SpaceWire 101 Seminar
MAPLD 2006
SpaceWire origins and purpose
From IEEE 1355 to ECSS-E-50-12A

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25/09/2006 Introduction
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A little bit of History – Transputers

The transputer was a pioneering concurrent computing microprocessor design of the 1980s from INMOS, a British semiconductor company based in Bristol. For some time in the late 1980s many considered the transputer to be the next great design for the future of computing. Today, this interesting chip is largely forgotten.

Whilst ultimately a commercial failure, the transputer architecture was highly influential in provoking new ideas in computer architecture, several of which have re-emerged in different forms in modern systems!

Source: http://en.wikipedia.org/wiki/Transputer

The T9000 packet-based link protocol was called DS-Link and later formed the basis of the IEEE 1355 serial interconnect standard (IEEE Std 1355-1995 Standard for Heterogeneous InterConnect (HIC)

Low Cost Low Latency Scalable Serial Interconnect aka ISO/IEC 14575 DIS)
A little bit of History – Transputers and Links

DS-Link: Serial, asynchronous, Symmetrical, Flow-Controlled, Point-to-point Interface

- Data/Strobe, 100Mb/s+
- Packet protocol, Routing switches
- Modular
- Scalable
Serial links and Packet routing – Reference Architecture

This architecture is used by ESA as a reference for medium-range Data Handling Systems and the definition SpaceWire devices (SpW Router, SpW RTC, SMCS-SpW, …)
From IEEE1355 to ECSS-E50-12A (SpaceWire)

- The IEEE1355 standard has been defined for commercial, ground based applications.
- This standard has been revisited by space engineers, federated by the SpaceWire working group, in order to define a standard for space applications, covering: Links, nodes, routers and networks.
- This work has been done from the physical level (e.g. LVDS, connectors, initialization state machine) up to higher level protocols (e.g. SpW-SnP-RMAP). This is going on with the mapping of CCSDS-SOIS services and protocols on SpW networks.
- SpaceWire is seen as an open standard. Its is supported by major agencies such as NASA, ESA, JAXA and RSA
SpaceWire Standard (SpW), a standard for Space Applications

http://www.ecss.nl

http://spacewire.esa.int
SpaceWire Working Group – Meeting Schedule

**First** SpW WG Mtg, 15th and 16th (AM) of September 2004

**Second** SpW WG, 10th PM, 11th, 12th (AM) of November 2004 ⇒ RMAP Draft B

**Third** SpW WG, 15th, 16th, 17th (AM) of February 2005 ⇒ RMAP Draft C

**Fourth** SpW WG Meeting, 19th (PM), 20th and 21st (AM) of July 2005 ⇒ RMAP Draft D

**Fifth** SpW WG Meeting, 15th (PM), 16th and 17th of November 2005 ⇒ RMAP Draft E

**Sixth** SpW WG Meeting, 18th and 19th of May 2006 ⇒ Focus on Implementation Issues

**Seventh SpW Meeting – Inter-Agency Meeting 26th of September 2006** ⇒ focus on

- SpW Networks and Command & Control applications
- SpaceFibre

http://conferences.esa.int/01C25/
SpW Working Group Steering Group (Mtg 7)

Steering committee

ESA (Chair)  JAXA/ISAS  NASA  ROSCOSMOS
Ph. Armbruster  T. Takahashi  G. Rakow  A.G. Sukhoroukov
M. Suess  M. Nomachi (UoO)  R. Schnurr  Y. Shenin (UoStP)

SpW WG Steering Committee: Coordinates/Approves PID allocations and supporting documents. Configuration management of in-preparation and published protocols.

Steering committee supported by:

S. Parkes (UoD) SpW, Standard(s) Editor

SpW Working group contributors/participants: Agency engineering & projects representatives, Representatives from Industry, Experts
ESA Developments

A diagram showing various components of a spacecraft control system, including:
- Instruments
- I/O Module
- Routing Matrix
- Control Processor
- Dedicated DSP Processor
- DSP Processor
- Transmitter
- Telemetry Formatter/Encryption
- Spacecraft control bus

Key components include:
- High Capacity Buffer
- Telemetry Formatter/Encryption
- Instrument 1 DPU
- Instrument 2 DPU
- Instrument
- I/O Module
- Routing Matrix
- Control Processor
- Dedicated DSP Processor
- DSP Processor
- Transmitter

Notable sections include:
- SpaceWire
- Avionics Bus (MIL-STD-1553)
- cPCI Bus
- EIA RS-422/485
- RS-485
- Serial Link

The diagram also features images of various electronic components and circuit boards.

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Introduction

Slide: 10
Perspectives

- SpW is gaining momentum, used more and more
- Devices under development to be made available as ASSP – Support to Users
- Run a TopNet Pilot activity (see here below)
- Sustain development efforts at protocol level (e.g. for C&C and according to CCSDS-SOIS)
- Prepare the next step with SpaceFibre

**TopNet: Pilot activity, decentralised integration**

Involvement of different actors (industry, university, agency) in a **pilot activity** for **decentralized integration** of SpW-based data handling sub-systems that are geographically separated
Thank you for your attention