SpaceWire Traffic Simulator:

MOST v4.0

- ESA study Contract No. 4000116153/15/NL/AF - D15 Executive Summary

Introduction

The SpaceWire technology allows embarking high speed data networks on-board spacecraft and becomes widely adopted by agencies and industries missions. Need for new tool to support conception, development and validation of such high speed data network has increased with SpaceWire standard development. In that frame, the Modeling Of SpaceWire Traffic simulator (MOST) has been created by Thales Alenia Space, with development based on OPNET toolkit dedicated to network modelling.

MOST : Modelling of SpaceWire Traffic

MOST offers the possibility to build SpaceWire network models, selecting and configuring SpaceWire components, and it allows testing defined design without waiting for hardware. MOST allows failures simulation and gives the possibility to run various scenarios. As a result, MOST can decrease design risks and also secures planning thanks to early verification. MOST also gives opportunities for SpaceWire experts to easily test protocol or component changes. Therefore MOST is a tool not only for system engineers, but also for SpaceWire experts.

Simulations on MOST are built through a graphical user interface. MOST contains SpW nodes, routers and links which are selected by the user to build the network topology thanks to drag & drop actions. Each of these elements is fully configurable through the user-friendly interface. The simulator provides a wide variety of statistics outputs: in the form of data files and logs; for studying a network's topology and activity. Many variables can be measurable such as: the end-to-end delay of a packet, the buffers activity, the SpaceWire Time codes spreading, routers' activity, etc.

At the beginning of the project, MOST provided only a router model and one basic node model, with producer/ consumer application and a limited SpW protocol model. Since then, after several project phases MOST has been upgraded with implementation of representative models of SpW component as the SMCS116SpW, the SMCS332SpW, the RTC and the router SpW-10X. Modelling of these components is based on their data sheets. The development of these components is based on the Building Block (BB) concept. This concept, adopted since the beginning of the specification phase, is about creating nodes, routers or protocol by assembling bricks together. These bricks can be reused many times in many different elements.

The purpose of MOST is to be used on every phases of a project. At the early steps for evaluating possible designs and testing SpaceWire network's topologies. During the development of a project MOST is useful for validation and investigation. At the end of a project the Hardware/Software interface enables the user to perform tests on real SpaceWire networks, thanks to the iSAFT. Developed by TELETEL, the iSAFT workstation possesses several SpaceWire

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physical ports. This enables a connection between a virtual part of a network simulated by MOST, and a real SpaceWire network. The iSAFT contains several tools for an easy monitoring of SpaceWire packet traffic between the simulations and the real world. Thus, it is possible to study the content of any outgoing and incoming packet.

The development of MOST

MOST was first an internal project of Thales Alenia Space. Now under the ESA study Contract No. 4000116153/15/NL/AF, it consists in the specification, the development, the validation, the delivery and a demonstration of the simulator tool performances.

An incremental development has been applied, each step enriching the simulator by modeling new SpaceWire features and appending SpW component. First the basic components were added, then specific devices, and finally the hardware/software interface. Each of the development milestones went along with a campaign of tests & validation. The purpose of the tests was to validate each development steps and show the performance of the simulator. Some tests were done unitary, others were done on real spacecraft topologies such as the MTG (Meteosat Third Generation) SpaceWire topology. The test on real space craft topology was done to compare the outputs results of MOST with the real results in order to prove the reliability of the simulator. All the validation process and the results of the different development phases are archived in the final report.

Because MOST is not a static project, it has been developed from a perspective of allowing the user to modify or add components. This enables updating them according to any future evolution of the SpaceWire standard. To help the developers, a reference manual has been written. It contains all the details of the function used for creating the building blocks.