

A Two-level TDM Access Protocol for IP Support in WDM Optical Networks

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Abstract. This paper presents a new access protocol for constructing IP over photonic systems. The protocol is based on a two-level TDMA structure with wavelength division multiplexing (WDM). Many IP-based network applications such as distributed VPN services, high-resolution image, distributed database, and real-time video/audio service, generally require high-speed transmissions and usually exhibit traffic locality in WAN/LAN. As a result, the traditional TDMA is no longer appropriate for such traffic because of inefficiency. Consequently, based on the traffic parameters such as locality and loading, an architecture named a 2TDMA (2-level TDMA) network is proposed. An analytical model is also presented and evaluated. The results of the analytical evaluations show that 1) the performance of a network depends on the network loading, locality, and number of groups. 2) The increased traffic locality could increase the slot utilization and throughput. 3) If the traffic locality is larger than a threshold, a 2TDMA network can generate higher throughput than a network with TDMA. Hence, if a system can be operated with appropriate loading, group, and traffic locality, its utilization and throughput will be enhanced significantly.

Keywords. Wavelength division multiplexing (WDM), Time Division Multiplexing Access (TDMA), Optical networks, IP over WDM.

1 Introduction

Many new IP-based networks with high performance needs such as distributed VPN services, high-resolution image, distributed database, and real-time video/audio service, require more bandwidth/quality than ever before. These applications generally ask the data to be transmitted very fast under heavy traffic in a wide area network (WAN) or local area network (LAN). Optical fiber has been widely adopted for satisfying these requirements. The wavelength division multiplexing (WDM) technique [1] is widely employed to fully utilize the huge bandwidth available on optical fibers and has contributed significantly to high-speed communications.