

SpaceWire 101 Seminar

MAPLD 2006

SpaceWire origins and purpose From IEEE 1355 to ECSS-E-50-12A

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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.

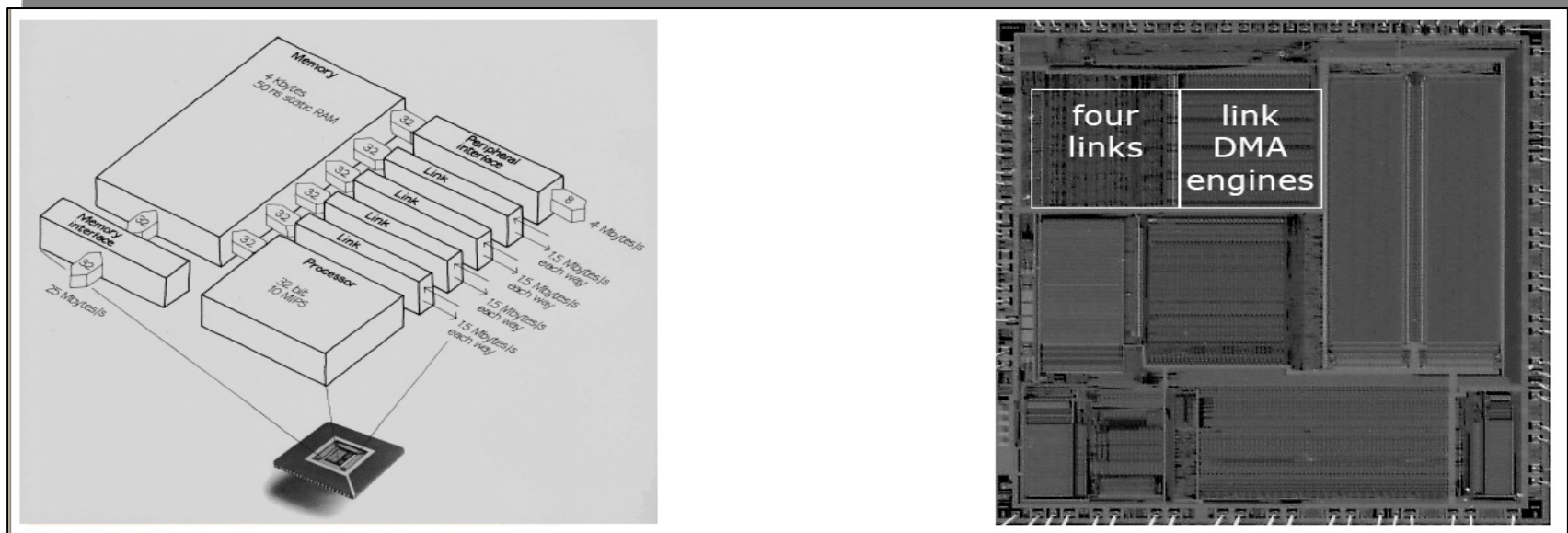
Whilst ultimately a commercial failure, the transputer architecture was highly influential in provoking new ideas in computer architecture, several of which have **re-emerged in different forms in modern systems !**

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

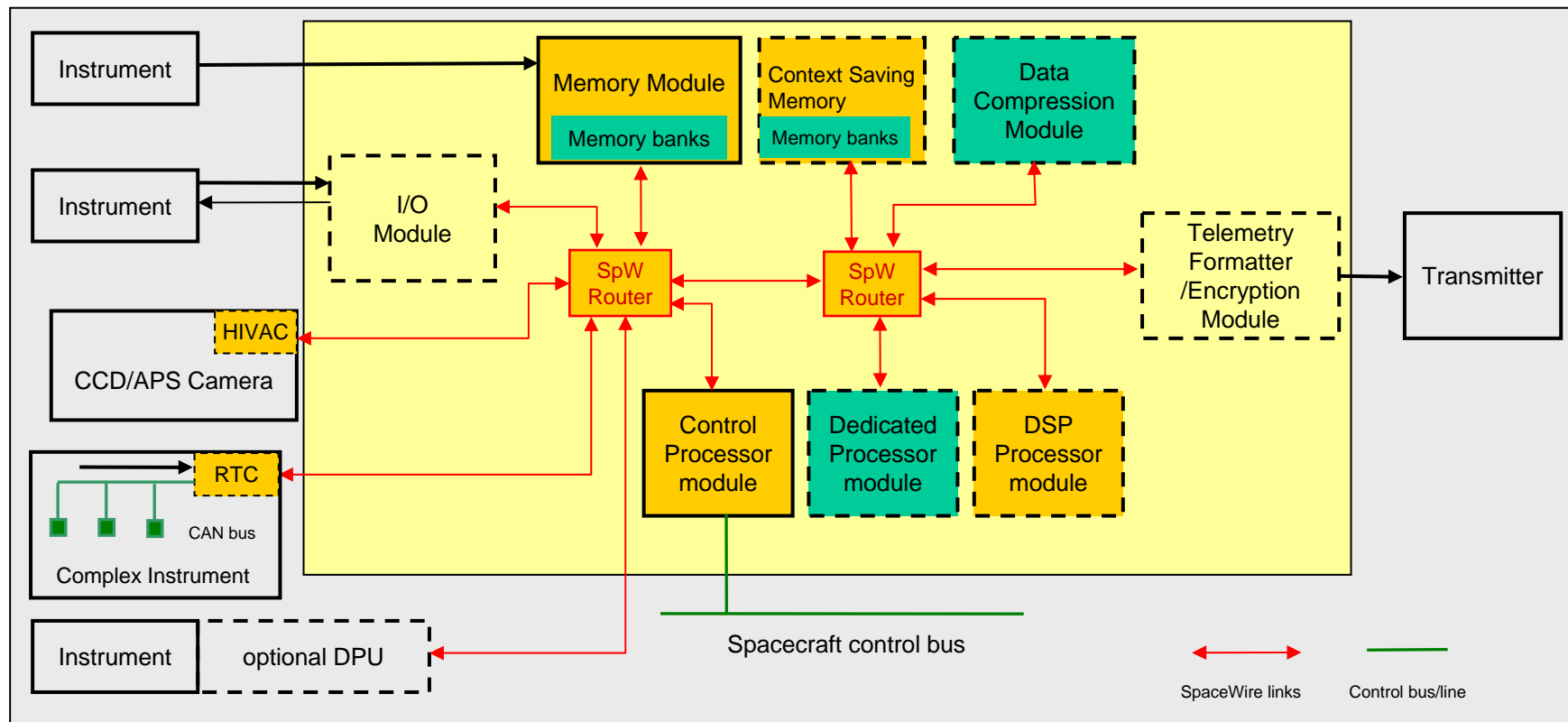
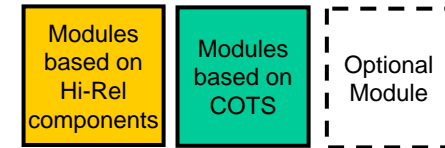


DS-Link: Serial, asynchronous, Symmetrical, Flow-Controlled, Point-to-point Interface

- Data/Strobe, 100Mb/s+
- Packet protocol, Routing switches
- Modular
- Scalable

Serial links and Packet routing – Reference Architecture

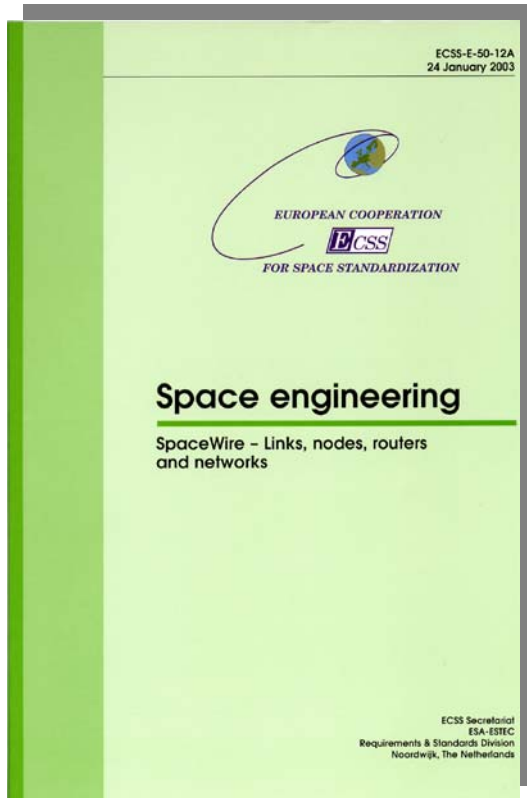
This architecture is used by ESA as a reference for medium-range Data Handling Systems and the definition SpaceWire devices (SpW Router, SpW RTC, SMCS-SpW, ...)



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>

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Introduction

SpaceWire is a standard for high-speed links and networks for use onboard spacecraft, easing the interconnection of:

- sensors
- mass-memories
- processing units, and
- downlink telemetry sub-systems.

SpaceWire is being widely used on many space missions by:

- [ESA](#)
- [NASA](#)
- [JAXA](#)

SpaceWire equipment is connected together using SpaceWire links which are:

- serial,
- high-speed (2 Mbits/sec to 200 Mbits/sec),
- bi-directional,
- full-duplex.

Application information is sent along a SpaceWire link in discrete packets. Control and time information can also be sent along SpaceWire links.

SpaceWire is defined in the European Cooperation for Space Standardization [ECSS-E50-12A standard](#).

For further information on the purpose and key features of SpaceWire and for a brief technical introduction please click on the following links:

- [Purpose](#)
- [Key Features](#)
- [Technical Introduction](#)

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<http://spacewire.esa.int>

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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

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SpaceWire Working Group – ESA – JAXA – NASA

Sixth SpaceWire Working Group Meeting, 18th and 19th of May 2006

The sixth SpaceWire (SpW-SnP) Working Group meeting has been held at Estec on Thursday the 18th and Friday the 19th of May 2006. Presentations and proceedings are available at [SpW-WG-Mtg6-Proceedings](#)

Proceedings of previous Meetings and Workshops

Fifth SpaceWire Working Group Meeting, 15th (PM), 16th and 17th of November 2005: [SpW-SnP-WG-Mtg5-Proceedings](#)

Fourth SpaceWire Working Group Meeting, 19th (PM), 20th and 21st (AM) of July 2005: [SpW-SnP-WG-Mtg4-Proceedings](#)

Third SpaceWire Working Group Meeting, 15th, 16th, 17th(AM) of February 2005: [SpW-SnP-WG-Mtg3-Proceedings](#)

Second SpaceWire Working Group Meeting, 10th PM, 11th , 12th (AM) of November 2004: [SpW-SnP-WG-Mtg2-Proceedings](#)

First SpaceWire Working Group Meeting, 15th and 16th (AM) of September 2004: [Mtg1-SpW-SnP-WG-Mtg1-Proceedings](#)

International SpaceWire Seminar, November 2003: [ISWS-proceedings](#)

On-board Payload Data Processing Workshop , September 19&20, 2001: [OPDP-proceedings](#)

Should you wish to have access to the proceedings or would have questions concerning On-board Payload Data Processing Systems, please contact:

Philippe Ambruster
ESTEC Data Systems Division - TEC-ED
email: spacewire.secretary@esa.int

<http://conferences.esa.int/01C25/>

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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)

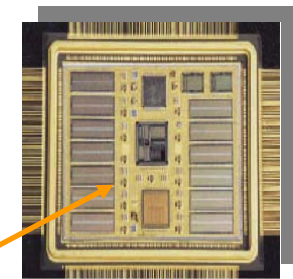
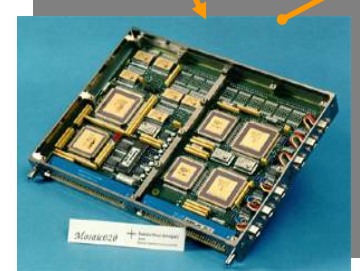
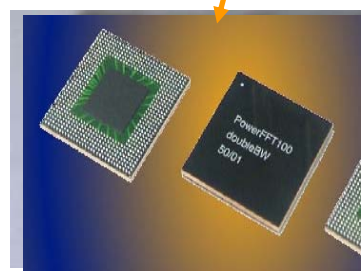
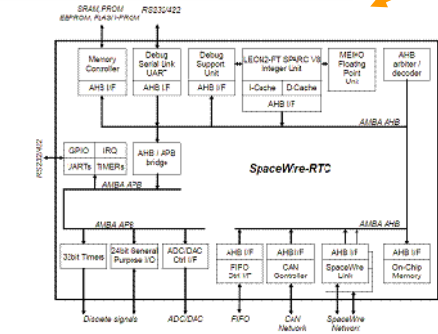
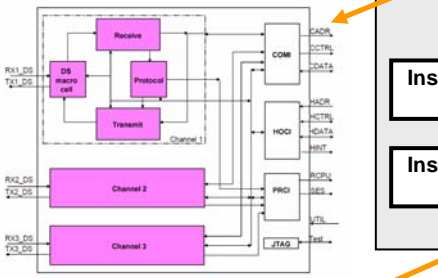
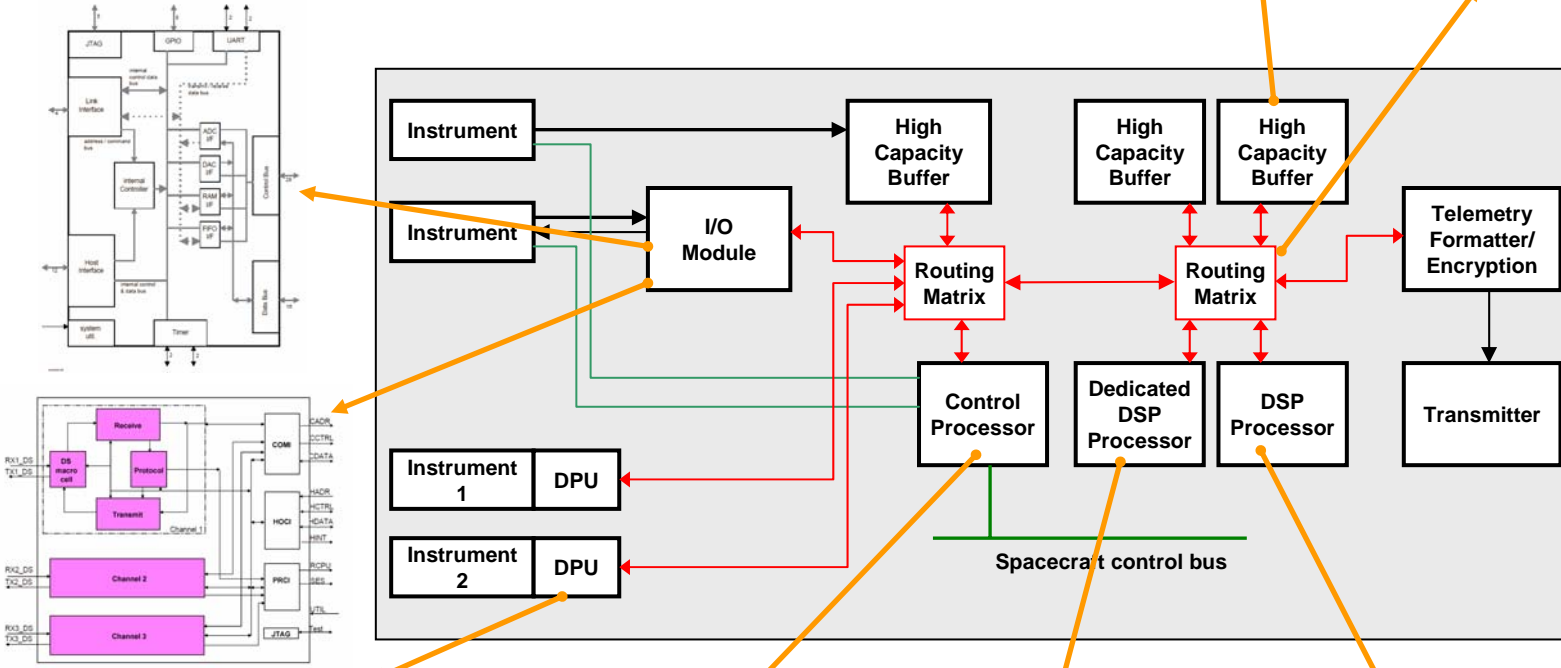
SpW WG Steering Committee: Coordinates/Approves PID allocations and supporting documents. Configuration management of in-preparation and published protocols.

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

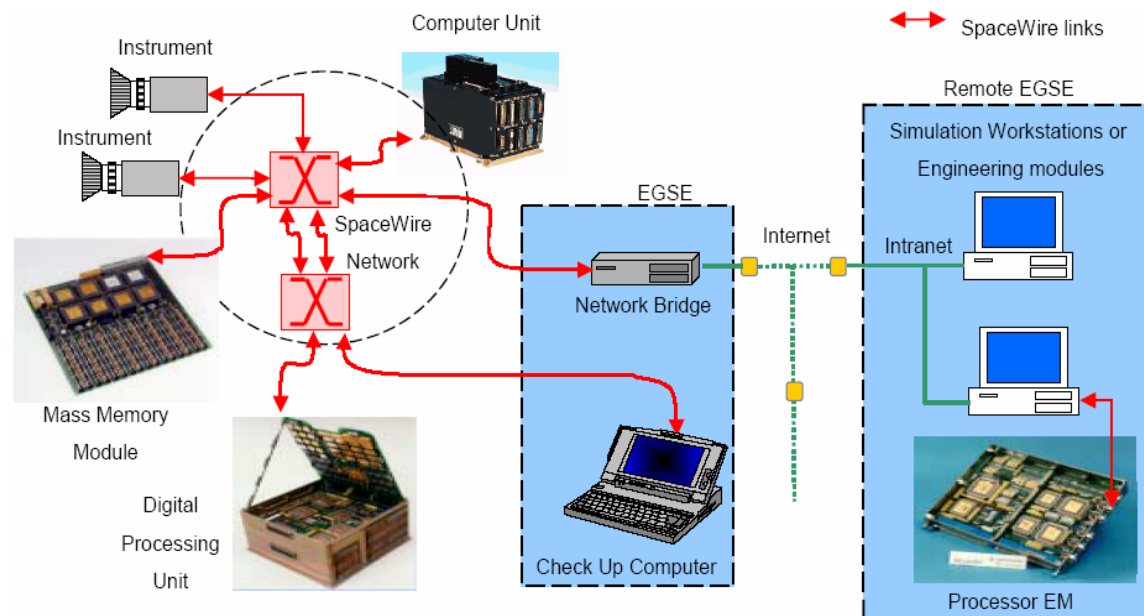


Perspectives

- 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