DESIGN CONSIDERATIONS FOR ADAPTING LEGACY SYSTEM ARCHITECTURES TO SPACEWIRE

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Short Paper

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ABSTRACT

Since first developed and standardized, SpaceWire has rapidly gained acceptance for use in space applications. SpaceWire offers many advantages to system designers over other on-board communications technologies. It is rather simple to implement, requiring relatively few logic gates and little interface memory to implement. Built upon low-voltage differential signalling, it provides for high-speed communications, supporting link speeds well in excess of 100 Mbps in practical systems. It uses point-to-point links to connect nodes rather than a shared-bus architecture and thus provides much flexibility for incorporating redundancy into spacecraft systems.

Prior to SpaceWire, many spacecraft bus architectures were based on communications technologies such as the MIL-STD-1553B and RS-422 serial links. This paper describes a basic design process and suggests some considerations for adapting such legacy systems to use SpaceWire.

Initially, a system designer must analyze data flows to evaluate direction, volume, criticality, and timing requirements. For time-critical data, a synchronous schedule is often preferable and can be accommodated easily by making use of the time codes feature of SpaceWire. After critical data flows have been identified, redundancy and retransmission can be used to guarantee delivery of important data. Incorporating routing switches into the system can offer much flexibility for architecting robust redundant topologies. Additional reliability can be gained by suitably applying higher-level protocols such as Remote Memory Access Protocol to support data acknowledgement and retransmission. As part of this research, we present analysis and some practical examples from experience from several projects.