Executive Summary

Fibre Channel Scaleable Optical Real-Time Interconnect (SORTI)

PNUM 46

Background: The SORTI contract was awarded to the Boeing Defense & Space Group (D&SG) on September 13, 1996. This fixed price contract was the result of a cooperative proposal submitted to the Open Systems Joint Task Force (OS-JTF) by the Naval Air Warfare Center - Aircraft Division (NAWC-AD), Indianapolis and Boeing.

The SORTI contract, awarded to the Boeing Defense & Space Group on September 13, 1996, was completed on September 13, 1997. This effort focused on the establishment of a proof-of-concept electronics assembly capable of providing a 4x4 subset of a Fibre Channel-based Interconnect Fabric. Tasks lead to testing, characterizing, and demonstrating the Interconnect Fabric Module (IFM) to validate unified network concepts and the methodology of utilizing popular industry standards to meet stringent military avionics processing requirements. Technology development, by the Boeing Optical Interconnect System (BOIS) internal research and development (IR&D) project, was available and beneficial to the SORTI program. Architecture development, application requirements, avionics benefits analysis, protocol design, and application specific integrated circuit (ASIC) development has been critical to meeting the SORTI contract goals. ASICs, developed by the BOIS project, implement key functions important to real-time avionics applications. These included: 1) dynamic low latency connectivity; 2) high performance concurrent connectivity; 3) deterministic priority arbitration and connection preemption; 4) single or multi- cast communications; 5) single or multiple frame connections; and 6) variable frame payload size. These functions along with the application of the popular American National Standards Institute (ANSI) T11 Fibre Channel industry standard enables the implementation of a truly standard scaleable unified network for avionics platforms. Hardware developed for the SORTI contract implemented a 4x4 subset of a Fibre Channel based interconnect fabric. The IFM implementation consisted of a 6U VME format motherboard (M-Board) printed wire board (PWB) and four ~3U VME format daughtercard (D-Board) PWBs that attach to the M-Board. Components were surface mounted on both sides of each board. The implementation used common industry PWB materials and fabrication methods. Four Pentium based personal computers (PCs) connected, via multimode fiber optic cables, to the IFM helped to accomplished hardware tests, characterization, and demonstration. These PCs used commercially available Systran Inc. Fibre Channel network interface cards (NICs) to communicate with the IFM. Demonstrated performance meets and exceeds the requirements for message passing and data flow protocols and provides significant improvements that support processor-to-processor or -to-memory data transfers. Key functions provide deterministic operation as required to implement hard real-time schedulable systems.

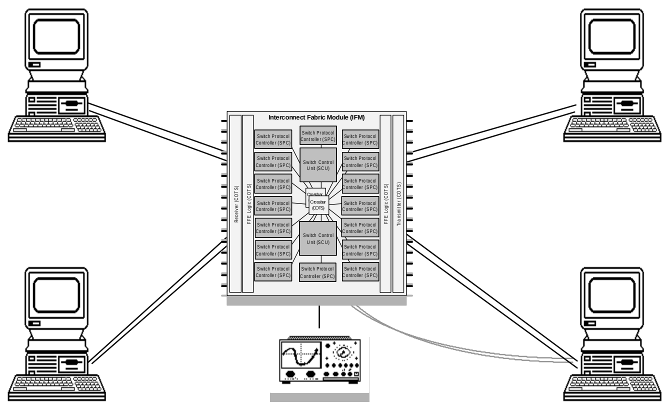

Figure 1. SORTI Test, Characterization, and Demonstration Setup.

Avionics Network Benefits: When applied to the fighter mission avionics problem the BOIS architecture provides some significant benefits that address specific customer goals for avionics. The network's simple interconnect structure and point-to-point nature support goals for lower systems cost, higher performance, and reduced maintenance. A single scaleable high performance network capable of physically extending over 200 meters between nodes can replace multiple proprietary backplane and system buses. Unlike existing bused structures, network aggregate bandwidth scales with the chosen technology and the number of nodes on the network. Goals for increased reliability with reduced maintenance are supported through reduced Line Replaceable Module and Unit (LRM and LRU) I/O connector densities, which have the potential to translate into a ~24% reduction in interconnect failures. Size, weight, and power reductions on the order of 50% per unit bandwidth will facilitate significant Life Cycle Cost (LCC) savings. An open architecture is achieved through the utilization of a widely accepted and adopted commercial standard which provides Commercial-Off-The-Shelf

(COTS) components, software drivers, and test and analysis equipment. All of this translates into a cost effective high performance architecture for next generation air vehicles and the retrofit of existing air vehicles.