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A SOFTWARE DEFINITION SATELLITE ARCHITECTURE BASED ON POWERFUL COMPUTING PLATFORM

Abstract

At present, most satellites can't change their functions once they were launched into orbit. Software and hardware are tightly coupled, which makes it difficult to upgrade the software and hardware onboard. Satellite platform is difficult to adapt to multiple payload requirements and support the definition of requirements and functions in orbit. The insufficient computing power of onboard computers makes it difficult to realize advanced applications such as target recognition, extraction, and decision-making in orbit, and it is difficult to support applications such as intelligent AI reasoning and learning, which makes it difficult to provide end-to-end services for users. Furthermore, the standardization of software and hardware design is low, and it is difficult to realize the replacement of the same component from different manufacturers, to some extent, it blocks the development of space technologies. The reuse of software and hardware products are low, and it is difficult to achieve rapid and cost-effective development of satellites. How to change the situation? In the future, onboard electronics need to adopt an open system architecture. Devices support plug-and-play, and application software modules will be installed as needed just like an app installed in an intelligent handphone. The satellite functions could be redefined in orbit by software upgrades. The use of powerful computing platform as well as software-defined radio (SDR) technologies will improve the reconfigurability and flexibility of satellites. Inspired by the development of intelligent automobiles, software definition X is a key technology solution. To achieve the above goals, we presented a general open system architecture based on a powerful computing platform. The computing platform integrates advanced CPU, Huawei Atlas GPU, and FPGA computing resources. A service-oriented software architecture is presented, and many meta-services are defined. Linux operating system and middleware software provide a universal operation environment and standardized interfaces. Under this framework, the features and functions of satellites are primarily reconfigured through software upgrades, a result of the ongoing transformation of the satellite from a product that is mainly hardware-based to a software-centric electronic device in orbit.