IT SERVICES BASED ON 4.0 TECHNOLOGIES FOR SPACEPORTS SYSTEMS AND OPERATIONS

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Abstract: Several dozens of small launcher initiatives are currently emerging all across the globe, with the aim of providing more responsive, flexible and affordable orbiting services to new generations of satellites.

Due to the prevalent miniaturization of components and the trend towards using resilient constellations of numerous small satellites, access to space is shifting towards a commercial market with higher launch cadences, shorter campaigns and lower costs. The NewSpace actors that are entering this competitive environment have needs and expectations that are fundamentally different from those of traditional space business: frequent access to specific orbits, flexibility and low cost, which cannot be fulfilled by existing launch services. By translating these requirements into the ability to flexibly host a variety of NewSpace launchers -a step that leads towards standardization- spaceports all around the globe have begun to envisage different suitable infrastructures.

To address these fast-evolving space industry requirements and the upcoming need for flexible launch base support, a European collaborative project has been launched: SAMMBA, or "Standard And Modular Micro launcher BAse services". The SAMMBA project aims to design standardized base service solutions based on technological building blocks, which will enable various spaceports to handle the diversity of launchers and the new needs of the coming decades. SAMMBA relies on state-of-the-art and innovative technologies and both modular architecture and standard interfaces to successfully provide new and unique base services for the developing NewSpace market [1].

To answer the requirements in such a context, this paper presents a System Architecture composed by building blocks in collaboration with different space partners demonstrating the standardization and modularity of the respective interfaces. The architecture is fully virtualized, including the application layer and the operational layer, aiming to provide service to operators disregarding their localization, at spaceport or off site, with the capability of orchestrating (monitoring and managing) the infrastructure. This strategy allows the use of standard software and Commercial Off-the-Shelf (COTS) hardware, consequently improving maintainability and cost, easy to replace and upgrade without impacting SW. The architecture includes applications for the management of both a single campaign (process automation tools) and the spaceport operations as a whole with planner/scheduler based on multi-objective techniques to optimize spaceport resources in a concurrent environment (multi-launcher). Additional information on the campaign planning comes from the application providing meteorological awareness and prediction in real-time triggering the re-scheduling of the spaceport operations if necessary. The architecture incorporates data communication brokers based on standard IoT protocols (Message Queuing Telemetry Transport, MQTT) that allow to interface monitoring and control systems for fluid and mechanical operations during the campaign. The architecture works on a Blockchain distributed database private network (Hyperledger), allowing to trace interactions between stakeholders contributing to spaceport operations in a secure, confidential and immutable way thanks to the encrypted and channelized information.

The system conformed by those technological building blocks is showcased through completion of use-cases, consolidating the technical and economic evaluation of services and demonstrating their benefits and added-value for spaceports once deployed and operational.

References:
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