

## QoS-Oriented Packet Scheduling for MC-CDMA System

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### Abstract

In future wireless multimedia networks, there will be a mixture of different traffic classes, each having its own quality-of-service (QoS) requirements. So it is a difficult task satisfying heterogeneous QoS requirements. In this paper, we propose a new QoS-oriented packet scheduling for the uplink MC-CDMA system. We consider QoS parameters such as bit error rate (BER), packet loss ratio (PLR), and delay requirements. The priorities of packet transmission are determined by novel packet priority function. The packets are scheduled by packet allocator according to their BER requirements and delay constraints. We compare WISPER with our scheduling scheme in terms of throughput, PLR and packet delay. Simulation results show that our scheme can guarantee heterogeneous QoS requirements in MC-CDMA system.

### I. Introduction

The fourth generation cellular wireless networks will support heterogeneous multimedia services including voice, data and video. Unlike wireline communications, wireless systems have very limited resources. So scarce resources have to be efficiently distributed to provide QoS to the users using appropriate scheduling algorithms.

Multi-carrier Code Division Multiple Access (MC-CDMA) system has been proposed as one of the promising technique for fourth generation wireless communications [1] and selected as a candidate for NTT-DoCom systems. But no adequate scheduling algorithms have been proposed for MC-CDMA system.

In [2], a wireless multimedia access control protocol with BER scheduling (called WISPER) is proposed for a Time Division-Code Division Multiple Access (TD-CDMA) system, where packets with the same or similar BER requirements are transmitted in the same time slot with the same received power level for all the packets. WISPER can be extended simply in MC-CDMA system by allocating packets with same or similar BER requirements are transmitted in the same sub-carrier band. But WISPER has a weakness because power levels of all code channels are assumed to be equal so power levels are not minimized.

In this paper, we propose a new QoS-oriented packet scheduling for MC-CDMA system. In this scheme, unequal power levels are used by packets with different BER requirements, so more packets can be accommodated in one sub-carrier group. Moreover, priority function also considers packet delay as well as packet time out values so smaller packet loss ratio can

be achieved.

The paper is organized as follows. In Section II, we describe the MC-CDMA system model. In Section III, we present the new QoS-oriented packet scheduling algorithm for MC-CDMA system. In Section IV, the performance of the scheduler is evaluated by computer simulation and is compared with WISPER. Finally, a conclusion is drawn in Section V.

### II. System Model

We consider a wireless network system that uses modified MC-CDMA. MC-CDMA transmitter spreads the original data stream over different sub-carriers using a given spreading code in the frequency domain. In other words, a fraction of the symbol corresponding to a chip of the spreading code is transmitted through a different sub-carrier. For better spectral efficiency we modify the MC-CDMA system model proposed by [3] make Frequency Division Multiple Access (FDMA) possible. Fig. 1 shows the modification of MC-CDMA system. We define a bundle of sub-carriers that has same data symbol but located in different frequency band as the one sub-carrier group.

In MC-CDMA system, any other simultaneous transmission in the same sub-carrier band contributes as noise to the transmitted signal. So most important factor determination of the BER is the number of mobile terminals that are simultaneously transmitting in the same sub-carrier group. This is the reason that requires efficient packet scheduling algorithm.

We assume that mobile terminals generate packets in batches, where all packets in a batch have the same timeout values.