

24th SpaceWire Working Group Meeting

Tuesday 22 September 2015 - Thursday 24 September 2015

ESA/ESTEC

Book of Abstracts

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”Assignment of Pin 3 in SpaceWire Unit Connectors”

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”SpaceWire Satellite Development Systems”

Corresponding Author: paul@4links.co.uk

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7th International SpaceWire Conference

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Deterministic network services in SpaceWire/SpaceFibre networks

Author: Valentin Olenev¹

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Presentation on determinism in SpW\SpFi networks, different types of determinism

SpW- and SpFi-related components / 19

Development of a Space Grade CPU

Author: Seisuke Fukuda¹

¹ *JAXA*

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ECSS-E-ST-50-12C-Rev1 status

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SpW- and SpFi-related components / 10

Independent implementation of the GigaSpace Wire codec on FPGA

Author: Grishin Viacheslav¹

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Independent development implementation of IP-cores- Codec Giga Space Wire on the basis of the standard's draft SpaceWire-ENG

Health check of the project at the lab bench

Interoperability test with other implementations of Giga Space Wire (to be fulfilled)

Summary:

Bench set test - confirmed the efficiency of the channel GIGA speed 2.5 Gbit/s

Interoperability tests are required

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Layering protocols over SpaceWire

Author: Yuriy SHEYNIN¹

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The SpaceWire protocol stack clearly specifies protocols layering from the Physical up to the Network layer. Layers over the basic SpaceWire protocol stack with a variety of Transport layer protocols, scheduling and FDIR services, connection with the Application layer do not have consistent specification. The problem of layering higher layer protocols over SpaceWire is considered.

SpW for Cmd&Ctrl / 0

Performance evaluation of SpaceWire-R IP Core and updates of the specification

Author: Takayuki Yuasa¹

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NEC and JAXA performed evaluation of SpaceWire-R IP Core (in VHDL) as a part of JAXA Standardization activities in Japanese fiscal year 2014 (April 2014 - March 2015). Results of the performance evaluation project will be presented including packet transmission latency and throughput for various payload lengths, segmentation size, and the number of concurrently opened communication channels. Since the protocol specification has been slightly updated to remove complexity in the last few months, we will also describe changes made to the specification.

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Recommended SpaceWire Standard Quality of Service Improvement (while maintaining backward compatibility)

Author: Glenn Rakow¹

¹ *NASA/GSFC*

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Discusses problems with SpaceWire Quality of Service and an alternative option other than SpaceWire-D to solve the problem without drastic changes to the SpaceWire design. This alternative solution allows existing SpaceWire nodes to remain unchanged with only changes to SpaceWire switches.

Summary:

Proposes using a solution based upon virtual channels over existing SpaceWire with changes only to the SpaceWire switch.

SpW Evolutions II / 3

SpaceFibre ECSS Standard

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The SpaceFibre standard has now started the formal ECSS approval process with a working group set up to refine the current standard specification. This presentation will outline the current state of the SpaceFibre standard.

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SpaceFibre Virtual Channels Throughput Estimation in Case of Transient Faults

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The SpaceFibre QoS defines VC Bandwidth Credit and the VC Available Bandwidth is measured for SpaceFibre links. We consider Available Bandwidth calculation rules in case of transient faults and frames retransmission and propose clarification for the SpaceFibre specification draft.

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SpaceFibre on Microsemi RTG4 FPGA

Authors: Albert Ferrer¹ ; Alberto Gonzalez Villafranca² ; Steve Parkes³

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STAR-Dundee Ltd working in close collaboration with Microsemi has implemented both SpaceWire and SpaceFibre on the new RTG4 FPGA. This demonstration will show SpaceFibre running at 2.5 Gbits/s between two RTG4 devices and to other equipment. It will also demonstrate SpaceWire running over SpaceFibre.

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SpaceWire Matched Impedance Connector

Author: Kevin Enouf¹

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I. INTRODUCTION

Under the ESA Technology Research Program (TRP), contract n° AO/1-7985/14/NLSW, Axon' Cable is working as a prime on the development of a compact impedance matched connector for SpaceWire links in partnership with Star-Dundee.

Connectors as per ESCC 3401/071 asked by ECSS-E-ST-50-12C are not ESCC qualified and do not offer optimal inner shield termination compatible with SpaceWire cables (ground continuity, EMC, etc.). Indeed, micro-D connectors used in current design drive the performances of the SpaceWire Cable Assemblies.

This new study is the logical next step following the development of Low Mass SpaceWire Cable which is now referenced by ESA specification (ESCC3902.004) and will lead to its ESA qualification approval imminently.

II. MAIN OBJECTIVES

The aim of this 2-year project is to develop a new connector with matched impedance SpaceWire links (100 Ohms characteristic differential impedance) to create a very high performance connection for the space environment.

This project will call for a trade-off on the link with regards to the electrical and physical characteristics such as for instance EMI and crosstalk performances, 360° shield termination for inner and outer shields; adapted to existing SpW cables (4 STP), compact, dismountable and a minimum of 400Mbit/s.

Axon' has already started with:

- A technical survey (still under review with ESA) like consulting SpaceWire users to check their needs for this product and potential candidates among existing connectors on the market.
- A preliminary design of the connector and cable in parallel

These activities will be followed by an advanced and final design, evaluation tests still to be defined, writing of a PID for the link and an audit by ESA.

III. CONNECTOR DESIGN

In order to reach the electrical requirements the connector will have one cavity with inner shield continuity for each pair of signal and the outer shield continuity with a dedicated backshell.

Axon' is using CST for microwaves finite element simulations. This tool helps us to design the entire connector with TDR, s parameter and eye pattern diagram results.

Per Axon' experience and to avoid contacts misalignment during mating, we are also working on a new guide pin solution. It will be fully integrated in the shells of the connectors without any additional component.

This new range of connectors will include in-line and panel mount configurations. A solution without backshell for 4 Shielded Twisted Pair cable without outer shield is also considered for potential other applications.

IV. PCB CONNECTION SOLUTION

Complementary to a rigid surface mount connection Axon' is studying a flexible solution by using a PCB flex as a media connection. This PCB is made up with polyimide insulation which will be impedance adapted. This component will be terminated with 2 rigid parts for the connection to the PCB and the shell of the connector.

This design offers matched impedance along the line with a complete ground plane on the back of the flex.

This compact connection is still in discussion with our sub-contractor for manufacturing process and surface finishes.

V. CABLE SURVEY

Axon' has launched an internal cable survey to analyze and compare cable types. The aim is to highlight advantages and drawbacks of each cable configuration and establish the most appropriate cable for SpaceWire links.

The standard SpaceWire cable and low mass variant are of course taken into account but also four parallel shielded parallel pair, shielded twin quad and a new intern development for a parallel pair mono-core.

Axon' is currently carrying out studies for each of these configurations and is manufacturing samples which will be tested before the end of the year.

Depending on the study results another ESA project dedicated to the cable could be considered but the cable evaluation is not part of this contract as agreed with ESA.

VI. CONCLUSIONS

The project is still at an early stage with on-going surveys and preliminary design. An important

outcome of this project in approximately two years should be a draft by Axon' of an ESCC specification for the link plus an ESCC PCB detail specification characterizing the new SpaceWire which could be innovative with a unique specification for a harness.

Summary:

This short paper presents the objectives of the development of a SpaceWire connector, matched impedance, high speed copper-based links, capable of transmitting SpaceWire signals at 400Mb/s or higher, using a custom interface connector. It looks briefly at the current status of connector preliminary design and PCB connection solution. The paper ends with ESCC specification that will be written by Axon' for the link and the PCB detail connection.

Index Terms— SpaceWire, Connector, Matched impedance, PCB connection, Microwaves simulation, ESCC Specification

SpW Simulation, Test, and Verification / 18

SpaceWire Satellite Development Systems

Author: Paul Walker¹

¹ *4Links Limited*

4Links will introduce the concept of SpaceWire Satellite Development Systems, together with brief descriptions of the first products. These will include the basic elements needed to build a model of the SpaceWire network on a proposed satellite: a single-board computer, a routing switch, and a bridge from SpaceWire to Ethernet to represent a link to the ground. They will also include a remote monitor that can be used in the final stages satellite assembly, integration and test (AIT) to resolve interaction problems between the subsystems about to be launched.

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SpaceWire network discovery scenarios in the SPACEMAN project

Author: Krzysztof Romanowski¹

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A number of SpaceWire network discovery scenarios have been studied in the SPACEMAN project. In the presentation the main functionalities of the SPACEMAN network management tool are introduced, then examples of network topologies are shown, both acyclic and cyclic (with cycles or loops). The algorithms used for determining the identity of the devices and discovering the network are discussed, including cases of multiple coordinated as well as non-coordinated control devices.

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SpaceWire-D

Author: David Gibson¹

Co-author: Steve Parkes¹

¹ *University of Dundee*

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The different services provided by SpaceWire-D will be described. Initial results of tests run on an experimental implementation of SpaceWire-D will be presented.

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SpaceWire-R implementation and test considerations

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The SpaceWire-R protocol, the specification of which has recently been updated, is the subject of a study in the Space-R project. In the presentation the testing objectives and scenarios adopted in the project are shown and related to the protocol specification.

Summary:

The SpaceWire-R protocol, the specification of which has recently been updated, is the subject of a study in the Space-R project. In the presentation the testing objectives and scenarios adopted in the project are shown and related to the protocol specification.

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SpaceWire2: System issues

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SpW Simulation, Test, and Verification / 1

Synchronization, Trigger and Decode of a SpaceWire data stream with an Oscilloscope

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This presentation shows the most recent aspects how to synchronize on very long and continuous SpaceWire data streams without gaps and synchronization patterns.
In addition, the presentation shows how to trigger and decode a SpaceWire data stream with an oscilloscope.

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[ITTI pres. 1]

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[ITTI pres. 2]