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AGENDA ITEM 4: AIR NAVIGATION

PROGRESS OF RESEARCH ON AIR-GROUND SWIM IN CHINA

(Presented by the People's Republic of China)

INFORMATION PAPER

SUMMARY

This paper presents the research progress of and follow-up plans for Air-Ground SWIM in China. A new air-ground SWIM architecture and an air-ground information exchange model are proposed to promote information sharing research.

PROGRESS OF RESEARCH ON AIR-GROUND SWIM IN CHINA

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 on which various systems rely needs to transform from a fixed data transmission mode to a flexible data transmission mode.

1.2 The Air Traffic Management Bureau (ATMB) of CAAC has established an experimental ground SWIM platform in some areas, which is designed and constructed around data collection, subscription, publishing, monitoring and management. ATMB of CAAC plans to build a verification platform for the air-ground SWIM in 2023-2025.

1.3 Air-ground SWIM system expands data sharing from ground to the air, i.e. expanding the data sharing from the two-dimensional plane to the three-dimensional space. Each aircraft is regarded as an independent node in the system, and the aircraft parallel with the ground system which produces and uses information.

1.4 The air-ground SWIM platform of ATMB of CAAC is shown in the figure 1. The platform is built in laboratory environment. Based on the original ground-ground SWIM, the air-ground information exchange service is added to serve as an interface to external service, realizing information management. This platform uses the laboratory simulation network to share data between ground platform and avionics simulation system.

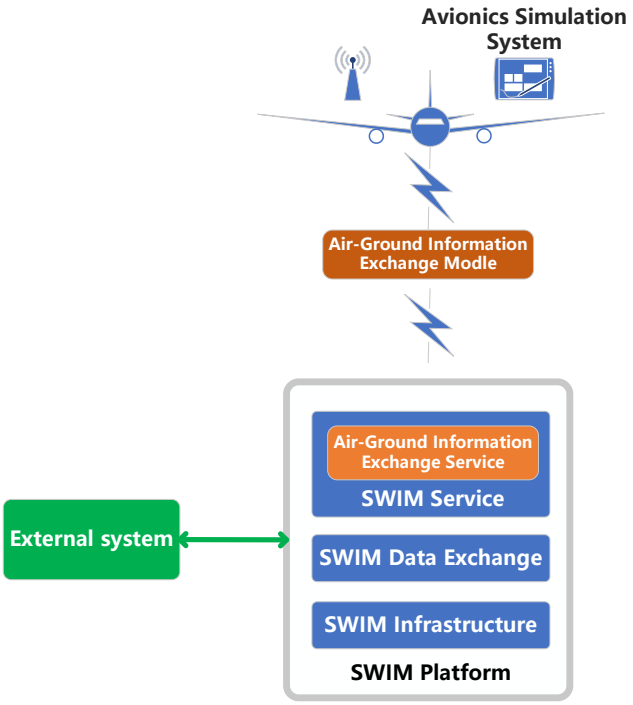

Figure 1 Air-Ground SWIM Platform

1.5 The air-ground information exchange service is of the capabilities of message delivery, information management and security services. It ensures the safety and efficiency of air-ground SWIM information services while realizing air-ground information sharing.

1.6 Security and efficiency are two key elements when realizing air-ground data sharing.

1.7 Security: ATMB of CAAC plans to adopt a series of security mechanisms to ensure data security. Shortly after the aircraft establishes connection with the ground, both parties conduct identity verification. After a prolonged communication link interruption, the system will establish the link again. In addition, without affecting the data transmission, the air-ground SWIM will randomly verify the identity of the communication parties.

1.8 Efficiency: ATMB of CAAC attempts to convert XML information into JSON format for air-ground transmission.

1.9 Air-ground SWIM information exchange model.

1.9.1 Considering the current data formats used by the SWIM (such as FIXM, AIXM, IWXXM, etc.),and taking the lessons from the XML tagging language, ATMB of CAAC finds that there is a large amount of format information, and the effective information ratio is relatively low. In air-ground SWIM data transmission, too much format information will make information transmission inefficient, and so it is necessary to reformulate the data format of air-ground SWIM.

1.9.2 ATMB of CAAC air-ground SWIM platform plans to adopt the data model of"identity verification information + data information + verification information". Identity verification information is used to ensure the authenticity of the source of the information. Data information is transmitted in the JSON format. Additionally, the entire data will be hashed to verify the integrity of the data.

Figure 2 FIXM Converts to JSON

1.10 New Air-ground SWIM Architecture

1.10.1 ATMB of CAAC proposes a new SWIM architecture: Kafka is used to exchange data, and a microservice cluster is built to realize SWIM services.

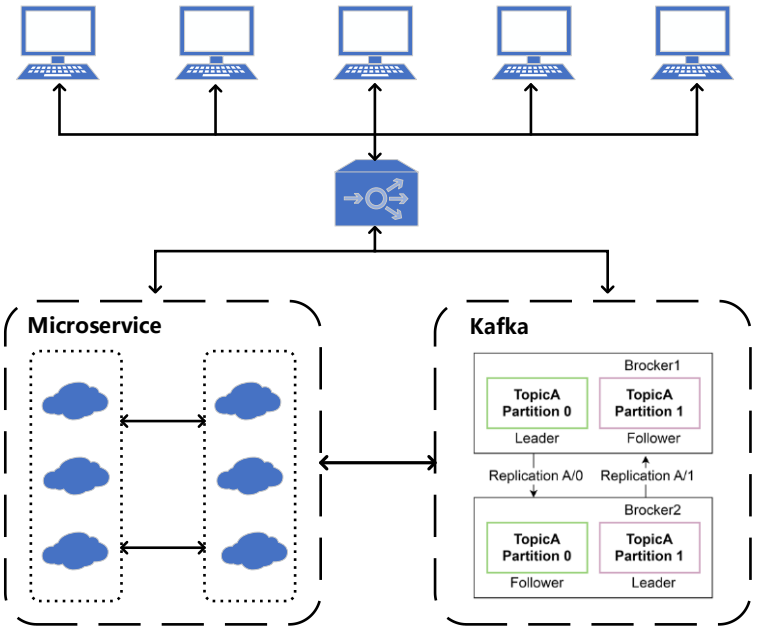

Figure 3 New SWIM Architecture

1.10.2 Compared with traditional message queues, Kafka is characterized by high throughput, low delay, high concurrency and high reliability.

1.10.3 The microservice architecture develops from the conventional SOA, emphasizing that business needs to be completely componentized. In the microservice architecture, the original individual business system will be split into multiple small applications that can be independently developed, designed and operated. These small applications complete the interaction and integration through services, reducing the degree of coupling among the SOA services.

2. DISCUSSION

2.1 Air-ground SWIM needs to focus on how to achieve safe and effective transmission of information. ATMB of CAAC attempts to use identity verification mechanisms and data format conversion to solve the problems, and the optimal solution still needs to be found out.

2.2 When building SWIM architecture, mature and advanced information technologies, such as microservices, could be considered. With the componentization of services, developers no longer need to coordinate the impact of other service deployments on the service. The service and development teams are divided according to specialized capabilities, and developers can freely choose development technologies and provide API services. This technology can not only effectively solve the problems faced by SWIM, but also has advantages in dealing with future challenges.

3. ACTION BY THE CONFERENCE

3.1 The Conference is invited to note the information contained in this Paper.

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