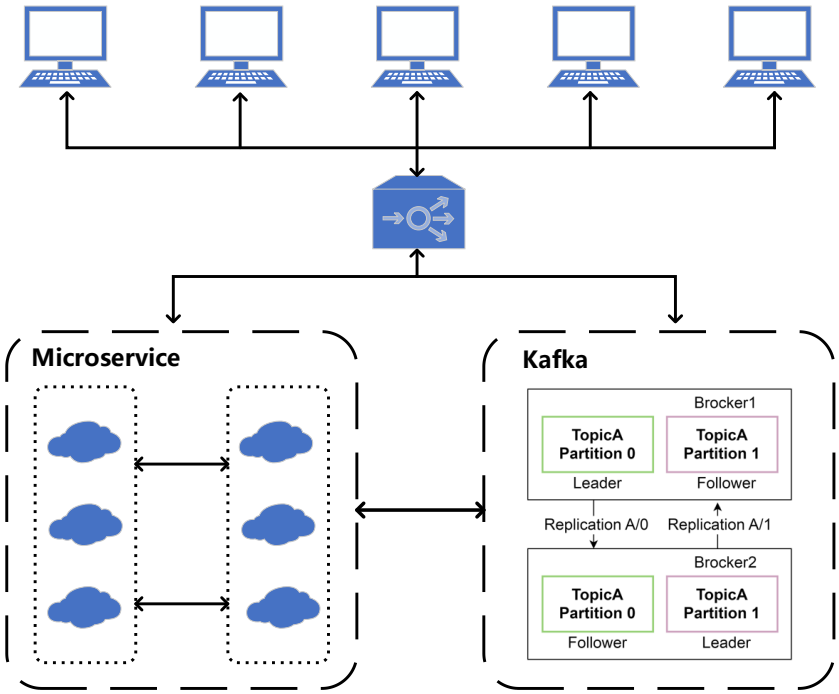

Figure 3 SWIM Architecture

3. CONCLUSION

3.1 The meeting is invited to:

a) because of the limitations of the air-ground data link, consider adopting a data exchange model with a higher effective information ratio to achieve air-ground data exchange.

b) while meeting the needs of SWIM, consider adopting new IT concepts and technologies to build SWIM.

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