ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2015

A Survey of Handover Mechanism with Mobility Management in Femtocell & Macrocell for LTE

Er. Limbad Sagar [1], Dr. Mohit Bhadla[2]

PG Student [CE], Dept. of Computer Engineer, Noble Group of Institutions, Junagadh, GTU University, Ahmedabad, India[1]

Assistant professor [CE], Dept. of Computer Engineer, Rai University Ahmedabad, India[2]

ABSTRACT: **"**The fast growing population of users leads to an exponential increase in traffic demand for the mobile network. Offloading traffic to the macrocell is becoming the major concern of operators. The femtocell is initially known as Home BS (HBS) dedicated for the residential usage where only the primary user has the access authority. It has recently evolved to the femtocell or small cell that allows the open access of any mobile subscribers (i.e. the indoor small BSs deployed by the operator in the malls). Our paper is focused on such network herein termed as the femtocell and macrocell network where the macrocell overlaps with the densely deployed small BS. The discontinuous coverage of macrocell causes the increased registration signaling overhead in the femtocell and macrocell network where the dense femtocellls overlapped with a macrocell are partitioned into small Tracking Areas (TAs). After analysis a new approach known as Delay Registration (DR) algorithm is proposed for overhead reduction with the expense of sacrificing the traffic offloading capability of the femtocell and macrocell in such case. However, its feasibility is greatly restricted because its effective implementation requires the accurate estimation of the mobile station (MS) information. We design a new scheme to enable both the low signaling cost location update without the complicated information estimation and the traffic offloading using the inter-cell handover."

KEYWORDS: Handoff, Femtocell, Macrocell, DR, Long Term Evolution (LET), Mobility Management, Cell association algorithms.

I. INTRODUCTION

Recently, with the instantly increase of various mobile users around in the world, total mobile traffics of the whole mobile world are exponentially growing [1]. Among these users, most of them highly desire high-data-rate and low-delay transmissions and wireless communication systems, the primary challenge is to improve the indoor coverage, capacity raise as well as to provide users the mobile services with high data rates in a cost effective way [2].The key feature of the femtocell and macrocell technology are users require User Equipment (UE) [3]. The deployment cost of the femtocell is very low whereas it provides a high data rate. Thus, the organization of femtocells at a large scale is the ultimate objective of this technology. In Fact, a well-design femtocell and macrocell-integrated network can large amounts of traffic from congested and expensive macrocell networks to femtocell networks [4]. They are connected to the network operator through a backhaul, e.g. Digital Subscriber Line (DSL), optical fibre etc [5]. In our case, the macrocell will consist of long range base stations (macrocells) that provides cellular coverage to mobile users, while the femtocell will be comprise of short range access points (femtocells) that offer large throughputs and new applications to indoor customers. Making a handoff decision is such an issue where the user has intense power levels ranging from Macro Base Station (MBS) to Femto Base Station (FBS). From a Base Station's (BS) perspective, there may be many users with close SNR values needing service but all users can't be accommodated due to bandwidth limitation. To make these decisions, appropriate handoff mechanisms that need to be adapted to fully exploit the advantages of these various scenarios in this network. The discontinuous coverage of femtocell and macrocell causes the increased registration signalling overhead in the femtocell and macrocell network where the dense femtocells overlapped with a macrocell are partitioned into small TAs (Tracking Areas) [1][3].Delay Registration (DR) algorithm is proposal for overhead reduction with the expense of sacrificing the traffic offloading capability of the femtocell in such case. However, its feasibility is greatly restricted because its effective implementation requires the accurate estimation of the mobile station (MS) information. In this paper we design a different scheme to enable both the low signaling cost location update without the complicated information estimation and the traffic offloading using the inter-

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2015

cell handover. The theoretical analysis and the simulation experiments are conducted for the performance evaluation and DR algorithm in reducing the signaling cost while achieving the better adaptability to the high and diverse mobility environment [7]. We aim at developing a low complexity algorithm with a small dwell time before handing off a macrocell user to a near femtocell and vice-versa. When the number of users in the network is smaller in comparison to the available Femto Base Station (FBS), we invigilate a better performance in reduce unnecessary handoffs and femtocell technology has been propose to offload user data traffic from the macrocell to the femtocell and extend the limited coverage of the mobile communication Network [1].

II. LTE FEMTOCELL SYSTEM ARCHITECTURE

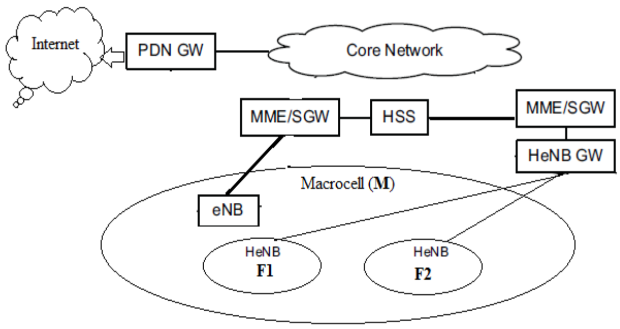

Fig. 1. The femtocell/macrocell network model in LTE system.

In this section presents LTE Femtocell System Architecture t, as depicted in figure 1, for the femtocell/macrocell network based upon the Long Term Evolution (LTE) system in the 3rd Generation Partnership Project (3GPP). The macrocell ***M*** overlays with the femtocells ***F1, F2*** and is connected to the core network (CN) through the mobility management entity (MME) and serving gateway (SGW) by evolved node base (eNB). Herein the eNB is equivalent to the BS and MME is implemented in the single node with SGW. The small Base Station of femtocell is named as home eNB (HeNB) that connects to the CN through the HeNB gateway (HeNB GW) and MME/SGW. The mobile CN connects the Internet with packet data network gateway (PDN GW). The coverage service area of femtocells may be discontinuous.

The cells in LTE are grouped into tracking areas (TAs) each with a unique TA ID (TAI) broadcast by the eNB. The MS can identify which TA it is in with TAI. When moving from one TA to another, the MS reports the TAI of the cell where it resides to the home subscriber server (HSS). The CN queries HSS to obtain the TAI of the called MS and instructs all cells in the TA to page the MS. The call is finally routed to the MS through the cell where the response is launched.

LTE allows the MS to belong to a list of various TAs to avoid the frequent location registration when the MS is "ping-ponging" between two TAs [7]. It however causes the potential heavy burden in the mobility management for the femtocell/macrocell network. Given all the femtocells are assigned with the same TAI but different from macrocell, the huge paging cost is accumulated because the dense femtocell deployment requires the MS searching involving hundreds to thousands of small BSs. If the femtocells are partitioned into small TAs each with the unique TAI, the MS must frequently perform TA update to keep the multiple TA associations which generates massive signaling overhead in the location registration.

There are some efforts on optimizing the mobility management for LTE small cells or femtocell . Especially, [8] presents a Delay Registration (DR) algorithm to reduce the signaling overhead in the network. It postpones the location registration until a delay timer expires when MS enters the overlapped femtocell. However, the overhead is reduced at the expense of degrading the traffic offload capability. Call arrival rate for each MS must be estimated very accurately for the effective implementation. These requirements restrict its feasibility meanwhile causing more processing load in the CN nodes such as SGW.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2015

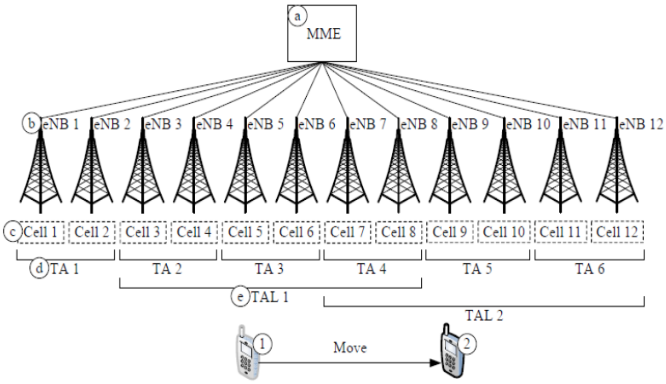

Fig. 2. Mobility Management Architecture for LTE based Networks.

In Long Term Evolution (LTE), [5] the Mobility Management Entity Architecture is responsible for the mobility management function in which is connected to a group of evolved Node Base Stations (Fig. (b)). Radio coverage of an eNB is called a cell (Fig (c)). Every cell has a unique cell identity. The cells are group into the Tracking Areas (TAs; e.g., TA 1 contains Cell 1 and Cell 2 in Fig(d)). Every Tracking Areas has a unique Tracking Area identity (TAI). The Tracking areas are further grouped into TA Lists (TALs). In Figure, TAL 1consists of TA 2, TA 3 and TA 4 (Fig (e)).A User Equipment stores (UE) the TAL that includes the TA where the User Equipment (UE) resides. Now, Mobility Management has four key Challenges which are listed are femtocell characterization / identification, Access Control, Network Discovery, Handover.

III. RELATED WORKS

In this section, we discuss earlier work aiming at efficient handoff mechanisms which reduce system latencies and ping pong effect. A combination of received signal strengths from a serving MBS and a target femto base station (FBS) is considered as a parameter for efficient handoff decision. A Different types of access scheme and a femtocell initiated handoff procedure with adaptive threshold were studied in When it comes to making a proper handoff decision, delay time is critical [1][6]. It is not a latency induced by the system but a guard time to check the reliability of a BS [3].

IV. SYSTEM MODEL

A. Assumptions and Equations

Let P_0 be the MBS transmit power and $h_{0,K}$ be the channel gain between the MBS and k-th user. Likewise, P_i and $h_{i,K}$ where $i \geq 1$ denote the transmit power of the i-th FBS as well as the channel gain between the i-th FBS and k-th user. We assume an additional white Gaussian noise (AWGN) at Mobile users with power density σ^2 [1] [3]. The capacity at the k-th user from its serving MBS is given by:

$$C_k = \frac{B}{N_0} log_2\left(1 + \frac{|h_{0,k}|2\, P_0}{\sigma^2 + I_{0,k}}\right) \quad (1)$$

Where B is the network bandwidth, N_0 is the number of MBS users, and $I_{0,k} = \sum_{i=1}^{M} |h_{i,k}|^2\, P_i$ is the interference from FBS's. We assume the bandwidth is equally allocated to all served users [1] [3]. The capacity at the k-th user from the i-th FBS is given by:

$$C_j = \frac{B}{N_i} log_2\left(1 + \frac{|h_{i,j}|2\, P_i}{\sigma^2 + I_{i,j}}\right) \quad (2)$$

Where N_i is the number of users served by the i-th FBS and $I_{i,j} = \sum_{l=1,l=i}^{M} |h_{l,k}|^2\, P_l$ is the interference from the MBS and other FBS's.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2015

B. Case I : Network Capacity

Initially, our objective is to maximize the total network capacity. By denoting U_i as the set of users connected to the i-th BS, we have $N_i = |N_i|$. Then, by using combination of 1 and 2, the objective function can be expressed as:

$$Max: C_{total} = \sum_{i=0}^{M} \frac{B}{N_i} \sum_{j \in U_i} log_2 \left(\frac{1}{1 - n_{i,j}}\right) \qquad (3)$$

The optimal solution to the problem above is that each BS chooses one user with the highest SINR to connect. This solution is able to achieve the highest network throughput by assigning only one best user to each BS. The rest of users are not allowed to access the network. This solution is unfair and inefficient because only a small portion of users are served. With this scheme, this system can only accommodate at most M + 1 (the number of BS's) users [1].

C. Case II : User assignment

To achieve fairness among users, we divide the bandwidth equally and allocate them to all users connected to the same Base station (BS). Then, a straightforward heuristic solution is proposed that each user j chooses a Base station (BS) with the highest Signal-to-Interference-Plus-Noise Ratio (SINR) to connect. However, this approach may incur the (QoS) problems, especially when all users choose the same Base station (BS) to connect. Each user is assigned with a very small bandwidth which leads to extremely low capacity for each user. On the other hand, the users with low Signal-to-Interference-Plus-Noise Ratio (SINR) from any of Base station (BS)'s may jeopardize the total network throughput. Obviously, blocking these users can improve the total network capacity. To guarantee the minimum QoS requirements of each user and maximize the total network capacity, only users with Signal-to-Interference-Plus-Noise Ratio (SINR) above λ1 are allowed to access network and each Base station (BS) is able to serve at most N_{max} users [1] [3].

V. PROPOSE WORK

Propose work type in here and Please tell me how manage mobility Mangament.

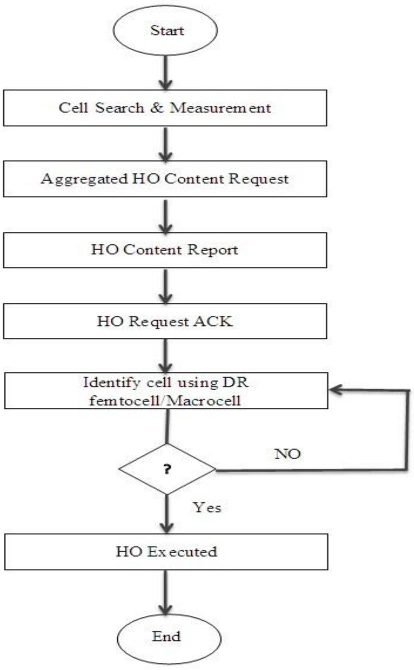

Fig-3 Flow Chart of Propose work

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2015

We proposal a new scheme for low cost management in femtocell and macrocell Network and reduce time required for Mobile Station (MS) for find free femtocell and marcocell in latency period. so accuracy inter Mobile Station (MS) of power dissipation and energy for node is maintain so signal reach on station on desire latency using DR algorithms.

VI. RESULT AND DISCUSSION

TABLE I

S.No.	Comparison		
	Name of Method	Signaling overhead	Offload Traffic
1	3GPP algorithm [8]	High	High
2	Green Algorithm[9]	High	High
3	Optimize Handoff algorithm [1]	High	Medium ~ High
4	DR algorithms [7]	Low	Medium
5	Congestion Control Algorithm [12]	High	Medium ~ High

VII. FINAL INVESTIGATION

In this paper, we propose a new scheme for Handoff in the femtocell/macrocell network. It disallows the cell reselection from the macrocell to femtocell, but keeps the most suitable femtocell information available at the MS which is used to trigger the handover to femotcell for traffic offloading when call arrives. It reduces the signaling cost meanwhile preserving the traffic offload capability of the femtocell, but requires any modification on the existing network. The performance comparison between our solution and another approach termed as Delay Registration (DR) algorithm is conducted with both the analysis and simulation. We are study our proposal of the DR algorithm in the cost reduction with the good adaptability to the diverse MS behavior in high mobility. We observe the need for implementing femtocell and macrocell technology in the next generation wireless communication.

VIII. ACKNOWLEDGEMENT

The authors express gratitude towards the Director, Noble group of Institutions - Junagadh and Dr. H.N. Nagaraja, Principal of Noble group of Institutions - Junagadh, and my guide Dr. Mohit Bhadla, Rai University, Assistant Professor, Department of Computer Engineer for their Support and encouragement towards this research area.

REFERENCES

[1] Saketh Anuma Reddy, Hui Zhou, Donglin Hu, Prathima Agrawal "Handoff Management With A Delay Requirement in Femtocell Networks",IEEE Journal ,pp 119-123, March 2013.
[2] Haijun Zhang, XiangmingWen, Bo Wang, Wei Zheng, Yong Sun "A Novel Handover Mechanism between Femtocell and Macrocell for LTE based Networks", *Communication Software and Networks, 2010. ICCSN '10. Second International Conference on*, pp 228-231, Feb 2010.
[3] Hui Zhou, Donglin Hu, Shiwen Mao, Prathima Agrawal, Saketh Anuma Reddy "Cell Association and Handover Management in Femtocell Networks", *Wireless Communications and Networking Conference (WCNC), 2013 IEEE Conference*, pp 661-666, April 2013.
[4] Mostafa Zaman Chowdhury and Yeong Min Jang "Handover management in high-dense femtocellular networks", *EURASIP Journal on Wireless Communications and Networking 2013*, pp 1-21, December 2013, 2013:6.
[5] Hetal Surti, Ketan Goswami "Optimization Handoff in Mobility Management for the Integrated Macrocell - Femtocell LTE Network", *International Journal on Recent and Innovation Trends in Computing and Communication*,Vol.2, pp63-67
[6] Lamia Osman Widda, Sami Mohamed Sharif "Design Optimization Of Tracking Area List For Reducing Total Signaling Overhead In LTE System ", *International Journal*, Vol.2, pp 18 -26, April.2014.
[7] Yifan Yu, Daqing Gu "The Cost Efficient Location Management in the LTE Picocell/Macrocell Network",*IEEE communication letter*,vol.17, pp. 904-907, May.2013.
[8] Huai-Lei Fu "Reducing Signaling Overhead for Femtocell/Macrocell Networks" Mobile Computing, IEEE Transactions on, Vol.12 pp 1587 – 1597, June 2012.
[9] G. Araniti, J.Cosmas, A Iera, A Molinaro, A Orsino, P. Scopelliti "Energy Efficient Handover Algorithm for Green Radio Networks" , *Broadband Multimedia Systems and Broadcasting (BMSB), 2014 IEEE International Symposium on Conference*, pp 1-6, June 2014.
[10] Tiantian Bai , Yuwei Wang ; Yu Liu ; Lin Zhang, "A Policy-Based Hanover Mechanism Between Femtocell and Macrocell for LTE based Networks", *Communication Technology (ICCT), 2011 IEEE 13th International Conference on*, pp 916-920, Sept 2011.
[11] Mandeep Kaur Gondara, Sanjay Kadam, "Requirements of Vertical Handoff Mechanism In 4G Wireless Networks", *International Journal of Wireless & Mobile Networks (IJWMN)*, Vol.3, pp 18-27, April 2011.
Zolfaghari, A.Taheri, H., "Queue-Aware Channel-Adapted Scheduling and Congestion Control for Best-Effort Services in LTE Networks", Electrical and Computer Engineering, Canadian Journal of Vol.:38, (IEEE Canada) pp 170-182, June 2015.