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SOFTWARE DEVELOPMENT AND VALIDATION: A COST-EFFECTIVE ENVIRONMENT AND APPROACH FOR LEON BASED SATELLITE AND PAYLOAD SUBSYSTEMS

Abstract

This paper describes a configurable Software Development and Validation Facility (SDVF), conceived to support the lifecycle of spacecraft equipment containing on board software (OBSW) - in our case LEON-based units - with a cost effective approach. The environment fulfils 3 main purposes:

- SDVF for OBSW
- Simulation for performance and design feasibility assessment
- Special Check-Out Equipment (SCOE) for hardware integration and testing

With a modular design, it can be modified into different configurations, from a full-virtual environment containing a processor emulator and a set of simulation models, to a processor in the loop (PIL) or complete hardware in the loop (HIL) configuration.

The key characteristics of the system are:

1. Easy configurability to use virtual models or real hardware versions of system components or a mix of them:
   - Possibility to use either a virtual LEON emulator, such as Gaisler Research TSIM, or a hybrid hardware/software emulator, or the target LEON processor board.
   - Possibility to use either simulation models or the real hardware of the periphery units.
2. Simple coupling of interfaces among the modules, based on TCP/IP sockets. This allows distribution on different hosts if needed.
3. Use of ESA's SCOS-2000 software as Central Check-out System (CCS): The integration of SCOS allows easier system level testing of the software and enforces compatibility of the equipment under development with the final system EGSE or mission control system, if based on SCOS2000.
4. Use of COTS I/O cards such as PCI-Spacewire or other standard interfaces to connect to the hardware equipment.

The facility has been successfully deployed to CESR, an institute in France for astrophysics and payload development and integration, providing emulation of a LEON3 processor, high fidelity models for X-ray detectors and a NAND based fault-tolerant mass memory unit, each replaceable with its hardware counterpart.

It is currently being integrated with a LEON2 hybrid hardware/software emulator developed by AS-TRIUM under ESA contract (LeonSvf).

The design of the environment would enable the system to be integrated into a larger satellite EGSE system if required. In this case the facility can be easily configured as SCOE dedicated to the subsystem integration and testing.

The SDVF takes full advantage from COTS products and ESA software products, such as SCOS-2000, to provide a light weight, scalable and cost-efficient solution, for development, integration and validation of satellite subsystems and payload equipment containing embedded software.