BENCHMARKING SPACEWIRE NETWORKS

Session: SpaceWire Networks and Protocols

Long Paper

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ABSTRACT

Measuring and comparing performance, cost, and other features of SpaceWire networks is a significant challenge. A new benchmark for SpaceWire-based satellites is presented. The benchmark contains a potential architecture of a multi-mission satellite, as well as specifications of the traffic flow. The architecture includes attitude and orbit control computers, reconfiguration controllers, communication devices and data links, image and video cameras, navigation equipment, storage nodes, power controllers, propulsion control, and instrument controllers.

The system is interconnected by a SpaceWire network, including full redundancy and bandwidth guarantees. The traffic flow represents the communication needs of the said architecture. The proposed benchmark is demonstrated on an OPNET-based network simulation for various network architectures, yielding measures such as end-to-end delays, throughput and link utilization.

The traffic may be sorted according to priority levels. The benchmark assumes at least three levels of priority. The highest level consists of short and urgent SIGNAL messages. The medium priority level includes longer messages, remote DMA, and control signals. Long streams and large block transfers may constitute the lowest level of priority.

The SpaceWire network may support priority in multiple alternative manners. We examine four modes of supporting priority: (1) a simple SpaceWire network that ignores priority, (2) a network that supports packet priority according to the SpaceWire specifications, (3) a non-standard support for N-Char interleaving on multiple virtual channels, and (4) a non-standard support for priority-based N-Char interleaving.

The SpaceWire benchmark can aid in the design of specific networks, in the evaluation of new equipment and components, and in the evaluation of proposed changes in the

SpaceWire standard. The benchmark is open-code and is posted on the internet for free use.