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# ENERGY AND THROUGHPUT TRADE- OFF IN CELLULAR NETWORKS USING BASE STATION SWITCHING

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**Abstract:**

In recent years, the cellular network market has shown a rapid growth and with the advent of new technologies, the cellular data traffic has increased significantly which has led to excessive power consumption of the network devices. In this paper, we present a brief survey on techniques to enhance the power efficiency of the cellular network. On the basis of recent study it seems that base stations consume a major part of the energy in the cellular system. We put forward a few techniques to minimize the energy consumption with the energy efficient hardware design like power saving via sleep mode and network self organizing methods that involve cell zooming, and multi layered cellular architecture. Lastly, this paper also includes a brief survey of the enabling technologies such as- cognitive radio, MIMO, Femtocells and cooperative relaying.

**Keywords:** Cellular networks, cell zooming, self organizing networks, cognitive radio, Femtocells, MIMO, cooperative relaying.

## 1. INTRODUCTION

The rapid growth in cellular networks and network devices has led to severe impact on the environment. The number of subscribers and the demand for cellular traffic has grown exponentially. With the advent of technologies such as iPhone, Android, 3G Networks more number of people use Cellular network for data transmission. According to Technology analyst [1], fraction of the worldwide energy, ranging between 2%-10% is consumed by the ICT industry in manufacturing, using and disposal of ICT equipments. Green Communication [1] is a new era of communication where we can greatly improve energy –efficiency and resource efficiency of the cellular network without compromising the quality of services for the users. India is the second largest and fastest growing market in the world [2]. The ever growing India Telecom Industry is concerned about the energy cost which is the largest operating expenses and cost to several million dollars annually to telecom operators and energy consumption from telecom networks is an increasing contributor to global Green house gas emission. The objective of this paper is to provide the brief survey of the techniques that have been proposed for green cellular network. We have divided the paper into four sections. This award winning solution by Ericson with latest technology and innovation design to reduce construction cost, decrease carbon emission, energy optimization and for pleasant look[1]. Tower tube has its radio base station positioned at height for increased network's coverage, capacity and low feeder loss. The slim designed equipments encapsulated in the tower make it space-efficient. The Tower tube lowers the amount of carbon dioxide in the manufacturing process. Energy-efficient, radio resource management schemes are developed to reduce energy consumption in base stations without affecting the quality of service. One of the promising approaches for this cause is the Sleep

 

mode mechanism. When a base station is in sleep mode the air-conditioner and other energy consuming equipments can be switched off and thus can largely reduce the energy consumption. the authors have proposed two sleep mechanisms for base stations that include shutting down a number of system resources during light traffic: dynamic way and semi-static way. In dynamic way resources are activated or deactivated in real- time as a function of instantaneous load of the system. In a semi-static way, resources are kept unchanged during longer time intervals. Authors show that the former technique achieves larger energy reductions while the latter has an acceptable performance with low complexity.

## 2. RELATED WORK

The authors define cell zooming as the ability of the cell to adaptively adjust the cell size according to the traffic conditions. This technique can balance the traffic load and hence reduce energy consumption. Cell zoom-in and zoom-out are used to manage conditions of congestion and low traffic. The cell with high traffic zooms in to relieve congestion so that those there are 7 base stations named A, B, C, D, E, F, G. Assuming that there are 1400 active users in the area, in the peak hour. The cell sizes have been designed to support this peak load. Now assume that during the off-peak time, there are only 700 users in the area and only 50 users under base station A. Now these 50 users can either be served by base station A itself or by the central base station D. This decision is taken on the basis of the energy consumption. If the extra energy consumption of BS D for serving these extra users is less than the energy consumption of the BS A for serving its users, then these users are served by the central BS D rather than BS A, which is switched off to save energy. Here, in figure-1b the cells under the base station D are known as Umbrella cells while the other cells are known as Subsidiary cells. Hence the base stations corresponding to these cells are known as Umbrella BS and subsidiary BS respectively. Noting that an umbrella BS can turn off its transmit power in a sector if a subsidiary BS is ON in that particular sector, thereby reducing the coverage in that direction. Here in the figures 1c and 1d, cell D is the subsidiary cell with all other umbrella cells. Recent research on technologies like cognitive radio, MIMO, Femtocells, and cooperative relaying has been brought to significant attention for both academics as well as industry. Enabling the utilization of radio spectrum in a more efficient manner, cognitive radio seems an adaptive and intelligent wireless communication.

## 3. PROPOSED SYSTEM

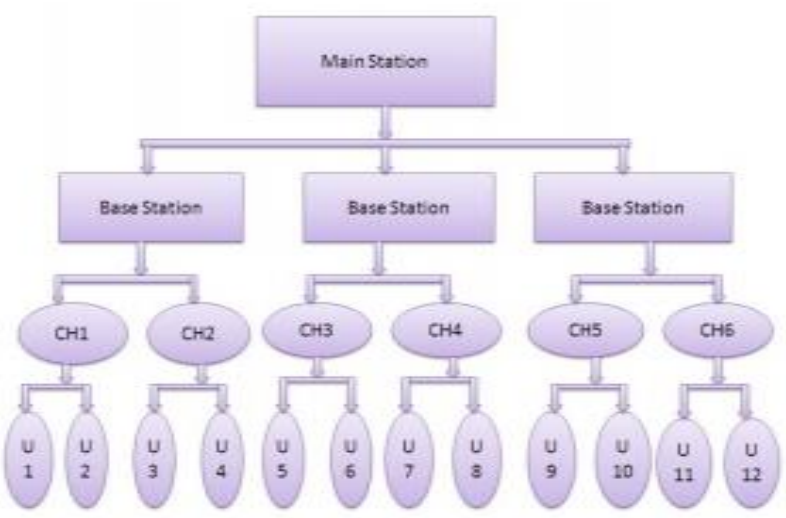


**Fig.1.Proposed base system**

However, as technique of MIMO requires complexity transmitter circuit and powerful signal processing capability, the realization of multi- antenna technique is impractical to sensor nodes whose physical size and energy are limited Multiple- input multiple-output (MIMO) technology has been attracting researcher's attention for its capability of providing improved link reliability and system capacity without extra spectral resources. MIMO has been deployed in a number of advanced wireless communication systems such as Worldwide Interoperability for the Microwave Access (WiMAX) and the Long Term Evolution (LTE). The latest LTE standard for instance, can support up to 8-layer transmission which is equivalent to at least 8 antennas at the base station (BS) and 8 antennas at the mobile station (MS). Massive MIMO is a technology where the number of terminals is much less than the number of base station (mobile station) antennas. It can improve the spectral efficiency (bit/s/Hz/cell) of cellular networks by orders of magnitude, without the need for more spectrum or more base stations (BSs). In massive MIMO, each BS is equipped with an array of hundreds of active antennas, which are processed coherently to improve the signal quality in the uplink and downlink. Massive MIMO is a form of MU-MIMO (multiuser MIMO) systems where the number of base station antennas and the numbers of users are large. In Massive MIMO, hundreds or thousands of BS antennas simultaneously serve tens or hundreds of users in the same frequency. In massive MIMO systems, the transmitter and/or receiver are equipped with a large number of antenna elements (typically tens or even hundreds). Note that the transmit antennas can be co-located or distributed in different applications.

## 4. RESULT ANALYSIS

Clustering provides a method to build and maintain hierarchical addresses in. In adhoc networks. A technology can be sustainably viable only if it can find widespread use order to allow ad hoc networks to achieve commercial success, we must solve the scalability problem. One promising approach is to build hierarchies among the nodes, such that the network topology can be abstracted. This process is commonly referred to as clustering and the substructures that are collapsed in higher levels are called clusters. Clustering is a process of defining such an abstracted structure of a network. It can be applied recursively to obtain a multi-level hierarchy.

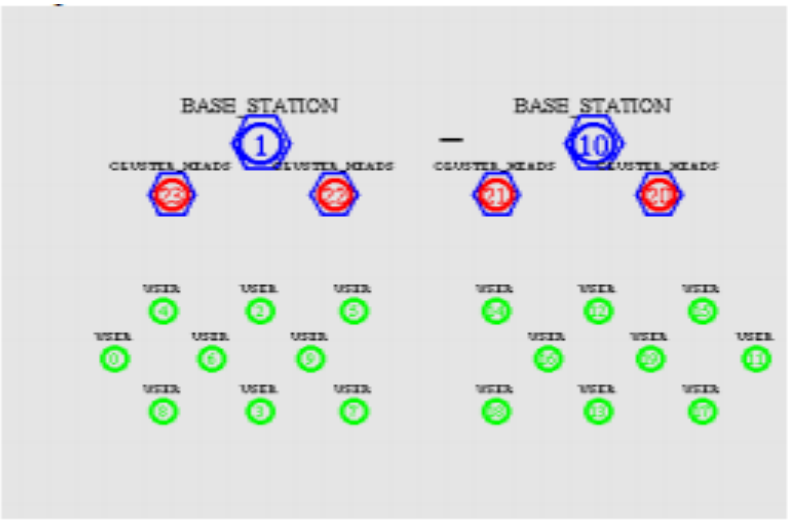


**Fig.2.System Implementation**

After clustering, each node in the hierarchy can be assigned a hierarchical address that indicates its position in each level of the hierarchy. Routing can easily be carried out using such addresses Clustering with independent dominating sets : One can produce a relatively small number of clusters of a given graph by insisting that the dominating set is also an independent set. Some researchers argue that better connectivity among the cluster-heads is an advantage for applications such as message broadcasting. The vertices of a connected dominating set induce a connected sub graph that can be used as a virtual backbone so that broadcast redundancy is reduced significantly.

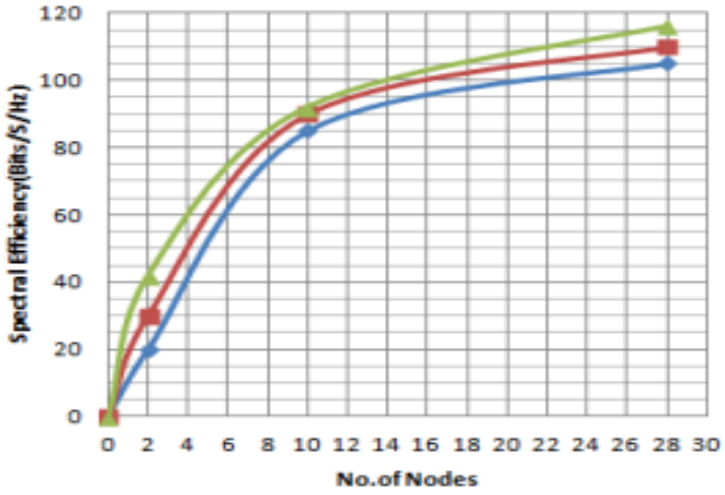


**Fig.3.Graph output**

Now we summarize over all solution by comparing the existing system and our proposed technology on the relative performance such as delay, average delay, packet deliver ratio, and throughput and energy efficiency. A dual uplink transmission strategy to the above for a mobile user in a network corresponds to transmit continuously at a constant power and take advantage of the instances when the channel is good due to proximity to a BS. In this case the power transmitted is fixed, but it is the communication rate that is fluctuating with distance. the percentage of the global world CO2 emissions due to the information and communications technology (ICT) is estimated to be 5%. While this may seem a small percentage, it is rapidly increasing, and the situation will escalate in the near future with the advent of 5G networks [6][14]. The next generation of wireless communication technologies, that is, 5G is best known for its prediction and promise of supporting 1000 times data traffic as today beyond the year 2020. The energy consumption of wireless systems and networks, from an operation point of view, cannot and should not increase with the same pace. Therefore, improving the energy efficiency of wireless systems and networks has also become a key target of 5G.

## CONCLUSION

We have reviewed several important problems in MIMO antenna such as less number of antennas (2×2, 4×4), suitable for limited users, high delay etc. we demonstrated how the above problems can be overcome by using Massive MIMO and clustering technology can be efficiently applied. Massive MIMO technology can achieve great balance between energy efficiency, throughput and delay, and it is very promising for next generation cellular communication. Even though there are numerous advantages some more disadvantages is also present. While using more number of antennas at base station the CO2 emissions and

carbon foot prints releases at peak. It is very harmful for our environment which leads to green communication. But this problem can also be overcome by using solar panels or bio fuels at the base stations to generate the power.

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