A Cost-Based Scheduling Algorithm for Differentiated Service on WDM Optical Networks

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***Abstract*—One of the important issues in the design of future generation of high-speed networks is to provide differentiated services to different types of traffic with various time constraints. In this paper, we propose an adaptive scheme to manage message transmission in single-hop passive-star coupler based wavelength-division multiplexing (WDM) optical networks. This study suggests that when scheduling message transmission in WDM networks differentiated service should be considered in order to meet the time constraint to transmission of real-time messages while non real-time messages are being served so that the overall performance of the network could be improved.**

***Index Terms*—Communication system performance, optical communication, real-time system, scheduling.**

I. Introduction

A TYPICAL and simple network structure of optical WDM networks is one with a single-hop topology, which directly connects the network nodes to a passive star coupler [1], [2]. Media access control protocols are needed to schedule the messages to be transmitted through the multiple channels of an optical fiber. The major contribution of this paper is that we develop a novel scheduling algorithm for the reservation-based media access control protocol in the single hop passive star coupled wavelength-division multiplexing (WDM) optical network to provide differentiated service to messages with different time constraints. The remainder of this paper is organized as follows. Section II specifies our system model for the network. Section III presents our new algorithm. Section IV shows the results from our simulation experiments. Finally, Section V concludes the letter.

II. System and Service

We consider message transmission in a single-hop WDM optical network whose nodes are connected to a passive star coupler via a two-way fiber. Each direction of the fiber supports $C+1$ WDM channels. C data channels are used for message transmission. Another channel is used to exchange global information about the messages among nodes. There exist N nodes in the network. Each node in the network has two transmitters and two receivers. One pair of transceivers is fixed and tuned to the control channel. The other pair is tunable to any of the data channels. The nodes are assumed to generate messages with variable length composed of several equal-sized packets. The nodes are divided into two non-disjoint sets of source nodes s_i and destination nodes d_j. A queue of messages to be transmitted is assumed to exist at each source node s_i. A time-division multiple access (TDMA) protocol is used on the control channel. Each node can transmit a control packet during a predetermined time slot. N control packets make up one control frame on the control channel. Fig. 1 illustrates some of the basic concepts in our model.

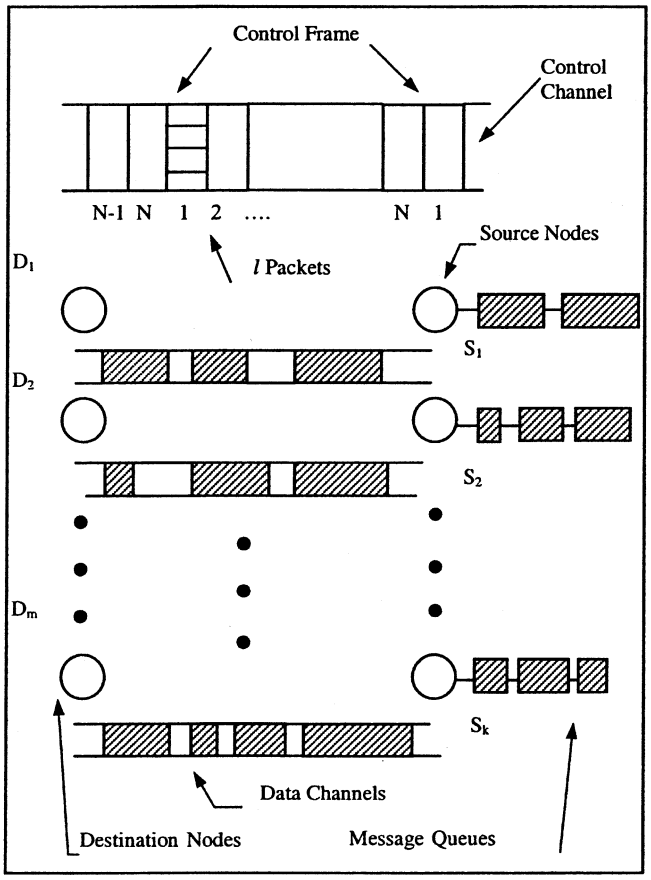

Fig. 1. Data and control channel configuration.

III. Scheduling Algorithm

We adopt *Earliest Available Time Scheduling* (EATS) algorithm as the technique to assign data channels and transmission time slots to the selected messages. The basic idea of EATS algorithm is to assign a message to a data channel that has the earliest available time slot among all other channels. To determine the message transmission sequence, priority schemes

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