TIME-TRIGGERED SERVICES FOR SPACEWIRE

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Long Paper

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ABSTRACT

Modern computer network architectures introduce dedicated network components like routers to reduce the number of communication links in the system. Nodes will then connect to a router, for example, instead of connecting directly to each other with individual point-to-point communication links. Besides the obvious weight and cost reduction of this architectural approach, additional media access logic has to be realized in order to establish a mutually exclusive access of the nodes to the communication links, which become a shared network resource.

In the simplest form, the media access logic implements an event-triggered principle, in which a node is free to access the network at arbitrary points in time and in which the nodes are serviced on a first-come first-served basis. An immediate drawback of this event-triggered principle is the cumulative transmission delay and jitter, when several nodes need to communicate onto the same shared communication link. The time-triggered principle constitutes a media access logic that uses a system-wide synchronized time-base to provide coordination between nodes in a distributed computer system, such that transmission delay and jitter are kept within low bounds.

This paper presents the outcome of an ESA-funded study on investigating the general applicability of time-triggered services for the SpaceWire protocol as well as identifying resulting constraints on SpaceWire Nodes and Routers. As a general outcome of this study we conclude that time-triggered services seamlessly integrate with the SpaceWire protocol which already provides synchronization primitives, so called Time Codes that can be leveraged to establish a system-wide synchronized time-base.