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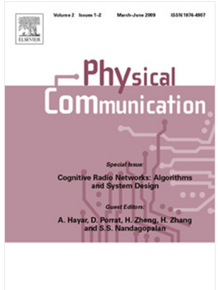

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A Dynamic Inter-cellular Bandwidth Fair Sharing Scheduler for Future Wireless Networks

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Abstract

Due the limitation of the frequency spectrum, channel assignment remains a main challenge in future wireless networks. In this context, the Inter-cellular Scheduling Scheme consists in dynamically allocating/reallocating the bandwidth to the cells, adapting it to the inhomogeneous traffic distribution that appears in a multi-cell environment. More precisely, it dynamically selects the cell that experiences the highest difficulties and grants it supplementary radio resources borrowed from its neighboring under-loaded donor ones. In this paper, we introduce and explain the concept of minimal bandwidth, which corresponds to the minimal amount of radio resources that an under-loaded cell must keep in order to be protected from sudden and uneven high bit rates peaks. This minimal bandwidth guarantees a minimal service. The majority of the existing works on dynamic channel assignment neglects the use of this important parameter or consider it as a static one. In this context, we introduce a novel multicellular scheduler called *Dynamic Inter-cellular Bandwidth Fair Sharing* that dynamically computes the minimal bandwidth of a cell according to its ratio of used bandwidth and available bandwidth. In the first step, the proposed solution is applied to the channel assignment scheme Reuse 3 and compared to a state of the art inter-cellular scheduling strategy in order to underline the benefits of the dynamic minimal bandwidth adaptation. In the second step, we have applied our methodology to the Fractional Frequency Reuse (FFR) scheme and compared it to the four frequency allocation schemes, Reuse 1, Reuse 3, FFR and Soft Frequency Reuse (SFR), as well as to a reference Dynamic FFR (D-FFR) solution that does not take into consideration the needs of the cells in terms of minimal bandwidth while redistributing the radio resources. Simulation results show that although the D-FFR scheme enhances the performances of the overloaded cell, it deteriorates the performance of the neighboring under-loaded ones. On the contrary, our solution called FFR_{DIBFS} improves the provided Quality of Service (QoS) of both the congested cells and the whole cellular network.

Index Terms

Wireless Networks, Channel Assignment Schemes, Load Balancing, Scheduling, Quality of Service.

I. INTRODUCTION

Future cellular networks are faced with a great challenge in terms of capacity as they will have to answer to a massive demand for wireless services and the associated exponential growth in mobile data traffic. For example, from 2015 to 2020, the mobile data traffic is expected to increase at a Compound Annual Growth Rate of 53 percent, reaching 30.6 exabytes per month by 2020 [1]. Moreover, increasing the system capacity is particularly relevant for the future wireless networks in view of the limited availability of the frequency spectrum. In this context, making an efficient use of the scarce radio spectrum is mandatory. The opportunistic intra-cellular scheduler algorithms [2-5] combined with the adaptive modulation and coding schemes allocate the bandwidth between users in a given cell in order to maximize the system capacity. However these solutions do not deal with the problem of the non uniform distribution of the traffic load among the cells of the network. In order to be more efficient, resource scheduling algorithms