SIMULATION OF A SPACEWIRE NETWORK

Session: SpaceWire Test and Verification

Long Paper

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ABSTRACT

Data traffic gets more and more heavy and complex, mainly due to performance enhancement of payloads. The SpaceWire standard usage covers the growing need of high speed board-to-board communication links. But, since SpaceWire does not provide end-to-end flow control at packet level, the nodes applications, as generators and consumers of packets, significantly impact the traffic in the network. Furthermore, the definition of networks topology, as far as contents of routing tables, are left to the engineering judgement of the designer and can be only validated at a late stage, during system testing. This justifies use of new tools providing efficient help in conception, development and validation of flight network designs.

This paper presents a simulator dedicated to embedded SpaceWire networks, developed under ESA contract, taking into account all communication layers, up to constraints induced by nodes' behavior.

The main objectives of the study concerns the development of an industrial tool, supporting engineers in defining embedded communication networks within command/control architectures, up to the last phases of project development, via an incremental building/block approach. The OPNET graphical editor provides an easy way to create any SpaceWire network topology, by picking and connecting together routers and nodes models, after what, various scenarios can be executed, simulating any traffic load.

The results provided by scenarios execution have multiple purposes, each being covered by various explicit drawings:

> ➢ enlightening networks weakness for architects, as traffic jam and packets loss,

➢ showing traffic load or resources usage at node level (e.g. buffer sizes),
➢ verifying expected (global or local) performances via statistics, as end-to-end delays, mean transfer time or required margins,
➢ analyzing or verifying local behaviors by accurate zooming on time-slot for selected links (automatic disconnection/reconnection, anomaly cases, time-code thru network etc…)
➢ identifying nodes contribution to traffic profile and critical items,
➢ etc…

All these making possible adjustment of the network design and characteristics, along the project.

The tool itself is required to be opened to evolutions of the standard, to implementation of new protocols and to insertion of new components (representative HW parts models), with lowest development effort.

The simulator's validation campaign applied in the frame of this study, is based on pre-defined significant use-cases, representative of the space missions domains, the final product being delivered with user documentation.