Energy Efficient Resource Allocation and Utilization in Future Heterogeneous Cellular Network

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***Abstract*—Future Mobile Heterogeneous Cellular Networks are emerging as promising technology in terms of high speed, low latency and ubiquitous connectivity. Providing energy efficient services in exponentially increasing user size and rigorous utilization of mobile services is a key challenge for mobile operators. The mobile operators deployed dense small cells to enhance the network capacity for providing the network services to maximum users. Instead of fully utilize of the existing deployment, operators leads to enhance the number of small cell base stations to enhance the network coverage. When the number of small cells increases, the energy consumption of the cellular network also increases. Thus a resource efficient, cost effective and energy efficient solution is required to control the deployment of new base station that consequently enhance the energy efficiency. In this paper, an efficient resource allocation and utilization model is proposed using Cognitive Fusion Centre (CFC). Where the CFC has Resource State Information (RSI) of the network resources and manages the free available resources. It helps in generating resource segment to facilitate the incoming users at peak hours. The propose solution can be deployed to any dense environment for maximum resource utilization.**

***Index Terms*—HetNet; Resource Allocation; Cognitive Fusion Centre (CFC); Efficient Resource Utilization.**

I. INTRODUCTION

The aim of Future Mobile Heterogeneous Cellular Networks(FMHCN) is to provide ubiquitous connectivity for any kind of devices and any kind of applications that may benefit from being connected, which may require 1000-fold more capacity, extreme low-latency (under 1 ms), and low energy consumption (90% reduction) for trillions of devices [1]**.** The traffic demand in cellular network is increasing rapidly, forcing mobile operators to provide larger capacity to serve more users. Therefore, the number of base stations (BSs) has increased dramatically. When the number of BSs in Wireless Heterogeneous Cellular Network (WHCN) increases, the energy consumption will also increase. It is proven fact, that increasing number of BSs is directly proportion to the energy consumption of the network, thus effecting energy efficiency of BSs [2], [3]. To realize the vision of essentially unlimited access to information and sharing of data anywhere, any time for any one and anything. In the FMHCN era, with a large number of BSs deployed, the energy consumption will increase tremendously. Therefore, the cost-effective, flexible, and energy efficient solution becomes one of the most urgent and critical challenges in the design of Heterogeneous Cellular Networks (HCNs) [4]. Traditionally, macro cells and small cells usually operate on separate dedicated channels in the ultra-dense environment. This dedicated channel approach leads to resource underutilization because base stations may not be able to fully utilize their radio resource with fixed partitioning when the traffic load in the network is fluctuating [5]**.** With the tremendous growth in wireless traffic and service, it is inevitable to extend efficient utilization of available free resources to wireless networks [6].

In this paper, an energy efficient resource allocation scheme is proposed using Cognitive Fusion Center (CFC), where CFC generates the segments of available free resources. In this proposed scheme a segment number is assigned to a user for getting resources. A Segment consists of radio resources such as spectrum, frequency, power and related hardware such as SBSs, routers etc. shown in Figure 1. The CFC generates the segments through segment generator of each available resources based on its Quality of Services (QoS) i.e. (energy efficiency). By Efficient Resources Allocation and Utilization (ERAU), large amount of the energy consumption can be saved significantly, and also will help in saving the cost of equipment's and its installation in WHCN. The proposed scheme consists of three layers. 1. Physical Network Resources Layer (PNRL), which includes all Physical Resources (PR). The PR consists of radio resources such as spectrum, frequency, power and related hardware such as SBSs, routers etc. 2. Cognitive Fusin Center Layer (CFCL), where manage and generation of all available free resources through segment generator. 3. Segment Cloud Layer (SCL), which is consists of all generated segments. The segment generation is done by the SG, which is the part of CFC at CFC layer. The simulation results show that a large amount of energy is saved compared to current baseline techniques. According to our information, we are the first to exploit the energy efficient resource allocation and utilization by CFC and segment generation to achieve low energy consumption and high-energy efficiency for WHCN.

Therefore, according to the next generation due to very heavy traffic load, we need the efficient resources allocation and utilization framework for base stations (BSs) and Radio Resources (RSs). Numerous researches done in area of cellular network resources utilization, but does not consider small cell network. Recently, some work has been done using small cell resource allocation and is referred as key