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# SURVEY OF RESOURCE ALLOCATION TECHNIQUES IN SELF ORGANIZING NETWORKS (SON)

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## ABSTRACT

The main goal of a self-organizing network (son) is self healing network deployment, network execution optimization and real-time adaptation according to environmental changes. in this paper we have done survey of different resource allocation techniques in a heterogeneous network, in a self-organizing manner. resource allocation mostly done by using ideal communication links where it has been expected that data can be transmitted between different base stations on time. resource allocation is purely done in distributed manner. to improve the power distribution some techniques and algorithms are discussed in this paper.

***Keywords***: *Resource allocation, Power control, Heterogeneous Networks*

## I. INTRODUCTION

Next generation 5g or upcoming technologies of mobile communication is required to provide high quality of voice and video quality services as well as better power consumption with cost effective keeping in mind the end goal to satisfy the requirements of both customers as well as Service providers. Emerging new technologies such as augmented reality, mobile-broadband substitution are expected to increase the load on mobile networks. The traditional cellular structures are incompetent to meet the demands for higher data rates from increasing number of devices. The spectrum available to operators is limited and radio link improvement is approaching the theoretical boundaries. Current cellular structures require a massive network deployment which is neither economically nor ecologically viable using current cellular architectures suppliers. Among them, the growing energy consumption of the networks is a main challenge which will directly result in the increase of carbon footprint and particularly environmental problems. In the networks, Personal use of this material is permitted. With the studies to achieve better coverage and capacity, for example, femto-cell has appeared as one of solutions quality of service (QoS) and satisfaction of customers have been greatly improved. On the other hand, the deployment and maintenance of network are becoming complex and expensive. Therefore, the study to reduce capital expenditure (CAPEX) and operational expenditure (OPEX) with guaranteeing high quality service is important to satisfy both customers and service providers. Self-organizing network (SON) is introduced in the 3GPP Long Term Evolution (LTE) as a promising technology for meeting market and technological aspects.

## II. LITERATURE SURVEY

Small cell networks (SCNs) is a potential technology to provide the next performance and capacity leap in wireless networks. SCNs are low-cost, low-power BSs that can provide service in a much smaller area compared to the macro cells. SCNs, in theory, can provide a better link between users and BSs due to the smaller distance between them. There are many technological advances that have improved the capacity of wireless communication systems such as coding and modulation schemes, however the dominant ingredient is utilizing smaller cells and universal frequency reuse. In short-term, femtocells can be utilized to offload the mobile data traffic from the cellular networks. However, in the long-term, data rates such as Gb/s are not possible without an overhaul of network

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architecture. The common point is the multi-tier architecture, which may consist of macrofemto BSs, or macro-SCN BSs, or a combination of both . There are various challenges for operators to overcome before successful deployment of multi-tiered networks. Self configuration and self-optimization are crucial for SCNs (or femto cells) as, when deployed, a SCN should be able to auto configure basic system and radio parameters as well as perform resource allocation. Another important problem is interference management in multi-tiered networks which is more complex compared to the single-tier networks due to cross-tier interference. Shared spectrum between tiers introduces crosstier interference along with co-tier interference. The problem becomes more challenging under a network architecture with high density of small cells. Hence, a efficient interference mitigation is required to enhance the coverage and capacity of the system. Due to cross-tier interference and possibly unknown locations of SCNs, centralized planning is not feasible in practice. Therefore, approaches developed for single-tier networks are not suitable for multi-tier networks. A Stackelberg game is used to formulate the interference management and resource allocation problem in a two tier wireless network in [13], where incomplete channel state information is utilized in an interference limited environment. Another game theoretic approach which uses a three stage Stackelberg game model is given in [14]. The proposed approach in considers electricity price decision along with power allocation and interference management to reduce the operational expenditures. A cooperative bargaining game theoretic approach for uplink sub-channel and power allocation problem is proposed in which investigates minimum outage probability, cross-tier interference mitigation and fairness under imperfect channel state information. A non-cooperative Stackelberg game where users compete for system resources is proposed . A self organizing algorithm for small cells, utilizing evolutionary game theory is introduced

A novel framework is purposed for joint channel allocation and BS ON-OFF switching problem in densely deployed HetNets. We propose two novel channel allocation schemes. The first scheme is implemented at the level of BSs, allowing BSs to dynamically choose their channels, and adapt them to the network's conditions. Since the channels themselves do not have their own individual payoff functions or preferences, investigating non-cooperative game is more suitable compared to a matching game with two-sided preferences. Moreover, in a matching game, the matching can require additional signaling between two player sets which can lead to overhead in the design and increase complexity. On the other hand, due to the distributed nature of networks and the competition among BSs, we cast the problem as a non-cooperative game. To solve this game, a novel distributed learning-based approach is used, in which the knowledge of received interference on each channel is needed for choosing the appropriate channel.

A novel resource allocation framework is introduced to address the DUDE problem within a LTE-U system. The proposed Q-learning algorithm enables the dual-mode SBSs learn to allocate licensed and unlicensed bands to the users in both uplink and downlink according to the network environment, autonomously. In the context of LTE-U SCNs, the self-organizing, decentralized reinforcement learning algorithm will outperform simple association mechanisms in present works .It can maximize the network's overall performance and minimize the overhead of the coordination among SBSs. Numerical results demonstrate that the proposed Q-learning algorithm can reach up to 12.7% and 51.1% improvement in terms of the overall LTE-U system sum rate compared to conventional Q-learning and nearest neighbor algorithms, respectively. Compared to mathematical calculations shows our proposed Q-learning algorithm can always converge to a mixed Nash equilibrium. Simulation results also show that the proposed algorithm needs 19% time less to coverage compared to the traditional Q-learning.

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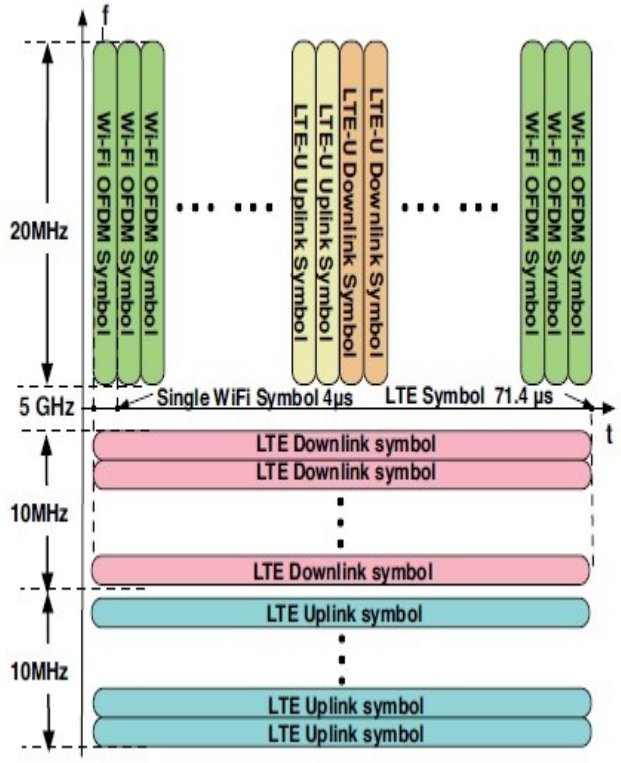


***Figure: Illustration on spectrum resource distribution between WiFi, LTE-U and LTE users.***

The Het-Net system consisting of one HPN and various LPNs have multi-dimensional radio resources to be allocated, such as the power allocation, sub-channel allocation, user scheduling, and cell association. Since one HPN/LPN may serve numerous UEs, the power allocation of different beam formers is not trivial. Because the HPN has a higher power and attracts more UEs than LPNs do, which may deviate the best Overall performance, achieving load balancing among HPN and LPNs through cell association becomes critical. Besides this, in an overloaded Het-Net that supports a very large number of UEs, user scheduling is essential to balance the transmission bit rate and fairness. Game theory is a widely used approach to optimize multidimensional radio resource allocation that involves individual agents trying to maximize their own selfish objectives, which usually would be at the detriment of other nodes involved in the game. Game theory was shown to provide relatively high gains as compared to classical learning algorithms by relying on certain information exchange among LPNs.

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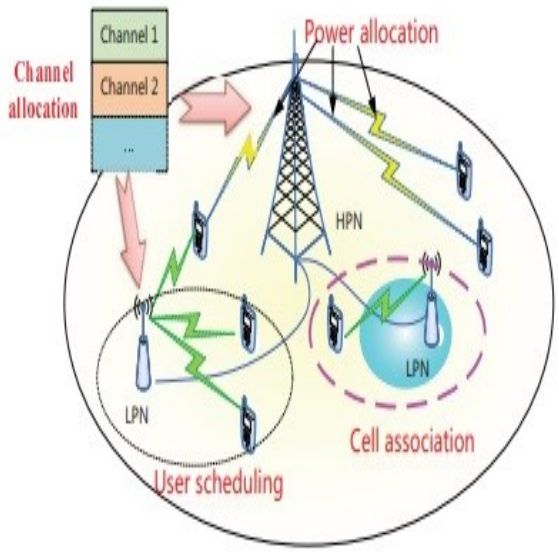


***Figure: System model of multi-Dimensional radio resource optimization***

An equilibrium point (Nash equilibrium) could be reached where each LPN could not unilaterally take an action to improve its state, for the given state of other LPNs in the HPN-LPN coexistence networks.

## III. CONCLUSION

In this paper we have done survey of different resource allocation techniques and algorithms self-healing issue to solve unexpected failure in SON. To deal with this problem, we introduced several concepts like HC and proposed CRA algorithm which consists of following two steps:

**1) HC allocation**

**2) Resource allocation including sub-channel.** Q-learning algorithm enables each BS to decide on its spectrum allocation scheme autonomously with limited information on the network state. DCA-LA and GUIA are combined with a BS ON-OFF switching algorithm in order to reduce the energy consumption of the network

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