BIG DATA SW FRAMEWORK FOR EGSE PRODUCTS (ESTEC CONTRACT NO. 4000121348/17/NL/CBI)

Electrical Ground Support Equipment (EGSE) is essential at all levels of pre-launching testing of satellite and spacecraft, namely the Assembly, Integration and Test activities (AIT) and the Assembly, Integration and Verification activities (AIV). EGSE is an integrated suite of electrical and electronical testing solutions that is required in every space programme to verify the correctness and soundness of satellite/spacecraft subsystems (hardware, software, instrument, platform, mission operations, cargo/payload, power, communication). It is based on the ground and can be remotely controlled from a command centre. Popular EGSEs include Payload EGSE, Platform EGSE (e.g. CDMU EGSE, MMU EGSE etc.), Instrument Simulators, Platform Simulator, etc.

An apparent trend in recent years, is that the systems under test (airplanes subsystems, spacecraft subsystems) are continuously evolving and becoming more complex, using communication networks with significantly higher data rates (e.g. AFDX in Airbus or SpaceWire in the space domain) and also employ significantly more interfaces (e.g. I/O analog/digital discrete interfaces) connecting the different sub-systems, with increased sampling rates. This trend imposes also a major challenge in the design of the EGSEs, since they need to store, process and analyze a continuously increasing volume of test-data, usually in very accurate time-series format, in real-time or in near real-time in order to satisfy the demanding requirements of air/space-craft Assembly Integration & Testing (AIT) activities.

Current EGSE SW architectures are based on a central test system (referred as Core EGSE or Central Check-Out System (CCS) in the space domain), which controls all the other test systems (such as Special Check-Out Systems-SCOE or Data Front Ends - DFE) that compose the Test Bench. The Core EGSE needs to collect test-data from different SCOE/DFE and to process and analyze them during the different testing and validation campaigns. The main problem with the current EGSE SW architectures is that they do not scale well with the increased volume of test-data since the central storage, processing and analysis is performed using a relational database management system (RDBMS) or by directly accessing file archives stored at the Core EGSE. This data volume imposes a major bottleneck, even with the use of modern multi-processing PC systems, fast SSD disks and advanced RDBMS systems. Thus, Test Benches require a high degree of flexibility in order to fulfil the AIT requirements.

On the other hand, Big Data processing has gained particular attention in the ICT domain due to the significant challenges it imposes and it has increased the demand of information management architectures and specialists. Big Data uses exceptional technologies to efficiently process large quantities of data within tolerable elapsed times and several frameworks are currently available by the Apache open source project. In this context, the required flexibility can be provided by spinning-in existing Big Data technologies and architectures to the EGSE domain.

TELETEL Space Srl has identified the above needs and respective business opportunity, and within this project has designed, developed and validated of a proof-of-concept prototype of a Big Data SW framework for EGSEs, with particular focus on high data rate DFEs based on SpaceWire interfaces. The introduction of Big Data architectures and technologies in the EGSE domain is considered as a sustaining innovation. Thales Alenia Space France (Cannes) acted as subcontractor in this project and provided requirements to TELETEL Space Srl and also validated the project results in a representative EGSE demonstrator.