Efficient Measurement Procedure for Access Control to Maximizing Throughput in LTE Femtocell Networks

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Abstract- LTE networks are becoming more and more popular nowadays. There are two main problems in implementing LTE networks - coverage and capacity. Both these problems can be solved by deploying femtocells in LTE networks. Femtocells can enhance the capacity and offload traffic from Macrocell networks. There are several issues that must be taken into consideration for the successful deployment of Femtocells. One of the most important issues is mobility management. Since Femtocells will be deployed densely, randomly, and by the millions, providing and supporting seamless mobility procedures is essential. Proposed an approach to handle mobility management with access control for several femtocells.

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I. INTRODUCTION

Mobile broadband has changed the way we live and work. LTE is future of mobile broadband. The recent increase of mobile data usage and emergence of new applications such as MMOG (Multimedia Online Gaming), mobile TV, Web 2.0, streaming contents have motivated the 3rd Generation Partnership Project (3GPP) to work on the Long-Term Evolution (LTE). LTE is the latest standard in the mobile network technology tree that previously realized the GSM/EDGE network technologies that now account for over 85% of all mobile subscribers. LTE will ensure 3GPP's competitive edge over other cellular technologies. Now world is moving towards 4G. There are 2 options for implementation of 4G, WI-MAX and LTE advanced. LTE can transmit voice + broadband data on same channel which is main advantage of LTE over WI-MAX. Most of mobile service providers are moving towards LTE-A for implementation of 4G worldwide.

Pushed by the rapidly increasing demand for bandwidth- hungry multimedia services, wireless networks are compelled to evolve in order to meet the extraordinary performance requirements of future broadband networks. Conventional macrocellular networks are in a major transition from a centralized, well-planned single-tier network to a multi-tier heterogeneous network, often consisting of relays, picocells, femtocells, as well as distributed antennas. As a result, the conventional macrocell networks share the spectrum with several base stations (BSs), often deployed in an irregular manner, operate with no coordination, and have different operating parameters (e.g. transmit power, density). Within this palette of co-existing wireless systems, femtocells are low power, user-installed base stations, which are intended for short range communication. A femtocell-aided network is able to extend the cellular network coverage providing high-speed data service inside home and enterprises to indoor users with superior reception [1]. Such small cell networks are attractive to wireless operators as they are deployed at the user premises and they leverage on the user's existing broadband internet connection for backhaul. Therefore, there is neither additional deployment cost, nor energy supply or site rental cost incurred on the operator. Although shrinking the cell size offers theoretically higher capacity and coverage, this reduction increases the complexity of all operator tasks: cell planning, site acquisition, parameter configuration, and tuning. Furthermore, one of the major challenges in femtocell deploy- ment is the incursion of inter-tier and intra-tier interference due to aggressive frequency reuse and uncoordinated coexis- tence, which can deteriorate the effectiveness of the two-tier femtocell architecture. Therefore, interference management is vital for successful deployment of femtocells and guaranteed quality-of-service (QoS) for macrocell traffic [2], [3].

Depending on the access control mechanism employed by the femtocells, the effect of cross-tier interference will differ significantly [4], [5]. In closed access systems (CSG), only a subset of subscribed users defined by the femtocell owner can connect to the femtocell access point (FAP), while in open access systems (OSG) both macro and femto users can access to the FAP. Compared to open access systems, closed access systems are considered to be more secure and with lower network overhead. However, one drawback of closed access is its vulnerability to cross-tier interference. The implementation of open and closed access schemes on the downlink in two-tier networks is considered in [6], [7]. In

[6], both macrocell and femtocell open accesses are considered in a stochastic geometric setting. However, interference from other macrocell base stations (MBSs) is ignored, which turns out to be of significant importance as shown by our work. Cell association, as well as cell splitting and range expansion schemes, achieving a certain QoS are described in [8]. In [7], a handover policy of a mobile user from FAP to MBS based on geographic position is studied. Nevertheless, the randomness of FAP locations is not captured and other-cell interference is not taken into account.

II. PREVIOUS WORK

They proposed and studied a tractable two-tier network model and derived analytically the success probabilities in each tier under both open and closed access FAPs. This framework also allows us to generalize our results to multi-tier networks, as well as to obtain useful insights into spectrum allocation and reuse, namely the optimized joint and disjoint subchannel allocations. Supported by extensive numerical results, they observed that the optimized joint and disjoint allocations provided the highest throughput among all subchannel allocations in sparse and dense closed femtocell deployments, respectively. Furthermore, they proposed an open access policy and showed that the optimized joint allocation with open access FAP obtained the highest achievable throughput for all femtocell density regimes.

2.1. Previous Algorithm

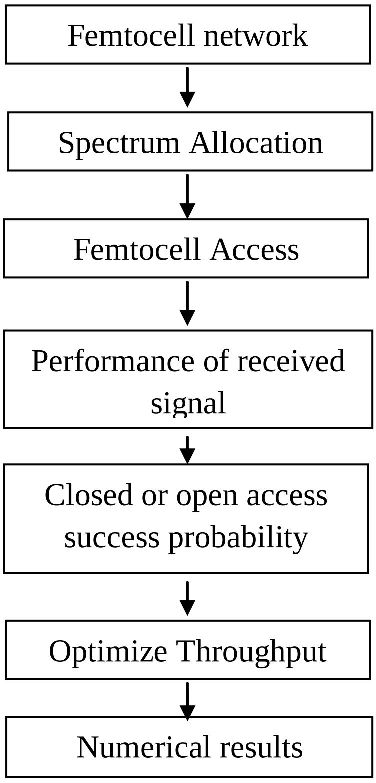

Fig. 2.1 algorithm of the Previous work

In this method, first make a two tier femtocell network model ad then allocate spectrum into it,after that added access control into it then find the performance of received signal.After that find the success probability of both closed access and open access then optimize throughput and calculate the numerical results.

III. PROPOSED ALGORITHM

We want to add cell association policy into the two tier femtocell network . We want to investigate the effect of access control and cell association in two-tier networks, where the macrocells employ closed access, whereas the femtocells can operate in either open or closed access. We want to consider a simple open access policy, in which a macrocell user hands over its connection from its closest MBS to its closest FAP when the latter is sufficiently near.Our proposed algorithm is given below.

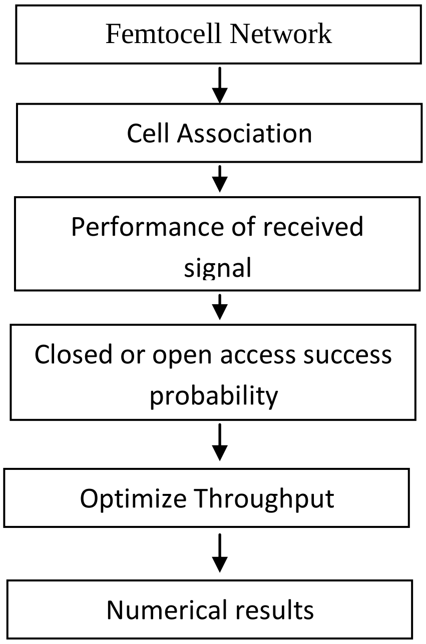

Fig.3.1 propose algorithm

3.1 two tier femtocell network

We consider a macrocell network overlaid with femtocells. The first tier consists of MBSs arranged according to a homogeneous PPP Θ of intensity λm in the Euclidean plane, i.e.$\Theta \sim$ PPP(λm). The spatial distribution of macrocell users is modeled as a stationary point process $\hat{}\Theta$ with constant intensity μm. Each MBS operates at a fixed transmit power of $P m$. The association of a macrocell user to a base station depends on the access policy adopted by the femtocells, namely open or closed access.

The second tier consists of a set of randomly deployed FAPs Φ, which are located according to a homogeneous PPP with intensity λf, i.e. $\Phi \sim \text{PPP}(\lambda f)$. Each FAP operates at a fixed transmit power Pf.

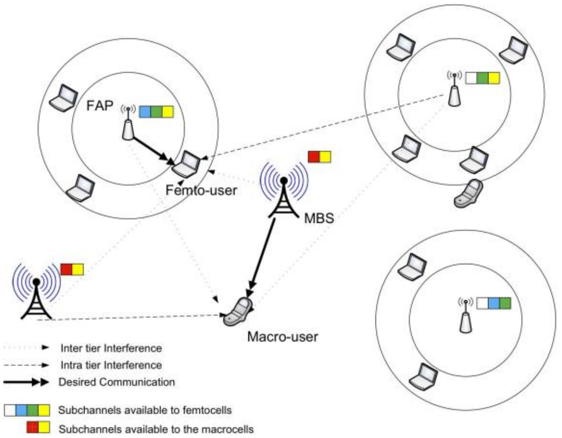

Fig.3.2 Two tier femtocell network

The probability density function (pdf) of the distance from a FAP to its user is given by.

$$fR(r) = 2r/((Rf+\Delta)^2)1(Rf \leq rRf+\Delta) \qquad (1)$$

3.2 Cell Association

With closed access, only registered femtocell users can communicate with their FAPs, and every macrocell user u is associated with its geographically closest MBS M. When femtocells operate in open access, a macrocell user can access to both MBSs and transmitting FAPs, as long as it is within the femtocell coverage area. Assuming that each user knows its distance from its potential base station, the macrocell user's communication is handed over from M to its closest transmitting FAP F according to the following open access policy, for constant $0 \leq \kappa < 1$.

- *M is u's designated BS if* $\kappa\,|M-u| \leq |F-u|$
- *F is u's designated BS if* $\kappa\,|M-u| > |F-u|$

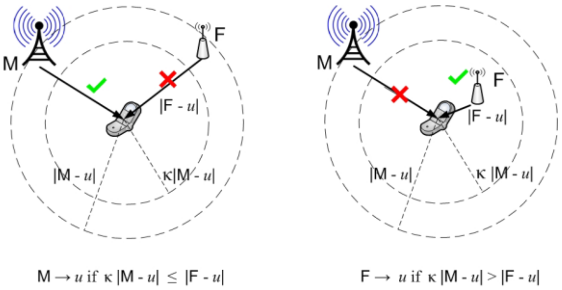

Fig. 3.3 Open access scheme with cell association policy

3.3 Signal to Interference Ratio

For notation convenience, we denote a BS or a user by its location. For receiver u and transmitter x among the set of transmitters Ω, we define the signal-to-interference ratio (SIR) from x to u is given by

$$\text{SIR}(x \rightarrow u) = \frac{P_x h_x g_\alpha(x-u)}{\sum_{y \in \Omega(x)} p_\gamma * h\alpha(y-u)} \qquad (2)$$

3.4 Success Probabilities

When FAPs are configured as closed access, the macrocell and femtocell success probabilities are given by

$$P_{m,c} = \frac{1}{1+p\frac{\lambda_f}{\lambda_m} * C(\alpha_o)\left(\frac{p_f \gamma_m}{p_m}\right)^\wedge \left({}^{2}/_{\alpha_o}\right) + \rho(\gamma_m, \alpha_o)} \qquad (3)$$

3.5 Throughput Optimization

In the following, the total network throughput is defined as a function of p under QoS constraints. Optimization for both open and closed access cases, where in the former we assume $\kappa = \hat{k}$.

The total network throughput (area spectral efficiency) for closed access FAPs is defined by Tc respectively as,

$$\text{Tc}(p) = |j|\,[\mu_{m P_{m,c}\log(1+\gamma_m)} + p\lambda_f \bar{c} p_f \log(1+\gamma_f)] \qquad (4)$$

IV.RESULTS AND DISCUSSION

We have created femtocell network using NS3 simulator and got Signal to interference noise ratio (SINR).Next using this femtcell network, We will add channels. Then we will implement cell association in this network model.At last we will add open access policy and optimize throughput.

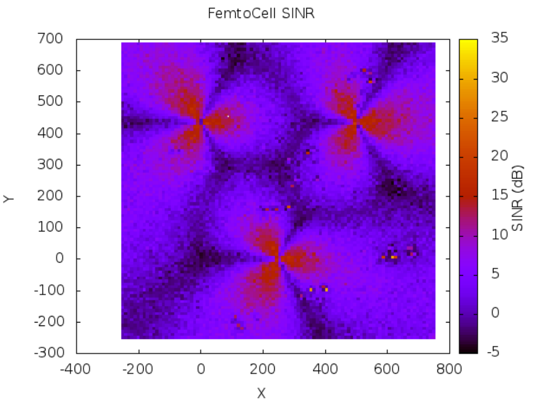

Fig.4.1 Two tier femtocell network

V.CONCLUSION

Femtocells represent a new technological advance, conceived to signicantly boost cellular network performance. The use of femtocells has been an attractive solution since it achieves better coverage and capacity and low cost for deployment and maintenance. Various access control method should be used for mobility management in LTE femtocell network . Open access can solve the problem of closed access method by improving the performance of non subscribers. If it is well employed we can get the benefits and overcome the drawbacks. Open access method can be propose as a solution

A femtocell network has been created and got signal to interference noise ratio(SINR) which has been performed in network simulator 3 (NS3). If we add cell association policy into the two tier network model then total network throughput can increase in femtocell networks.

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