International SpaceWire Seminar

Welcome and Objectives

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SpaceWire history in ESA (1/4)

Taking into account the need to develop a suitable high speed interface in order to interconnect:

- Components and Boards

- Units

Decision was taken in 95, in the frame of a round table, to consider the IEEE1355 as a baseline.

On this basis, a first set of devices were developed in order to proof the concept, notably:

- An IEEE1355 controller (SMCS332), a remote terminal (SMCS116)

- An IEEE1355 PCI board and basic support software

- At this time, PECL drivers were replaced by LVDS drivers and 9 pin sub-miniature connectors were selected.

These first implementations were fruitful, allowed to consolidate the validity of the baseline and to evidence some technical shortfalls.

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SpaceWire history in ESA (2/4)

On the basis of the first experience, it became clear that high speed serial links were highly desirable but that IEEE1355 technical definitions were to be revisited for instance with respect to:

- The link initialisation sequence

- The specification of space compatible cables

- The handling of exceptional end of packet

Furthermore, it became clear that:

- Routers are required in order to avoid an over-multiplication of point to point links. This implied the definition of addressing and priority resolution schemes

- A synchronisation mechanism had to be included
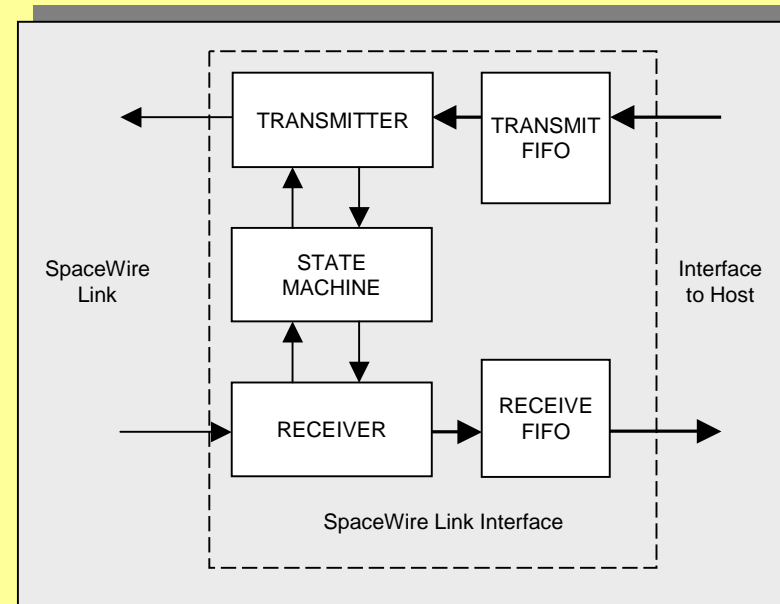
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SpaceWire history in ESA (3/4)

A proper description of the space version of the modified IEEE1355 specification was prepared by a Working Group, leading to the SpaceWire ECSS-E-50-12A and its companion Codec macro-cell

SpaceWire standard

ECSS- Space Engineering

SpaceWire – Links, Nodes, Routers and Networks

SpaceWire Codec macro-cell

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SpaceWire history in ESA (4/4)

In parallel to the standardisation effort, the development of a new set of Design tools and EGSE interface boards had to be initiated, among others:

- A SpaceWire conformance tester, a Link monitor, Protocol Analysers

- Next generation EGSE interfaces (based on PCI, PCMCIA, USB, Ethernet …)

More recently:

- The TopNet concept has been introduced in order to extend across networks the functionality of SpaceWire networks and their validation

- Work is performed in order to extend the capability of SpaceWire links in terms of speed, harness mass optimisation, galvanic isolation (e.g. SpaceFibre)

- Higher level protocols are being studied and defined in order to provide an homogeneous interface at application level

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SpaceWire Applications (1/3)

Initial objectives have been reached, SpaceWire point to point links are presently used to interconnect modules and units (processors, mass memories, instruments …)

Furthermore, SpaceWire networks are very suitable to implement
Distributed Data Handing and Processing systems,
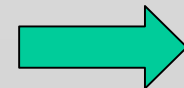that are inherently

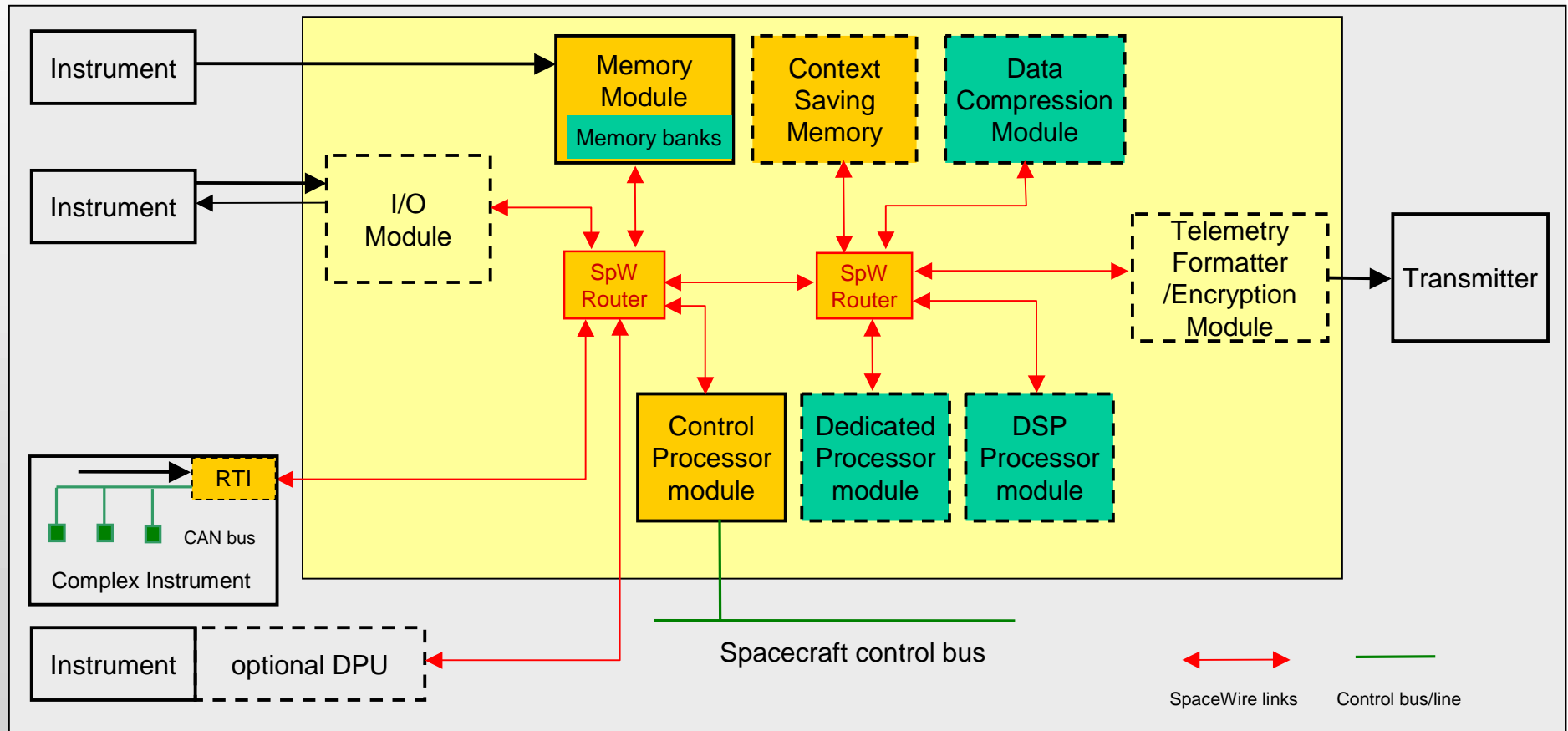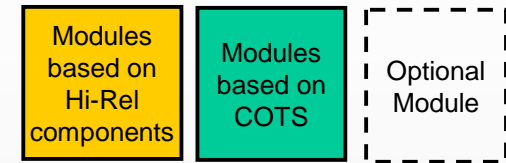**Modular**   **Scalable**   **Evolutionary**

can be made **Re-configurable**

And can be modelled by a **reference architecture**

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SpaceWire Applications (2/3)

Reference Architecture

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SpaceWire Applications (3/3)

Strategy for on-board payload data processing systems

On the basis of previous experiences and prospects, the proposed paradigm is to base on-board processing systems on:

- a distributed architecture

- an on-board network based on routers providing embedded reconfiguration mechanisms

- a set of nodes with well allocated functions (processing, storage, I/O)

- a development methodology with tools supporting phase A, B, C/D & E

- the promotion of results and the establishment of a product family policy (a good way to reduce costs is to favour re-use)

This concept is based on a ... robust, powerful and <u>stable</u> ...

communication infrastructure (the network), allowing ...

... nodes to evolve according to their own technology pace.

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Thank you for your attention ……

        and we all hope that you will enjoy this seminar

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