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SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
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Author: Prof. Steve Parkes
University of Dundee, United Kingdom

Mr. Chris McClements
University of Dundee, United Kingdom
Dr. David McLaren
University of Dundee, United Kingdom
Dr. Alberto Gonzalez Villafranc
STAR-Dundee Ltd, Spain
Dr. Albert Ferrer Florit
STAR-Dundee Ltd, Spain

SPACEFIBRE: ADVANCED NETWORK TECHNOLOGY FOR SPACECRAFT ON-BOARD APPLICATIONS

Abstract

SpaceFibre is a multi-gigabit/s serial network technology which operates over fibre optic or electrical media and which is designed specifically for spaceflight applications. SpaceFibre aims to support high data-rate payloads, for example synthetic aperture radar and hyper-spectral optical instruments, operating at 2.5 Gbits/s with current flight proven technology, at over 4 Gbits/s with radiation tolerant chip technology currently being developed, and at over 20 Gbits/s using multiple lanes. It provides robust, long distance communications for launcher applications and supports avionics applications with deterministic delivery capability. SpaceFibre provides a quality of service mechanism able to support priority, bandwidth reservation and scheduling. It incorporates fault detection, isolation and recovery (FDIR) capability in the interface hardware. It is designed to be implemented efficiently, requiring only three times the number of logic gates of a SpaceWire interface while providing many capabilities missing from SpaceWire. Furthermore SpaceFibre is backwards compatible with SpaceWire at the network level allowing existing SpaceWire devices to be readily integrated into a SpaceFibre network and to take advantage of its QoS and FDIR capabilities.

SpaceFibre is currently a mature draft standard being specified by the University of Dundee with contributions from ESA, JAXA, NASA, Airbus DS, Thales Alenia Space, SubMicron, ELVEES, NEC Toshiba Space, Misubishi Heavy Industries, St Petersburg University of Aerospace Instrumentation, University of Pisa and other organisations. It is currently undergoing the formal standardisation process of the European Cooperation for Space Standardization (ECSS). In parallel with specifying the SpaceFibre standard the University of Dundee and STAR-Dundee designed and tested a VHDL IP core for SpaceFibre. This was necessary to ensure that an implementation of SpaceFibre was efficient in terms of both performance and gate count. SpaceFibre has been simulated, implemented and tested extensively in support of the standard specification. Several beta site evaluations of SpaceFibre are underway using the SpaceFibre IP core in various spacecraft applications. Flight connectors and cable for both electrical and fibre-optic media are being developed. A SpaceFibre engineering is currently being developed to raise the TRL of SpaceFibre. In addition an experimental SpaceFibre ASIC has been implemented.

The full paper will provide an introduction to SpaceFibre, describe the IP core and test equipment developed to support SpaceFibre applications, and provide an update on the status of the formal SpaceFibre standard.