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A Novel Self-Organizing Mechanism for Load Balancing & Handover in Network

Manjunath Hanchinal[1], Ziaur Rahman[2]

M.Tech Scholar, CS&E, Acharya Institute of Technology, Bengaluru, India [1]

Assistant Professor, CS&E, Acharya Institute of Technology, Bengaluru, India [2]

Abstract: Fourth generation networks and beyond have recently emerged to satisfy the increasing demand for maximum data rates. Cost-effective methods have been designed in 3GPP LTE Advanced standard to significantly enhance coverage and capacity of the network. By introducing the small cells in the Heterogeneous Network Huge performance gains can be achieved by increasing the density of node [1]. Self-Organizing Network (SON) is a new approach where it aims in reducing the human effort. SON functions include some of the techniques such as self-configuration, optimization and self-healing. In this circumstance, I have focused on three Self Optimizing functions so called Admission Control (AC) and Handover (HO) and finally the Load Balancing (LB). The simulation results show the performance of this approach through evaluation of some parameters such as average throughput and cell load.

Keywords: SON, LTE-Advance, HetNet, self-configuration, AC, HO, LB, QoS.

I. INTRODUCTION

The main purpose of communication network is to connect computers and mobile phones for the purpose of data exchange and signalling the messages. The main aim of network is to accept the data from the transmitting device and to forward that data to the receiver without any errors in the network using the data forwarding protocols and routing protocols for routing purpose. The examples of various communication networks are internet and fixed land line phones and mobile phones. Using the mobile networks within short time we can achieve unified targets and we can achieve high performance and efficiency in the heterogeneous network.

The communication system is fully controlled by a particular network operator and is often known as a public land mobile network (PLMN). There are three main components of PLMN, they are core network, radio access network finally the mobile phone which is near the user. The core network has a role similar traditional fixed line telephone network were it sends information such as voice calls and text messages from one phone to another. It uses the switches to do so. It maintains the database which contains the information about network operator's subscribers. This database used for preparing the bills and distributing them regarding the usage of user. it also monitors the locations of mobile phones, so that the network can send information to them as they move around because of the mobility. The radio communication between the core network and mobile phone is handled by radio access network. This type of network consists of huge number of (BS) base stations each transmits and receives the radio signals from the mobile phones. The area located around a base station is often divided into multiple sectors by equipping the base station with multiple directional antennas, each antennas communicates with the mobile phones.

II. EVOLUTION OF MOBILE NETWORKS

First generation (1g)

The first generation that is mainly known as 1g has fulfilled basic mobile voice. The 1g network uses analogue communication tactics but they were very bulky and expensive and they were also regarded as luxury items. Although 1g uses analogue it also uses digital signalling is used to connect the radio tower and the voice is modulated to higher frequency.

Second generation (2g)

Mobile phones are widely used from 1990s, the introduction of global system for mobile communications (). It is also known as wireless telephone technology. The three advantages of 2g networks are the mobile conversions are digitally encrypted and they were significantly more efficient and it introduced the data services. It uses digital communication techniques which are powerful, and have allowed their cost to plummet, and also allowed them to provide a wide range of services than before communication systems. Capacity and coverage are been introduced in the so called second generation and it is also called as 2g.

Data services are supported by fixed and mobile networks which are usually packet based which also supports the low and high mobility application and huge data rates according to the service demands in multi-user environment. It also provided the service such as text messages and picture messages and mainly it provides multimedia messages support. The messages were digitally encrypted because to provide the security to the messages transmitted between the sender and the receiver as only the receiver can only read those messages by decrypting the message sent. The disadvantages of 2g are, in less populated areas weaker digital signals transmitted may not reach the tower.

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Third generation (3g)
Access to wide range of telecommunication services is provided by the third generation (3g), and it also includes advanced mobile. Third generation (3g) also use digital communications, but they send and receive their signals in different way compared to others like 2g or 1g. it allows to support higher data rates compared to preceding, and it provides the on demanding services such like video calls and high speed internet access. the information transfer rate in 3g telecommunication networks are very much high such as 200kbits/s. the main application of 3g are global positioning system (GPS), location based services, mobile tv, telemedicine, video conferencing and many more.

Forth generation (4g)
A 4g system provides the services which are provided by 3g in addition to the voice service, it also provides mobile broadband internet access. current applications and potential applications include mobile web access, gaming services, hd mobiletv, ip telephony, 3d television, and cloud computing services. Two 4g systems are deployed such as the mobile wimax standard, and the (lte) long term evolution standard.

LTE (long term evolution)
It is commonly known as 4g LTE and it is standard for wireless communication of high speed data in mobile phones. To increase the capacity and speed of wireless data networks using the digital signal processing techniques and modulation. The near future goal of LTE was to redesign and simplify the network architecture to IP-based system with the reduced transfer latency compared to 3g networks. LTE interface is not incompatible with 2g and 3g, so it must be operated on a separate radio spectrum. The LTE provides downlink data rates of 300 mbit/s, and the uplink data rates of 75 mbit/s and QOS provisions permitting transfer latency less than 5 ms in radio access network.

III. SELF ORGANIZING NETWORK (SON)

It is technology used to make the network simpler and faster indeed. It is a technology designed for planning, optimizing and management of network and there is concept called self healing where if any problem or error occurs in the network it is healed automatically. When we add a new node or base station it must be self configured and the parameters should be initialized [3].

When the node is added it scans for the neighboring node and it downloads all the software's and parameters in that node [1][5]. With the help of those, it self configures automatically without any human interaction. Therefore the son has a main goal that is to minimize the human effort in the SON functionality. The resource utilization is less if we use SON functionalities in the network.

SON ARCHITECTURE TYPES
SON are mainly divided into three architectural type that are briefly mentioned in the following phrases.

- **Distributed SON (D-SON)**

  In this type functions are distributed among the edge of the network which is also called as ENodeB elements. The functionality is provided by the vendor manufacturing the radio cell. Vendor who provides the network equipment only provides the functionality for it, this implies a certain degree of localization.

- **Centralized SON(C-SON)**

  In this type function are more typically closer to work nodes, to allow a broader overview of more edge elements. It also provides coordination. Due to the need of inter-work with cells supplied by different equipment vendors, C-SON systems are supplied by third parties like Celcite, Cisco and any more.

- **Hybrid SON**

  This type is a mixture of distributed and centralized SON, combining the elements of both the network architectures to form a hybrid

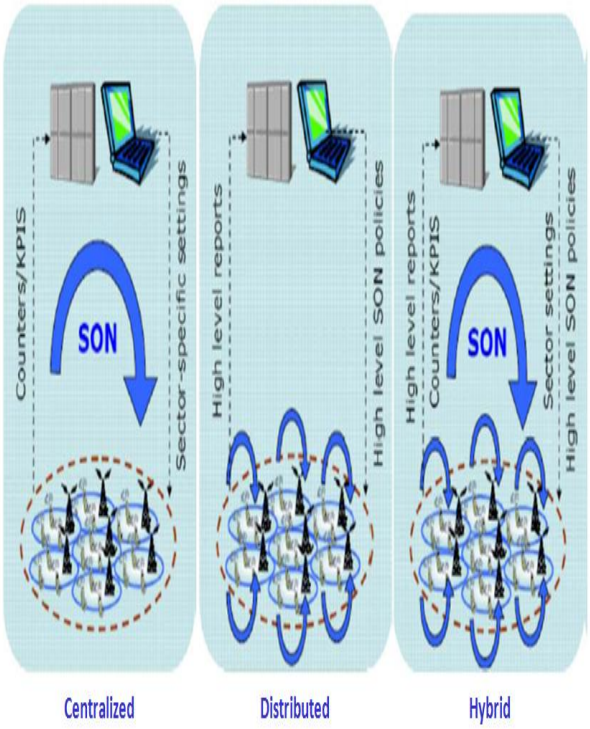

Fig. 1. Architecture of SON

SON FUNCTIONALITIES

The SON functions are of three types, they are.

Self Configuration

When there is a need for a newly deployed node it uses the dynamic plug-and-play configuration. Were it doesn't need any human interaction for configuration. The node will itself configure the transmission frequency, rollout, Physical Cell Identity, and power, leading to faster cell

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planning. The interfaces are also dynamically configured, and the IP address and connection to IP backhaul is also dynamic in nature. To reduce the human interaction Automatic neighbor relations (ANR) is used. It also configures the neighboring list in newly deployed nodes and it optimizes the list configuration during operation of network is going on.

The process of dynamic configuration includes the self configuration of layer 1 identifier and (PCI) physical cell identity and finally the cell global ID. There are two ways of assigning the PCI, they are, first on e is in a centralized way and another one in a distributed way. In the below figure 1, the newly deployed eNB requests a report to (UE) user equipment or the remaining eNB's. The report is sent through air or it may be sent using some interface in the network and it also includes the PCI's which exist or which are in use. Successful handovers and the number of dropped calls can be minimized by maintaining Correct and up-to-date neighboring lists. The newly deploys eNB will randomly choose its PCI, if there are any unused.

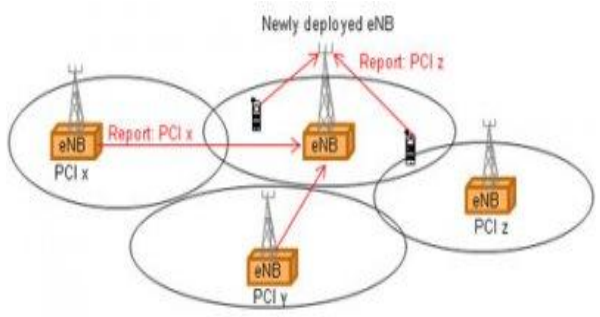

Fig. 2. Self Configuration

Self Optimization

Functions for self-optimization include optimization of interference, coverage, handover and capacity. The process of transferring the load from the cells suffering from the congestion to the cells which are free and the resources are also available in that cell. This process of transferring the load is called (MLB) Mobility load balancing [3]. MLB also includes load reporting between the nodes for the purpose of exchange of information about load level and available capacity. The report can contain hardware load, transport network load and Radio resource status of the network. The Radio resource status reports are separated in two types such as Up Link and Down Link reports, which also include the total allocation guaranteed and non-guaranteed traffic. MLB can be used in between the different Radio Technologies. Mobility robustness optimization (MRO) is a solution for automatic detection and correction of errors in the mobility configuration.The process of transferring the controls of the user equipment to another eNB is called handover. This process increases the coverage and efficiency of network. Here there are two types of handover, on is the early handover and other one is the late handover. The figure3 explains the late handover.

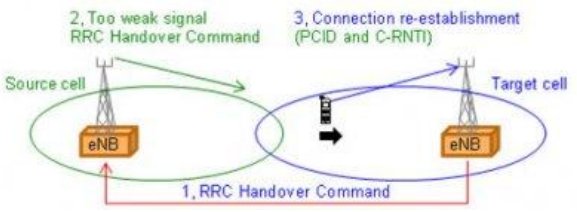

Fig. 3. Late handover

When the UI moves very much far from the present eNB then the signal will be week [4]. That time there are the chances of connection failure. When the UE moves far away from the NB, the UI becomes out of coverage so the handover process cannot occur, because of the week signal it cannot connect to the target node.

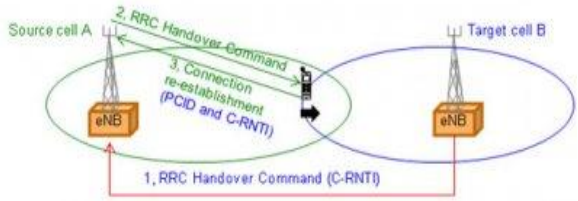

Fig. 4. Early handover

The figure 4 shows the early handover. When handover process is carried out early, the connection is lost after that. The connection is lost because of the week signal of the target node. And it again tries to connect with the previous NB.

Self healing

It is the concept used when network faces some problems such as many errors in the networks, they detected and the solution to that problem is found and the problem is being solved automatically. It reduces the human efforts and interaction which is used to solve the errors occurred in the network.

IV. RELATED WORK

In this paper [1] they used the small cells also known as Femto cells which acts like base station. They considered only the small cells as it is not efficient in the real time. And there are many useless handovers and many radio link failures occur. In this paper [2] they have done a optimization of admission control and handover functions. They facilitate HO by prioritizing HO calls in favour of fresh calls. This article [3] surveys the literature over the period of the last decade on the emerging field of self organization as applied to wireless cellular communication networks. Self organization has been extensively studied and applied in adhoc networks, wireless sensor networks and autonomic computer networks. In this paper [4], they have proposed a self organized solution for the LTE handover parameters set up, based on mobility performance indicators that are accurately specified by the standard. In this paper [5] they have deployed the small cells which acts like a small base station to increase the

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network capacity. But it causes many useless handovers and becomes the reason of decreasing performance. The main aim of SON is to reduce the number of RLF (Radio Link Failure) and the number of useless HO. In this work, only small cells are considered, therefore, the obtained results are not relevant for real networks. In the idea of LB by shifting the users this may cause a huge number of HO which could degrade the performance (delay and resource consumption) and also radio link failures. Furthermore, the interference level could increase due to the fact that the User Equipment (UE) can be connected to an evolved NodeB (eNB) that is not the best one radio transmission wise. In this paper [6] resource utilization is efficient by using the inter cell interface (ICI).

In our proposed system, we avoid limitations of preceding introduced works. It is done by considering all types of handovers in the HetNet. And it also deals with the with the LB issues. In the preceding works, only one self-organization function was implemented and studied. Our major contribution is to produce a procedure which is complete and that takes into account the most important resource management tasks for a 4G network. In addition, small cells are also taken into account since they are necessary for advanced network operators. Our main aim is to provide the environment to the deployment of small cells, insure reliable HO between macro cells and small cells and also between the small cells. Minimization of radio link failures and to increase the average throughput and the efficiency of network is the main theme of our approach. Minimization of resource utilization is done with the help of Load balancing techniques [6].

V. PROPOSED APPROACH

In our proposed approach, self optimization Of Handover (HO) and Load Balancing (LB) with efficient throughput, low delay. There is efficient load balancing and handover in the network.

As mentioned above, our novel approach deals with two functions for automatic network management, HO parameters, LB and AC optimization. However, obtained results are available for any other small cells types and macro cells and the UE. In our approach we use the vertical handoff algorithm [7]. The proposed approach includes the algorithm called a vertical handoff algorithm which uses the savitzky golay filtering method [7]. The algorithm involves the following steps

- Calculation of the location, which is done by using the coordinates.
- Calculation of velocity by using the distance formulae.
- Propagation delay is calculated by the losses happened by the environmental variation.
- Now the slow and fast shading are calculated using the propagation delay and shadow shading.
- The relative signal strength (RSS) is calculated using the slow and fast shading. RSS is calculated for both base station and the WIMAX base station which is also called as femto cell.
- After all this the filtering approach is done using savitzky filtering method.
- Now the handoff triggering unit triggers the handoff execution.

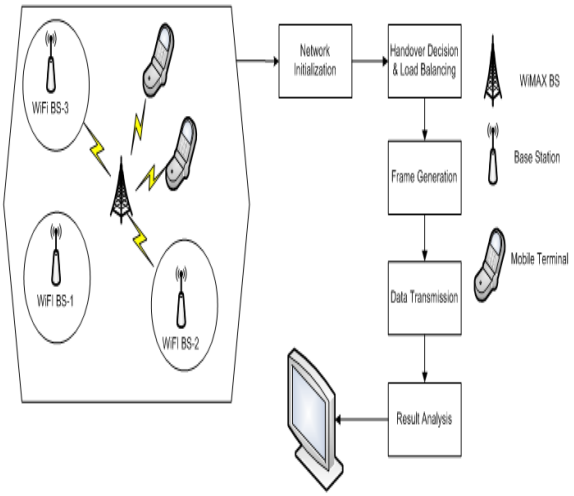

Fig. 5. System Architecture

The methodology includes below steps

- **Network Initialization**
  The numbers of nodes are defined in the network area. The nodes are created with different position in the network area of size 100*100 meter. The nodes are pointed with color and node's id. Once the network formation is done then next step is to assign the network parameters. The network parameters are ID, energy, load etc., initialized with default values.
- **Handover & load balancing**
  In this module we need to maintain self-organization network. The nodes are moved from one location to another location within the transmission range or outside the transmission range. We need to hand over the network whichever newly nodes are joined in the network. Then we need to find the load of each base station in the network. If any base station have the more load we need to balance that load by assigning into different base station whichever has low load.
- **Frame Generation**
  In this process the text data (symbol) or a image is given as a input is generated. This generated data is transmitted through the network. Data should be error free before and after it is transmitted.
- **Data Transmission**
  Once the load balancing and handover is done next step is to transfer the data from one node to another node with transmission range in the network area.
- **Result Analysis**
  The simulation results with network throughput delay and load.

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Vol. 4, Issue 5, May 2015

VI. SIMULATION AND RESULTS

In order to verify the performance of our approach, we consider the network topology consists of 20 UE and one base station which is located at the center, and the approach consists of 3 mini base stations which is also called as WIMAX and also called as femto cell.

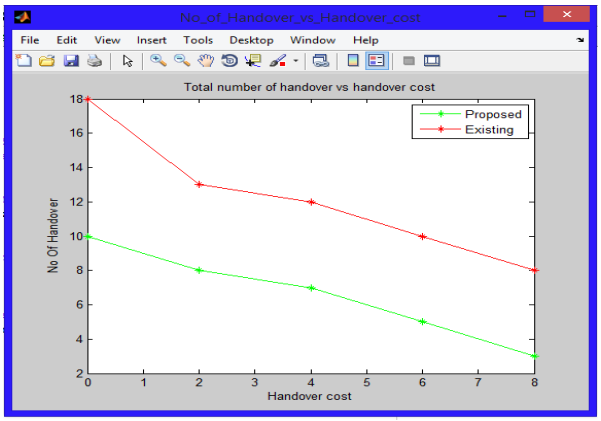

Fig. 6. Plot

The obtained results are compared with the existing approach. First plot shows the no of handovers and the handover cost and the second one shows the power consumption. By the following results it shows that the proposed system is more efficient then the existing one.

The results vary by 8 to 10 percent when considered in the real time. The proposed approach is optimizing the handover and load balancing functions and as well as providing the good quality of service. When we see the first plot, the numbers of handovers are less and the cost is also low when compared to existing one. The second plot shows that the power consumption is also low compared the existing one.

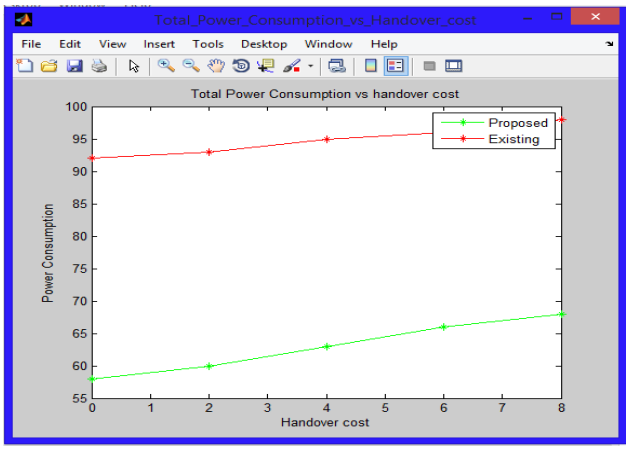

Fig. 7. Plot

VII. CONCLUSION AND PERCEPTIVES

Our work aims at offering an almost complete procedure for 4G operators to facilitate the remote resource management in HetNets. This new procedure comprises of optimizing LB and handover functions in order to maximize the resources utilization efficiency as well as providing good QoS to all the UEs in a fair way.

REFERENCES

[1] Maissa Sonia Sami "A Novel Self-Organizing Scheme for 4G Advanced Networks and Beyond", IEEE Published in 2014.

[2] Bart Sas ,Kathleen Spaey ,Irina Balan, Kristina Zetterberg and Remco Litjens "Self-optimization of admission control and handover parameters in LTE"

[3] Osianoh Glenn Aliu, Ali Imran, Muhammad Ali Imran and Barry Evans "A Survey of Self Organization in Future Cellular Networks", IEEE Published in 2012, pp 1-61

[4] Veronique Capdevielle, Afef Feki and Aymen Fakhreddine "Self-Optimization of Handover Parameters in LTE Networks"

[5] Albrecht Fehske, Ingo Viering Jens Voigt, Cinzia Sartori, Simone Redana, and Gerhard Fettweis "Small Cell Self-Organizing Wireless Networks"

[6] Mahima Mehta, Osianoh Glenn Aliu, Abhay Karandikar and Muhammad Ali Imran "A Self-Organized Resource Allocation using Inter-Cell Interference Coordination (ICIC) in Relay-Assisted Cellular Networks"

[7] Nagarjun R, Boniface A & Velmurugan T "A Novel Vertical Handoff Algorithm Using SavitzkyGolay Filtering Method For Heterogeneous Networks", IEEE Published in 2013, pp 286-291.