

SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Design and Technology for Small Satellites - Part 1 (6A)

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UNIFIED COMMUNICATION INFRASTRUCTURE FOR SMALL SATELLITES

Abstract

Typical state of the art on-board communication infrastructure comprises two independent communication architectures. Command and control operations use a robust low data rate bus such as MIL-STD-1553B or CAN Bus. Payload data-handling systems rely on high data rate interconnection networks such as SpaceWire. A unique communication architecture would simplify the system design and deployment while reducing the mass and energy required. Unfortunately the solutions specifically targeted for hard real-time control generally do not provide the data throughput necessary for transporting and managing large amounts of data. On the other hand, communications architectures for high-speed, large-volume data transfer are generally not designed to provide the guaranteed low latency and high reliability required for mission critical, hard real-time control systems.

SpaceWire-RT has been designed to provide the best of the two worlds by implementing different quality of services that fulfills the needs of each application under a unique network architecture. SpaceWire-RT is built on top of SpaceWire, a space-proven technology that is simple to implement and use, and is being deployed on many space missions. SpaceWire standard describes a low-latency interconnection network with arbitrary topology that handles variable data rates. SpaceWire-RT implements a quality of service layer to provide determinism and additional robustness for command and control operations.

SpaceWire-RT has two principal dimensions: reliability and timeliness. Reliability is provided using a redundancy scheme with alternative paths for packets to be routed over. Timeliness is provided using a time-division multiplexing of network bandwidth to ensure that a packet can be delivered within certain time constraints. Event-driven, time-driven, high and low rate data sources can be accommodated without penalties in the network performance.

The full paper will present an overview of SpaceWire-RT including results of prototyping. The new on-board communication paradigm will be compared with previous existing solutions to show the benefits of unifying the communications system: faster development, lower risk and a significant save in terms of cost, power and mass.