Admission Control Utilizing Region-Based Channel Capacity

Sungjin Lee and Sanghoon Lee
Wireless network Lab.(C703), Center for IT of Yonsei Univ.
134 Shinchondong Seodaemungu, Seoul, Korea, 120-749.
Tel : 82-2-2123-2767, FAX : 82-2-2123-2767, E-mail : elflee7@yonsei.ac.kr

Abstract— **This paper presents an admission control technique for multi-carrier systems with an FRF(frequency reuse factor) of 1. The FRF of 1 has been highly desirable for more improved channel throughput but the forward link capacity is rapidly decreased at the cell boundary region due to the increase in the ICI(InterCell Interference). By measuring a region-based channel capacity and deriving a closed form of blocking probability, a QoS(Quality of Service) maintenance technique and mobility model can be acquired. In the simulation, the proposed scheme demonstrates a blocking probability reduction of up to 40 % compared to the cell-based link capacity scheme.**

Keywords— **OFDM, Admission Control, Multicell, ICI**

I. Introduction

For next generation mobile access networks, OFDM (Orthogonal Frequency Division Multiplexing) has been studied as the most suitable modulation technique due to high spectral efficiency. For high channel throughput and ease of deployment, it has been highly desirable to use a frequency reuse factor of 1. However, due to the ICI (InterCell Interference) which is rapidly increased away from the central point of the cell, the forward link capacity of a multi-carrier system is rapidly decreased at the cell boundary region [1].

Over the multi-cell environment, the radio resource needed to maintain a certain QoS (Quality of Service) is quite different according to the location of each MS (Mobile Station). Suppose that a radio resource is allocated to an MS located in the central area at the initial service time. The MS then moves to the cell boundary during the service holding time. In such a case, an additional radio resource is required to maintain the QoS. However, if the BS (Base Station) does not have any other resources in reserve, the service cannot be maintained.

For the admission control over the multicell environment, it is necessary to take into account the location-based link capacity associated with the ICI. However, most of previous researches have been done for a given channel capacity as a function of a variety of system parameters such as the *equivalent number of users* [2][3], *mobility* [4], SIR(signal-to-interference ratio) [3][5], resource availability [6] and so on.

This paper presents a capacity-based admission control scheme over a multicell environment with an FRF of 1. To obtain the region-based link capacity, each cell is partitioned into multiple regions w.r.t. the central point of each cell. The major different feature compared to traditional methods is that a region crossing rate during the service holding time is estimated based on the location, velocity, channel holding time, and so on. Utilizing the region-based channel capacity, the necessitated resource is determined and used for the admission control. In the simulation, the performance gain accrued from region partitioning is measured.

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II. Problem Statement

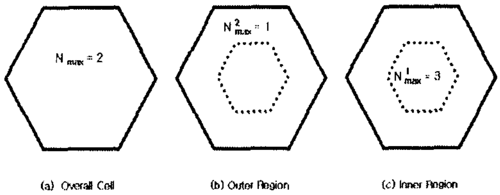

Fig. 1. The maximum number of admissible users per each region

Without loss of generality, a single class is only considered to state the problem. Fig. 1 depicts the key idea of the proposed algorithm using a simple comparison. In Fig. 1 (a), N_{max} represents the maximum number of admissible users using the average link capacity over the cells, named *Case I*. In the example, $N_{max} = 2$ for *Case I* in Fig. 1 (a). depict the region-based link capacity of the partitioned regions, named *CaseII*. In Fig. 1 (b), $N_{max}^2 = 1$ when all the users reside in the outer(2^{nd}) region. Due to the ICI effect, more capacity is required so that N_{max}^2 is decreased compared to *Case I*. This value is increased as the users move to the inner(1^{st}) region. In Fig. 1 (c), $N_{max}^1 = 3$ when all the users are in the inner region and no one is in the outer region. In general, let (a, b) represent a state where a and b are the number of users in the inner region and the outer region, respectively. Since $N_{max} = 2$ for *Case I*, the available states are (0,0), (1,0), (0,1), (1,1), (2,0) and (0,2). For *Case II*, the available states are (0,0), (1,0), (0,1), (2,0) and (3,0). The states of (1,1) and (0,2) in *Case I* are not allowable and become error states because the required capacity exceeds the maximum capacity obtained in *Case II*. These states are termed as *error states*. On the other hand, the state (3,0) in *Case II* is an allowable state which is not included in *Case I*. Thus, (3,0) is termed as a *loading state* accrued from the benefit of the region-based link capacity scheme, which does not exist in