

IAF SPACE OPERATIONS SYMPOSIUM (B6)
Ground Operations - Systems and Solutions (1)

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THE DESIGN OF THE SPACECRAFT TEST SYSTEM 4000 BASED ON MICROSERVICES
RUNNING IN CLOUD ENVIRONMENT

Abstract

Space exploration and LEO constellation programs are two hot spots in the current aerospace industry. This implies that the electrical ground support equipment (EGSE) must on the one hand exhibits a high degree of extensibility and adaptability for ultra-complex missions and on the other hand provides rapid deployment and horizontal expansion for LEO constellation programs. To satisfy these requirements and modernize the legacy EGSE in Beijing Institute of Spacecraft System Engineering (ISSE), a new architecture of the EGSE based on microservices running in the cloud computing environment is proposed named STS4000 (Spacecraft Test System 4000, the 4th generation of the EGSE in ISSE).

The design of the STS4000 will be discussed in detail in this paper including architectural dataflow, load balancing and etc. It adopts many recently popular concepts, technologies, and components, such as cloud computing, microservices, centralized configuration, message queue, time-series database, load balancing and etc. And majorly, it brings the following benefits.

(1) Running in the cloud environment naturally means it is a multi-tenants supported system. And for each tenant it is also a multi-missions supported system. So, it is very suitable as a software service for spacecraft test of commercial space-flight companies.

(2) Dividing the whole system into many microservices, for one thing, it provides rapid upgrade and release, and for another thing, it naturally provides rapid deployment and horizontal expansion in the cloud environment.

(3) Through the interface exposed by the RESTFUL API service and WebSocket service the third-party extended application can be easily accessed to the system for each tenant to tailor the system.

(4) By the kernel isolation in the backend and the multi-mission support in the frontend application, the system implements the stability, high-performance and ease of use for multi-tenants and multi-missions.

At present, the preliminary development of the STS4000 has been completed in ISSE and it has been used in the spacecraft AIT to verify its capability. The preliminary results show that the STS4000 meet the spacecraft test requirements in AIT well. Of course, the improvement and upgrading are ongoing and expected to be a mature software service running in the cloud environment for spacecraft test in AIT for multi-tenants and multi-missions.