The Coexistence Structure of the OFDMA and the WCDMA for the Delay Sensitive Service in Future Mobile Multimedia Systems

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Abstract

In wireless multimedia systems, satisfying the quality of service (QoS) is becoming more important. In this paper, we proposed a coexistence structure of the OFDMA and the WCDMA for providing the QoS of the delay sensitive services. By utilizing the spread spectrum technique of the WCDMA, the delay sensitive signal is spread into a part of the OFDMA frequency band, and then transmits in random access fashion. As the load is increased in random access, the delay performance is increased and the throughput performance is decreased rapidly. To maximize such the feature of random access, we assume that it뭔 been experiment in the lower part of load. The simulation results show that the delay performance of the real-time response service in the proposed system is better than that of the conventional system while maintaining comparable overall throughput performance.

Index Terms쎕 ybrid multiple access, wideband code division multiple access, orthogonal frequency division multiplexing

I. INTRODUCTION

Looking forward to the future wireless communication systems, intense interests have been focused on the increasing demands for wireless high-rate multimedia applications. One of the goals of the future wireless communication systems is to support wireless Internet services in an affordable way. Therefore, they need to provide services for heterogeneous classes of traffics with different quality of service (QoS) requirements.

As the demands of the multimedia services increase, the issue of the delay in the real time service becomes more important. The well known real time service can be divided into two different groups: the real-time response service and the non-real-time response service. The former is defined as the service in which the delay between a command and the associated response is emphasized, and the latter is general real-time service on an average which usually involves the buffering process. So, the non-real-time response service allows some processing delay, but the real-time response service does not.

The orthogonal frequency division multiple access (OFDMA) system has been regarded as one of the potential candidates to support wireless services, mainly due to its high data rate capability even in the rough wireless communication environment. In the OFDMA system, data signals are transmitted in parallel over many narrowband orthogonal subcarriers, and the channel fading on each subcarrier is usually different. Therefore, an adaptive modulation scheme can be employed into each subcarrier of the OFDMA systems [1][2].

However, if the services are delay sensitive and bursty, it is very hard to optimize the subcarrier assignment efficiently. Furthermore, since the OFDMA systems are sensitive to the misalignment of timing and the frequency offset, almost real-time synchronization is required between the transmitter and the receiver. On the other hand, in the WCDMA systems, the bursty packet data can easily be transmitted in a random access fashion since the system is less sensitive to the synchronization [3]. Since the random access scheme do not cause a long processing delay at the normal traffic, it can be considered in combination with WCDMA as a solution for the bursty delay sensitive services.

In this paper, we propose a new system structure of coexistence scheme for the real-time response service in the OFDMA systems. Applying the spread spectrum technique of the WCDMA, we propose to spread the real-time response service and then transmit in the random access fashion into the same wireless channel as the OFDMA under the interference level of the OFDMA signal. Instead, the adaptive modulation mode of the OFDMA traffic is controlled adaptively.

In the rest of the paper, we describe the system model in section II, and the structure of the proposed coexistence system for the real-time response services in section III. We then present the computer simulation in section IV. Next, in section V, we summarize our conclusion.

II. System Model Based on the OFDMA

In the OFDMA system, the appropriate modulation mode for transmission in each subcarrier is selected according to its instantaneous channel characteristics. The system employs higher order modulation modes for subcarrier having good channel conditions so as to carry more bits, and employs lower order modulation modes for those subcarriers affected by deep fading to carry only one or even zero bit. Since the channel characteristic is affected by the location of the users within the cell, the appropriate modulation mode depends on the position of the users.

As shown in Fig. 1, the user closer to the BS tends to employ a higher modulation mode, and the user farther from the BS

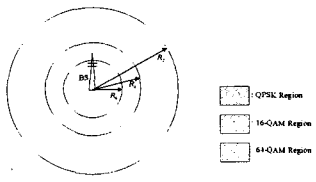

Fig. 1. The region of the available modulation mode according to the distance from the BS in the coexistence system