AN OPTICAL FIBER IMPLEMENTATION OF A LOCAL AREA NETWORK

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ABSTRACT

The main objective of this project is to support a combined research launched in developing necessary system hardware and software in an implementation of a Local Area Network for the University premises. Although the primary purpose of the total research is the implementation of the seven layer ISO/OSI reference model for the LAN, the portion covered by this part of the work deals with the lowest 4 layers of the model.

The remaining sections of the research work is carried out by three other researches in parallel. The design and implementation of a generic machine, code conversion and development of the top three layers are some of the constituents of their research. In the proposed generic machine high speed Electrical / Optical interface will be installed for necessary high speed transfer of data between the internal bus and the network. An interim proposal for speed up is presented with this work, which will be replaced by the high speed E/O interface, of the generic machine.

The bulk of the presented material is oriented toward the Physical Layer implementation using Optical Fibers. Physical Medium is the lowest layer of the so called seven layer model. Experimental set ups for bidirectional communications are proposed and implemented. In contrast to common two fiber bidirectional communications, single fiber realizations are presented, which utilizes relatively less number of components and installation is not that complicated as with the conventional method. As a novel idea a single fiber - single wavelength bidirectional communication model is presented and

theoretical reasoning to prove the validity of the model is included. This implementation reduces so many cost factors involved in selecting devices for the network. Instead of costlier WDM devices and multiple window optical fibers, this new concept utilizes less expensive directional couplers and single window optical fibers. In the conventional method of using two wavelength for bidirectional communication, wavelengths are separated by WDMs. In this new approach directional couplers are sufficient to separate the optical carrier flows in the two opposite directions since the system is operated with only a single carrier wavelength.

The new idea is primarily based on the spectral width of the optical transmitters used in the model. It will best work for broad band spectral width transmitters. Any practical optical transmitter has a range of probable optical wavelengths known as the spectral width. Any two transmitters generate the same spectral wavelength simultaneously is remote. Again the probability of such simultaneous generation is dependent on the size of the spectral width of the transmitters used. Since the spectral widths of both LED and LD transmitters are very different, a statistical analysis is carried out for the two types and selection of most suitable transmitter for the system, is proposed based on this analysis. During this research two way back to back transmission of data using the proposed method is tested at 1MHz rate and no visible error is detected.

In order to get the least power loss at fiber connector junctions a correct connector installation process is required. The process followed is included in the Appendix. Software written to support the data communication between devices are also included.