High Density Microelectronics Packaging Roadmap for Space Applications

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High density interconnect microelectronics emphasizes the effective integration of several critical and complex electronic packages and technologies. This Roadmap introduces major technologies in use, related strategic issues, and research recommendations for space applications. Electronic packages are optimized for low cost, portability, robustness, high speed, power efficiency, and for small size and low weight. The Optoelectronics Industry Development Association forecasts Internet traffic will surpass voice traffic by 2001 and that voice will occupy only 1% of network traffic by 2005. Satisfying these demands will require better electronic performance with an associated improvement in packaging. The traditional hierarchical network topology of circuit switching will need to evolve to a flat network topology for packet switching which is more conducive to data and Internet traffic. Technology development required to support this includes single tunable lasers to replace multiple fixed wavelength lasers, ultrawide bandwidth fibers and optical amplifiers, and large capacity optical cross connects and routers for handling multi-terabit information rates on a single fiber. Also needed is development of 13 GHz laser drivers and amplifiers, evolving 10Gb/s to be as affordable as 2.5Gb/s in general, defining standard interfaces for 10Gb/s metallic or fiber, as well as further development of receivers and transmitters to use wave division multiplexing for 10Gb/s traffic. Technical challenges and directions for high density interconnect microelectronics packaging include understanding latent electromigration and dendritic growth, multilayer board hole wall wicking reliability issues, and characterization of reworkable underfill. Technology challenges are described first for components, then the state of the art for high density materials and processes. Forecasts and recommendations for research direction are given for components, materials, and assembly methods.