MIL 1553 SUPPORT IN THE EGSE PRODUCT LINE OF AIRBUS DS NL

The EGSEs developed by Airbus Defence and Space Netherlands are based on a modular architecture, called ESPRiT

ESPRiT offers reusable hardware and software components that are combined to meet the needs of a specific project.

The ESPRiT (EGSE and Simulation PRoducTs) equipment has successfully integrated several higher-level protocols such as SpaceWire, CANbus, RS422 and the MIL-STD-1553B. The Assembly, Integration and Test (AIT) of satellites often relies on Specialized Check-Out Equipment (SCOE) which can simulate missing equipment and the dynamics and environment of the S/C. Such Simulator Front-Ends (SIM-FE) provide a remote-control interface to the Central Check-Out System (CCS) and host a Real-Time Simulator (RTS), which propagates the satellite attitude and orbit position, and calculates from the acquired control commands and the measured actuator outputs, the emulation and stimulation data covering all mission phases.

As part of the EuroSim consortium, Airbus DS NL has co-developed a COTS RTS simulator kernel (EuroSim). This product provides tools for the complete simulation life cycle. It contains all of the functionality needed to develop, integrate, execute, and post process real-time simulators, with an elaborate set of graphical user interfaces. EuroSim provides proven hard real-time performance. Jitter and latencies on model execution are in the sub-milliseconds range.

The ESPRiT SIM-FE allows a range of simulator kernels to be integrated in a SCOE. In one configuration, the ESPRiT SIM-FE integrates a EuroSim based RTS, combined with support for a range of configurable analog and digital I/O. As part of its default setup, EuroSim provides MIL1553 support with extensive monitoring, recording and error injection capabilities through AIM APE1553-x PCIe cards. Key in this setup is direct access of EuroSim to the AIM hardware through the Board Software Package (BSP) which is shipped with the APE-1553-x cards.

The Model Development Environment (MDE) offered in EuroSim contains a Model Reuse Architecture (MRA), which allows a modular approach to modeling the I/O and functionality of equipment. Equipment such as sensors and actuators are captured by a model with a math layer and I/O layer. The math layer typically obscures the signals through bias, error injections and (nonlinear) transformation. The I/O layer provides access to the data protocols, which are highly dependent on the brand and type of equipment. These I/O layer models are based on ICDs provided by suppliers.

The I/O equipment models have direct access to the MIL1553 FE model, which in its turns communicates through the AIM BSP to the APE1553-x hardware. This allows the user to implement higher level protocols on top the MIL layer in the real-time models, accurately represent the behavior of the equipment, while maintaining an abstraction layer for reusability.

In the previous scenario, EuroSim provides access to the BSP and the underlying MIL1553 hardware. AIM also supplies COTS software which allows to user to access the BSP functionality. This package, PBA.pro, is based on a highly configurable GUI with support for python scripting. In this use case, the focus is not on hard real-time simulation, but on open-loop features such as archiving, filtering, BC scenarios, open loop RT simulation
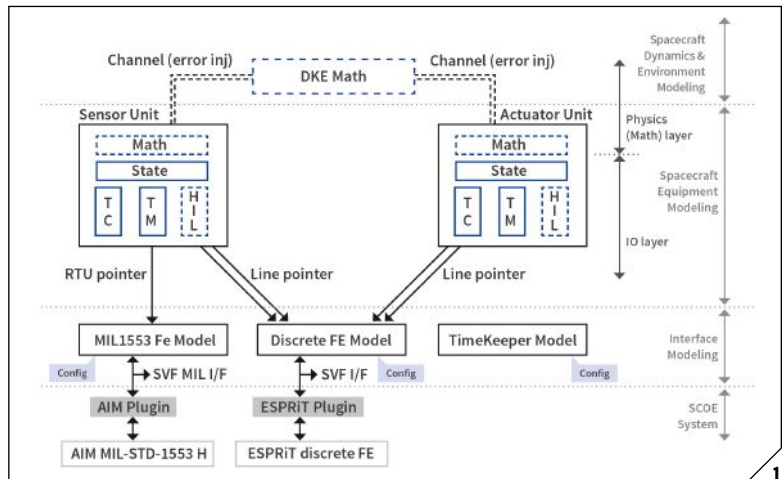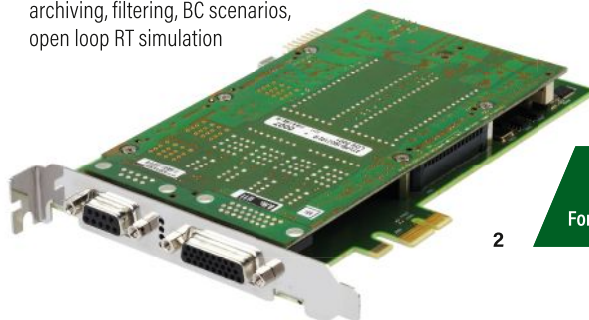

1 // The EuroSim Model Reuse Architecture (MRA)

2 // EuroSim provides MIL1553 support through AIM APE1553-x PCIe cards

etc. An independent software layer (such as PBA.pro) with proven performance validating the MIL1553 traffic is often utilized to validate and monitor the MIL traffic on a bus. Airbus DS NL uses the AIM APE-1553-X hardware, the BSP and PBA.pro in MIL1553 Front End (MIL-1553-FE) setups.

In local mode, the user can directly access and control the MIL traffic from PBA.pro. In remote mode from the CCS, the user can access similar functionality through a range of open interfaces – the user can load predefined configurations, control the Bus Controller, Remote Terminals and Bus Monitor and stream data towards the CCS. Particularly useful is the access to the run-time variables and modeled parameters in the PBA.pro database. This allows the user full control of the created project in PBA.pro.

PBA.pro is modular, scalable and customizable and runs on Windows and Linux. It integrates simulation, monitoring and analysis with dedicated GUI support and can be used with Scripts. PBA.pro offers a simple Databus Protocol Analyzer up to a System Test and Integration tool for handling multiple data buses via single software solution. \\