DETERMINISTIC DATA DELIVERY WITH SPACEWIRE

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ABSTRACT

SpaceWire provides a versatile network architecture which is ideal for many space applications. It has been widely used for payload data-handling on more than 30 space missions. SpaceWire is ideal for data-handling applications but does not address avionics and other applications where responsiveness, robustness, determinism and durability are essential requirements. There is a need for a spacecraft avionics network technology which combines the key features of SpaceWire with the quality of service requirements of real-time avionics applications. One critical requirement for avionics applications is deterministic delivery of information.

The question that this paper addresses is how can data be delivered deterministically over an existing SpaceWire network using existing SpaceWire components i.e. with no modification to the SpaceWire interface or router hardware? Two approaches to this question are considered: firstly the constraining of the SpaceWire architecture to provide determinism and secondly the sharing of system bandwidth using time-division multiplexing.

Constraining the SpaceWire architecture to use a single master device provides a simple means of providing determinism. It will be shown that several payload data handling applications have actually implemented such an architecture. Multiple masters can also be used without losing determinism.

Network bandwidth can be split up using time-division multiplexing. Time-slots for communication can be defined as the interval between time-codes. Each node is allocated a specific time-code when it is allowed to initiate transactions. When the corresponding time-code arrives the mode can start one or more transactions. When the next time-code arrives it must cease initiating transactions. This mechanism can be implemented in software on existing SpaceWire nodes.

The paper will explore deterministic delivery over SpaceWire networks, will described how this can be achieved with current SpaceWire nodes and routers, and will provide corresponding experimental results.