An Overview of Cell Zooming Algorithms and Power Saving Capabilities in Wireless Networks

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Abstract
Cell zooming has emerged as a potential strategy to develop a green communication system in our society and it has become an essential research area of wireless communication. Aiming to highlight the trend of existing cell zooming algorithms and their power saving capabilities, this paper reviews a number of cell zooming algorithms that have been proposed in the literature. Static cell zooming algorithms are effective for off-peak hours and their maximum power saving capability is 50% since off-peak duration is typically not more than 12 hours.Meanwhile dynamic cell zooming algorithms are applicable in full-day operation and they are useful not only for power saving but also for load balancing. However, on/off switching delay, signalling overhead due to traffic information exchange and how to attain information of traffic spatial distribution are existing challenges in dynamic cell zooming algorithms. One noticeable point is that relative power saving in dynamic cell zooming algorithm is less than 50% if traffic spatial distribution is considered. Since location management (LM) was designed for effectively servicing to customers, further researches could lead to work on location management (LM) based cell zooming algorithms for both effective servicing and energy saving.

Keywords: *Cell zooming, Green communication, Static switch-off algorithm, Dynamic switch-off algorithm, Location management*

1 Introduction

Today, two critical issues that come up with the increasing number of wired and wireless networks are larger energy demand to supply those networks and the footprint of CO_2 emission from massive energy production. In previous studies, it was reported that 3% of world's electrical energy is taken by information and communication technology (ICT) sector and it is responsible for 2% of world's CO_2 emission [1-4]. Although updated energy efficient devices are currently being deployed, the energy demand for communication is being increased by larger and larger number of communication infrastructures and customer premises. At this point, a larger portion of this energy demand is found in wireless communication networks rather than in wired networks [5]. More specifically, in a wireless network, base stations consume about two-third of total network power consumption and are logically responsible for 70% of CO_2 emission from entire network [6,7]. For this reason, management on energy consumption of wireless base stations has become an essential topic of discussion in the research society. In a wireless network, it is found that the operation of base stations regardless of traffic intensity and users' location in the network leads to unnecessary energy usage. This fact bears a conceptual strategy called "*cell zooming*" to optimize the energy consumption of base stations in a network. In a few words, cell zooming is the reduction or increment of cell size from its