Titulo do artigo: FPGA-based Networking Systems for High Data-rate and Reliable In-vehicle Communications

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The currently avaliable communication protocols for vehicles do not support the needed data transfer rate for future applications involving video processing and transfering.
Basically, the communication protocols can be divided into 4 groups, A to D, according to the data-rate transmission speed. Despite the existence of D class protocols, as FlexRay, MOST and IDB-1394, none of them is enough for vision systems, whether by been too slow or missing fault-tolerance and reliability.
In order to deal with all the issues a design of new intellectual property (IP) macrocells, implementing the emerging standard ECSS-E-50-12A known as SpaceWire (SpW) is presented, since there is no SpaceWire router IP core supporting PID and RMAP currently available. The SpW standard may make it easier to the set up of in-vehicle high-speed and reliable networks, thus helping to reduce system integration costs by the re-use of digital interfaces across different applications.
The solution is presented using FPGAs that, nowadays, are a better option over an ASIC for several reasons: they provide enough logic and performance; since the standard is not frozen, the cost relation is better.
SpW is a bi-directional, full-duplex, point-to-point, highspeed, serial data communication link. The Standard is defined at six different levels of protocol: Physical level, Signal level, Character level, Exchange level, Packet level and Network level.
Implemented in VHDL, the SpW router IP is a macrocell providing a complete SpW routing and interfacing solution compliant with the basic standard plus RMAP and PID completely technology-independent. It consists basically in two major blocks: the Router Core, witch is a switching matrix connected to the external world via N SpW interfaces, 1 time-code interface, 1 control/status interface and 1 host data transfer interface, and The Interface, witch is composed of a SpW Encoder-Decoder (Codec) and a SpW I/O wrapper. The SpW Codec is made up of three main parts: an encoder (or transmitter), a decoder (or receiver), and a finite state machine which implements the Exchange Level Protocol. The SpW I/O wrapper connects the SpW Codec to the router core through transmitting (TX) and receiving (RX) FIFOs.
Several IP cores have been used to build a complete SpW network solution. After validating the VHDL code of the SpW router the IP macrocell has been implemented in FPGA technology. The system was tested on a board hosting a Stratix II EP2S60 FPGA. Currently we are repeating the set of tests on the anti-fuse Actel (RT)AX2000 device since anti-fuse devices outperform SRAM-based FPGA.
The implementation results using anti-fuse Actel technology showed to be enough for the original proposal and even better when compared to an ASIC solution showing an power consumption almost 65% lower.
This paper introduces the SpaceWire standard to the automotive field. The proposed SpaceWire networking solution simplifies the connectivity, provides network safety and redundancy and guarantees to handle very high bandwidth data flows, up to hundreds of Mbps, not covered by current standard.