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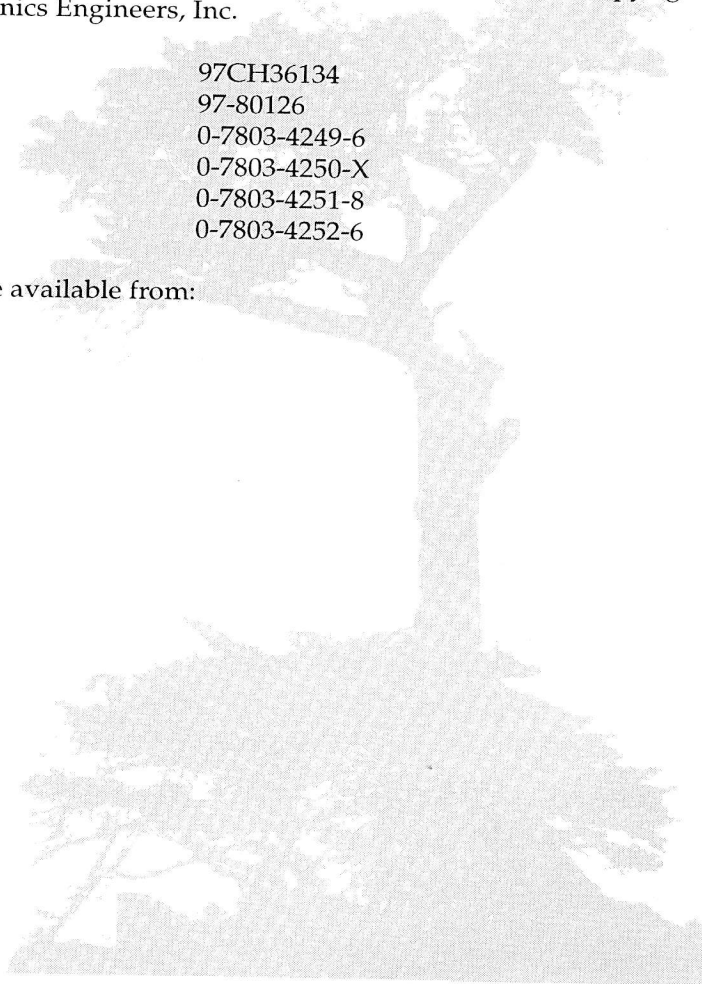
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A DYNAMIC PACKET RESERVATION MULTIPLE ACCESS SCHEME FOR WIRELESS ATM

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Abstract

Dynamic Packet Reservation Multiple Access (DPRMA) is a medium access control protocol for wireless multimedia applications. It allows the integration of both constant bit rate and variable bit rate traffic through a single access control mechanism that permits users to specify their bandwidth requirements. Users are allowed to repeatedly update this information in order to reflect any changes in their data rates. A base station analyzes the mobiles' requests, determines which can be accommodated, and conveys the resulting bandwidth assignments to the users. The ability of a mobile to initially reserve a portion of the channel capacity and to then dynamically alter this reservation is a primary feature of the system. In DPRMA, an attempt is made to match the capacity assigned to the user with the user generation rate. Furthermore, this capacity can be allocated using fractional or multiple slot assignments. The scheme is shown to provide improved performance over a system with a modified version of the Packet Reservation Multiple Access (PRMA) scheme.

1. Introduction

One primary focus of today's communication network technology is on the efficient integration of multimedia traffic such as voice, computer data, video, and other traffic types. A current state-of-the-art technique for achieving such integration is via the Asynchronous Transfer Mode (ATM) protocol. The success of ATM has engendered the desire to extend multimedia networks beyond their current capabilities. Consequently, there has been considerable interest in incorporating multimedia applications such as ATM into a wireless network. Before this can be accomplished, however, there are certain issues unique to wireless systems that must be addressed. One specific area is that of efficient Medium Access Control (MAC).

A new MAC protocol for the cellular environment must be designed based on features that are inherent to the system. It is assumed in this work that the cellular network is made up of a grid of cells, each of which con-

tains a centralized base station. Wireless mobile users communicate via the base station using an uplink (mobile to base station) and a downlink (base station to mobile) channel. Since the base station is the sole transmitter on the downlink channel, efficient resource allocation on this channel is a relatively easy task and no MAC protocol is necessary. On the uplink channel, however, a MAC scheme is required.

A considerable body of research has already been performed on the topic of MAC protocols, especially for voice and data applications. However, the Time Division Multiple Access (TDMA) schemes that are currently used are inappropriate and inefficient since they do not attempt to address the continuously changing needs of heterogeneous traffic types. One of the most noteworthy schemes for packetized voice transmission has been the Packet Reservation Multiple Access (PRMA) protocol [1]. Although PRMA is suitable for systems with voice and data traffic, there is no mechanism for accommodating users with changing transmission rate requirements. Furthermore, the system is optimized for a single traffic type, namely voice. Therefore the PRMA protocol is inappropriate for multiple real-time Variable Bit Rate (VBR) traffic users. Thus, a new MAC protocol that is more suited for the combination of both VBR and Constant Bit Rate (CBR) traffic needs to be devised.

In this paper, Dynamic Packet Reservation Multiple Access (DPRMA), a novel MAC protocol, is introduced. It is based on the principles of PRMA, which allow reservations of periodic time slots. Unlike PRMA, however, this protocol allows dynamic resource allocation to take place based on information provided by each user about its current resource requirements. Each user can update its request whenever it determines that its requirements have changed. The base station is responsible for monitoring all the rate requests and determining which can be accommodated at any given time. The base station then dictates which user will transmit in each slot of the uplink channel.

The PRMA protocol is briefly reviewed in Section 2. The basic concepts of DPRMA are then presented in Section 3. In addition, a technique is described for al-

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