INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume3, Issue2)
Available online at www.ijariit.com

A Review Paper on Improvement of Coexistence of LTE Femtocell Network with Dynamic Resource Allocation

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Abstract*— *A cognitive femtocell is a new small cell based on a smart home base station to solve the spectrum-scarcity problem. Recently, dedicated resource allocation for cognitive femtocells is extensively researched to mitigate the co-channel interference. However, the cognitive femtocell may suffer from the lack of frequency resource for its users due to high data traffic load of the macro cell. Interference control and quality-of-service (QoS) awareness are the major challenges for resource management in orthogonal frequency-division multiple access femtocell networks. There should be a self-organization strategy for physical resource block (PRB) allocation with QoS constraints to avoid the co-channel and co-tiered interference. Femtocell self-organization including self-configuration and self-optimization is proposed to manage the large femtocell networks. Recently, operators have resorted to femtocell networks in order to enhance indoor coverage and quality of service since macro-antennas fail to reach these objectives. Nevertheless, they are confronted to many challenges to make a success of femtocells deployment. In this paper, we address the issue of resources allocation in femtocell networks using OFDMA technology (e.g., WiMAX, LTE). Specifically, we propose a hybrid centralized/distributed resource allocation strategy

Keywords*— *Dynamic, Femto cell, QoS, Orthogonal, Interleaved, LTE, Localized, QAM, Optimization.

I. INTRODUCTION

With pace of time new technologies emerging but parallel growth of human being also increasing so to meet the demand we have to go through latest technology with economical budget. Wireless capacity has increased significantly due to reduced cell sizes and transmission distance, making it possible for wireless networks to support high data-rate applications. The infrastructure needed for reducing the cell size, namely the macro base stations, is expensive. One possible alternative is to deploy femtocells [1] that are short range low cost and low powered base stations, in homes or offices. Femtocells can be deployed in ad-hoc manner by different consumers. Femtocells increase capacity and improve coverage by the short transmit receive distance between base stations and users. This also help in improved macrocell reliability as some users are offloaded to femtocells, freeing up macrocell resources. There are two kinds of interference that can occur when femtocells are deployed in a macrocell. Cross-tier interference occurs between femtocells and macrocell, whereas intra-tier interference takes place between multiple femtocells using the same frequency spectrum. We study resource allocation among femtocells to mitigate intra-tier interference in this article [3-4].

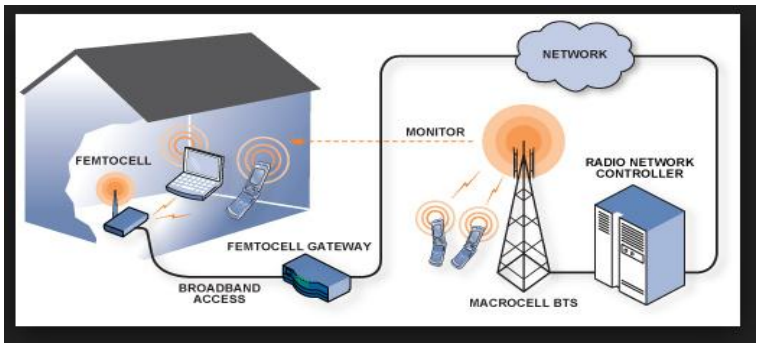

Figure 1 Femtocell and Macrocell Layout

We focus on OFDMA femtocell networks where the frame consists of time-frequency slots. Our unit of allocation, which we refer to Allocation Unit (AU), may be a time-subchannel slot, as in WiMAX networks or a resource block, as in LTE networks. Any other resource allocation unit can be also referred to as an AU. AUs may have different rates for different femtocells, as an AU can have different modulation and coding parameters for different femtocells, due to the adaptive modulation and coding feature of OFDMA networks. Every femtocell consists of a femtocell base station, which we also refer to as a femto cell access point (FAP). To remain competitive in the wireless communication market, vendors and operators need to make the reduction of both network cost and complexity a priority in future deployments of cellular systems. Moreover, the growth of indoor traffic forces network operators to compete with existing indoor coverage solutions, such as WiFi and Distributed Antenna System (DAS) to maintain their revenues. Since 2/3 of voice and 90 percent of data traffic occurs indoors [6-7], and because macrocells are not very efficient when delivering indoor coverage due to high penetration losses, providing such coverage has become a challenge for operators. That is why the use of femtocell access points (FAPs) seems a promising approach for coping with this coverage problem. An FAP is a low-cost low-power cellular base station deployed by the end customer. It is expected that femtocells will enhance indoor coverage, and also deliver high bandwidths, offer new services, and offload traffic from existing networks [2].

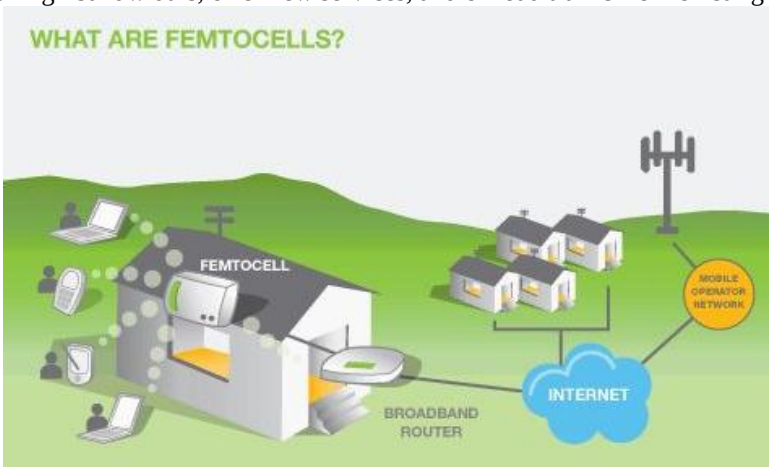

Figure 2 Devices connected in Femtocell

II. LITERATURE SURVEY

Research in this area can be classified into following categories:

A) Access control strategy: Guillaume de la Roche and et.al talked about access method, comparison between methods, technical challenges and solution, and describe hybrid approaches [5]. While author's focus on access control strategy a crucial aspect for operator to give preferential access to femtocells for their subscribers [6]. David L´ opez-P´ erez proposed FDTD (Finite-Difference Time-Domain) simulation for WiMAX mobile. System-Level in both case open and closed method access. Uplink outage analysis, with different methods of deployment femtocell, in addition to comparison between access methods has been introduced by Deepak and Venkatesh in [11]. Ping Xia and et.al has compared between open and closed access in uplink, from the viewpoint of owner and operator. And mentioned to the capacity in case orthogonal multiple access scheme, and case non-orthogonal multiple access. Lester and Holger show open access method is better than closed one, and provide better QoS and throughput, but it increase number of hand-off.

B) Co-channel frequency design and interference studies: This show that OFDMA femtocell as solution better than CDMA to avoid interference, also introduce some challenges as time synchronization between uplink and downlink, physical cell identity, mobility management and solution for each one [7]. While Authors concentrates on OFDMA based co-channel femtocell that cause minimum interference because of the sharing by the spectrum with macrocell and femtocell. While shows that there are two types of deployment operator first one called dedicated channel in this case it specified part of the spectrum for femtocell and the remaining for macrocell, second one called co-channel deployment in

this case femtocell lie on same frequency of macrocell. Parag and Tim explain how to manage radio resource in consideration of LTE femtocell, and introduce two approach for allocate resource according to application requirement first approach by identify the loud transmissions and avoid using their frequencies, the second approach by allocate to any resource block which not used by any somebody else. Also introduce several method to negotiate resource for avoiding or mitigating interference such as transmit power control, randomize frequency.

III. PLANNING OF WORK/METHODOLOGY

Moreover, the selection of an access control mechanism to femtocells has dramatic effects on the performance of the overall network, mainly due to its role on the definition of interference. Different approaches have been proposed:

Closed access: only a subset of the users, which is defined by the femtocell owner, can connect to the femtocell. This model is referred to as CSG (Closed Subscriber Group) by the 3GPP (3rd Generation Partnership Project)

Open Access: all customers of the operator have the right to make use of any femtocell

Hybrid Access: a limited amount of the femtocell resources are available to all users, while the rest are operated in a CSG manner.

When the access method blocks the use of the femtocell resources to a subset of the users within its coverage area, a new set of interfering signals is implicitly defined in such area. Hence, the deployment of CSG femtocells makes the problem of interference mitigation even more complex. Contrarily, the deployment of open FAPs would solve this issue, but bringing security and sharing concerns to the customer. Furthermore, when users move across areas with large numbers of open FAPs, the number of handovers and thus the signaling in the network increases. Finally, hybrid access techniques can be seen as a trade-off between open and closed approaches. However, the number of shared resources must be carefully tuned to avoid a large impact in the quality of service of the femtocell customers [10]. Access control mechanisms play an important role to mitigate cross-tier interference and handover attempts that is why they have to be carefully chosen depending on the customer profile and the scenario under consideration.

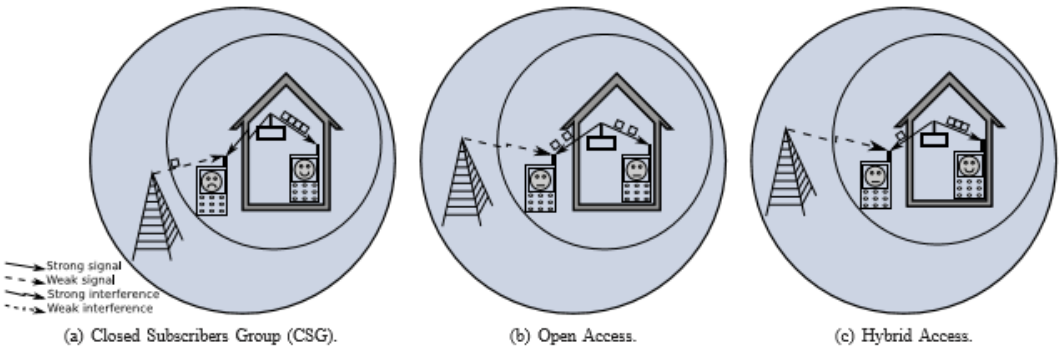

Figure 3 Access Method

HYBRID APPROACHES: Access control mechanisms have a direct effect on interference, and their features must hence be carefully analyzed. As seen in the previous section, all access methods suffer from advantages and drawbacks. In order to overcome those drawbacks, intermediate approaches are currently under scrutiny. Hybrid access methods reach a compromise between the impact on the performance of subscribers and the level of access that is granted to non-subscribers. Therefore, the sharing of femtocell resources between subscribers and non-subscribers needs to be finely tuned. Otherwise, subscribers might feel that they are paying for a service that is to be exploited by others. The impact to subscribers must thus be minimized in terms of performance or via economic advantages, e.g. reduced costs. In this section, particular cases of hybrid access methods for several technologies are depicted.

1. CDMA
2. OFDMA

IV. SOFTWARE USED AND SIMULATION RESULT

Software: MATLAB Version R2015a: It is powerful software that provides an environment for numerical computation as well as graphical display of outputs. In MATLAB the data input is in the ASCII format as well as binary format. It is high-performance language for technical computing integrates computation, visualization, and programming in a simple way where problems and solutions are expressed in familiar mathematical notation.

- Acquisition, Data Exploration, Analysing &Visualization
- Engineering complex drawing and scientific graphics
- Analysing of algorithmic designing
- Mathematical and Computational functions
- Modelling and simulating problems prototyping

- GUI (graphical user interface) building environment.

Using MATLAB, you can solve technical computing problems very easily and time saving as compared to traditional programming languages, such as C, C++, and FORTRAN.
The name MATLAB stands for matrix laboratory.

MATLAB Features

- MATLAB is a high-level language used for numerical computation, visualization, and application development
- It create very friendly environment for iterative exploration, design, and problem solving
- Mathematical functions for solving ordinary differential equations, Fourier analysis, linear algebra, statistics, filtering, optimization, numerical integration
- Development tools for enhancing code quality and maximizing performance
- Tools for building applications with custom graphical interfaces (GUI)
- Functions for integrating MATLAB based algorithms with external applications and we can able to generate code in hex file, c, embedded etc.

CONCLUSION

In this article different mechanisms of access to femtocells have been introduced. Both closed and open access models suffer disadvantages, the main ones being a lower network performance due to cross-tier interference for closed access, and a lower customer for open access, as well as a large number of handovers. Hence, hybrid strategies have been described, and models for CDMA and OFDMA have been detailed. Unlike open and closed, where the access mode is clearly defined, hybrid access offers a full range of algorithms that can be defined in order to control who accesses the femtocell and how the connection is configured. Such an approach brings thus together, the best of both worlds (closed and open access). Therefore, research is still needed to find hybrid access approaches well adapted to the different deployment scenarios.

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