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Poster Title:

Use of Dense Wavelength Division Multiplexing (DWDM) Optical Interconnects to Improve Parallel and Distributed Processing Architecture Connectivity

Abstract:

A number of programs funded by the Navy and Air Force have advanced the use of telecommunications developed Dense Wavelength Division Multiplexing (DWDM) optical interconnect technology for military applications. These efforts combined with internal R&D have resulted in a high performance embedded processing architecture that utilizes the inherent DWDM bandwidth, scalability, EMI immunity, and relatively distance insensitivity of fiber optics.

In particular, the results of the Air Force Highly Integrated Photonics (HIP) program have demonstrated the feasibility of building WDM Network Interface Unit (NIU) critical components that provide optical wavelength selective transmission, multiple optical wavelength simultaneous reception, optical amplification, and multiple node passive coupling. Prototype components were built and evaluated during HIP program phases I and II. Currently, the HIP program is in Phase III and is developing a WDM NIU system level demonstration. The results to date will be reviewed and the plans forward will be detailed.

The resulting multiprocessing architecture has a number of advantages over current interconnects, namely:

1. A flattened interconnect hierarchy that removes non-uniform processor connectivity limitations between resources (fiber optics has a very high bandwidth*distance product that results in uniform connectivity regardless of physical separation).
2. Increased interconnect bandwidth since one DWDM formatted transmission can accommodate 100's of optical wavelengths at very high speeds (10Gbps+) for potential bandwidths over a Terabit/second.
3. Increased fault tolerance since the broadcast DWDM star topology is constructed using passive optical devices which preclude active single points-of-failure.
4. Simplified development, integration and instrumentation due to the broadcast nature of the DWDM interconnect (all transmissions are available simultaneously to all users).
5. Improved scalability as a result of optical interconnects between processing resources that can be expanded with additional optical wavelengths and higher bandwidths without changing the physical interconnect.

Selected Applicable Topics:

1. Parallel and Distributed System Architectures
2. Networking and Interconnects