

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
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Author: Prof. Steve Parkes

University of Dundee, United Kingdom, sparkes@computing.dundee.ac.uk

Dr. Albert Ferrer Florit

STAR Dundee Ltd, United Kingdom, albert.ferrer@star-dundee.com

Dr. Alberto Gonzalez Villafranca

STAR-Dundee Ltd, United Kingdom, alberto.gonzalez@star-dundee.com

Dr. David McLaren

University of Dundee, United Kingdom, davidmclaren@computing.dundee.ac.uk

Dr. Chris McClements

STAR Dundee Ltd, United Kingdom, chris.mcclements@star-dundee.com

SPACEFIBRE: GETTING READY FOR SPACEFLIGHT APPLICATIONS

Abstract

SpaceFibre is a very high-speed serial data-link technology developed by the University of Dundee for ESA designed specifically for handling data on-board spacecraft. It can be used to provide point-to-point connections between equipment or, using SpaceFibre routers, to provide a complete interconnection network. SpaceFibre aims to support high data-rate payloads, for example synthetic aperture radar and hyper-spectral optical instruments. It provides robust, long distance communications for launcher applications and supports avionics applications with its deterministic data delivery capability.

SpaceFibre uses virtual channels to separate different streams of data running over a single physical link. Each virtual channel can be allocated a portion of the link bandwidth, given a priority, and scheduled to send data in a specific time-slot. Traffic flow over the SpaceFibre link then adapts automatically taking into account virtual channels that have data ready to send and available buffer space at the far end of the link, along with the link bandwidth and priority allocations. The novel quality of service (QoS) mechanism is simple but powerful and also allows the automatic detection of “babbling idiots” and virtual channels that are sending much less data than expected. SpaceFibre also includes a fault detection, isolation and recovery (FDIR) capability which detects and recovers from faults providing high reliability.

SpaceFibre is rapidly maturing in preparation for spaceflight. The SpaceFibre standard is currently in draft revision F3. Formal ECSS standard specification will begin in summer 2014. The standard specification has been independently simulated by St Petersburg University of Aerospace Instrumentation feeding back on drafts C, D and E. Thales Alenia Space France are currently simulating draft F and will provide further feedback in 2014. In tandem with the development of the SpaceFibre specification the University of Dundee has designed an IP core which has been used in Field Programmable Gate Array (FPGA) implementations to test and validate the SpaceFibre specification. This IP core is currently being used by several European organisations in various beta applications of SpaceFibre, including payload processing, instrument interfacing and mass-memory interconnect. A flight capable SpaceFibre interface is also being designed using a Microsemi AX2000 FPGA with a Texas Instruments TLK2711 serialiser/de-serialiser chip. This will raise the technology readiness level (TRL) of SpaceFibre to level 5 or 6. Independent implementations of SpaceFibre are being developed in Japan providing further feedback on the standard specification and allowing early interoperability testing to detect errors and ambiguities in the specification.