Distributed Interrupts in SpaceWire Interconnections

Prof. Yuriy Sheynin
St. Petersburg State University of Aerospace Instrumentation
Institute of High-Performance Computer and Network Technologies

190 000 St. Petersburg
Bolshaya Morskaya str., No 67
Fax: +7 812 3157778
E-mail: sheynin@online.ru

- Distributed on-board systems need some signals (e.g., interrupts) distribution.
- Sideband signal lines are used in previous generation on-board architectures
- The trend in modern interconnections – exclude sideband signals, include transfer of events, interrupts, etc. in the core interconnection itself, in its protocols;
  PCI Express is a good example
- The SpaceWire also needs adequate means for substitution of sideband signals by its core interconnection means for signal distribution

- The time codes distribution is a SpaceWire feature to substitute sideband signals for distributed systems clock synchronization.
  It is a clear advantage of the SpaceWire over other interconnection standards!
- Other signals, besides the time codes, are needed to be distributed in SpaceWire also
- It is important to have them at the low protocol layer, in order to get high priority distribution, minimum latencies, to traverse blocked by data links, etc.
  It is ensured for time codes.
  Should be ensured for other signals also.

- The questions are:
  - How many different signals?
  - What should be a mechanism for them?
  - How it correlates with the current and future SpaceWire standard releases?
  - To be aware: how it correlates with existing already SpaceWire implementations.

- Our proposal
  Interrupt codes distribution mechanism in the SpaceWire :
  http://conferences.esa.int/01C25/SpW-SnP-WG-Mtg2-Proceedings/SpW%20Interrupt%20code%20draft%201.0.pdf
  http://conferences.esa.int/01C25/SpW-SnP-WG-Mtg1-Proceedings/Presentations%20PDF/SUAI_SpW%20High%20Level%20Protocols.pdf
  - Up to 64 different signals
  - Fits in the current SpaceWire character coding format
  - Leaves a space in the character coding format for further extension
  - Different, to the time-codes, mechanism for signal distribution:
    The reason: to have compact implementations for a mechanism that can support dozens of different signals running simultaneously in an interconnection
  - Do not violate fixed part of the SpaceWire standard,
    do not cause conflicts with existing SpaceWire standard compliant implementations

Interrupt/Poll codes are implemented in our ASIC and FPGA SpaceWire implementation

Distributed Interrupts and Signals

"time-codes" extensions –

Usage of Control Flags (bits **T6** and **T7** of Time codes)

a) ESC+L-char

NULL=ESC+FCT

b) ESC + N-Char

T6 T7

Time-code

Interrupt-code

Poll-code

Extended-code (reserved)

Interrupt/Poll codes *do not* cause conflicts with existing SpaceWire standard compliant implementations

Interrupt/Poll codes *are* in conflict with Multi-Time codes

So,…

To have an interoperability

- Modes of operation, set in the Configuration:
  either Interrupt/Poll codes, or Multi-Time codes.
  (also PCI <-> PCI-X compatibility is an example of the approach)
- Not include in the SpaceWire standard neither Interrupt/Poll codes, nor Multi-Time codes.
  Treat them both as Logical (virtual) Sideband signals
  - NASA Multi-Time codes
  - RFSA Interrupt/Poll codes
- Tunneling of “alternative” through the both type routers

To study carefully both Interrupt/Poll codes and Multi-Time codes specifications. Investigate particular level of their interoperability /non-interoperability.