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Typical Heterogeneous Network Deployment in Green Cellular Networks

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Abstract- *Energy efficiency in cellular networks is growing and emerging concern for cellular operators and it is called green cellular networks. It not only maintain profitability, but also to reduce the overall environment effects to give a green environment. This raising trend of achieving energy efficiency in cellular networks depends upon the heterogeneous network deployment motivating the standardization authorities. Network operators to continuously explore future technologies in order to bring improvements to the whole network infrastructure to give good and green infrastructure to the word. The survey of this article, we present a brief survey of methods to improve the power efficiency of cellular networks, exploit some new research issues and challenges and suggestion of some techniques to enable an energy efficient or "green" cellular network. All the base stations absorbs maximum portion of the total energy used in a cellular system, we will first provide a comparative survey on techniques to obtain energy savings in base stations.*

Keywords: *green cellular networks, pico cells, macro cells, femto cells.*

I. INTRODUCTION

GREEN CELLULAR NETWORKS:

Energy efficiency has come into keen focus for information and communication technology (ICT) due to the global movement of energy saving related to the global climate change. The power consumption of ICT has risen in recent years and will continue to do so. Currently about percent of the global power consumption is caused by the ICT and a growth of 16-20percent has been estimated. A cellular network or mobile network is a communication network where the link of last is wireless. The network is distributed over the land areas called cells, each served by the least one fixed-location transceiver, known as a cell site or base station. This cell site provides the cell within the network coverage which can be used for transmission of voice, data and others. In a cellular network, each cell uses a different and wide set of frequencies from neighboring cells or network, to avoid certain interference and provide guaranteed bandwidth within each cell node. With these cell are connected together to form a cells that provide radio coverage over a wide geographic area. This network enhances a large number of portable transceivers like (e.g., phones, pagers, mobiles, etc.) to communicate with each other node with fixed transceivers and telephones of the network connected anywhere in the world, via cell site or base stations, even if some of the transceivers are moving through one or more than cell during transmission.

Cellular networks offer a number of desirable features:

Large capacity of a single and large transmitter, since the same frequency can be used for multiple ways of linked as long as they are in different cells of network connected. Mobile devices use less power than with a single transmitter or satellite which is widely used in the recent trend, since the cell towers are closer. Larger coverage of land area more than a single terrestrial transmitter, since additional cell towers can be added indefinitely and are not limited by the horizon.

ARCHITECTURE OF GREEN CELLULAR NETWORK:

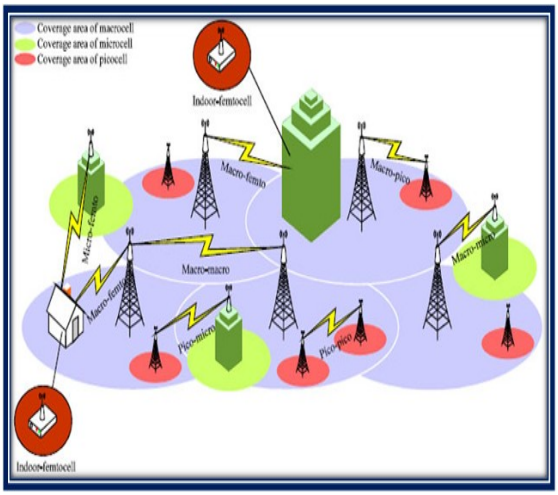

Figure 1. Architecture of green cellular network.

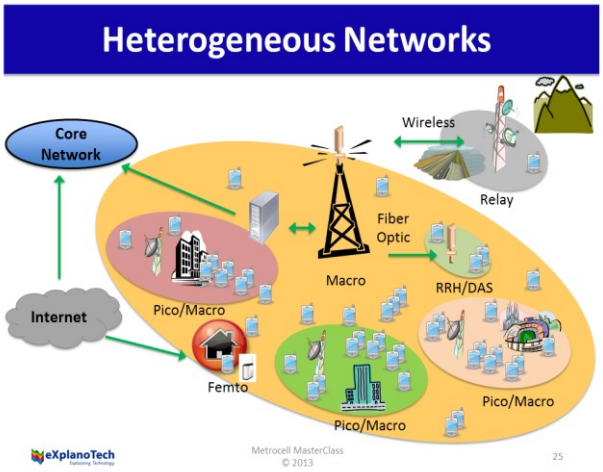

Figure 2. Typical heterogeneous network.

HETEROGENEOUS NETWORK DEPLOYMENT:

The extraordinary growth in demand for high data rates and other services in wireless networks or communication requires a dense deployment of base stations within network cells of each nod. The conventional macro deployments are less energy efficient, it may not economically feasible to modify the current network architectures. Macrocells are generally designed to provide large network coverage and are not efficient to providing high data rates. One and only way to make the cellular networks more energy efficient in order to sustain high speed data-traffic is decreased by the propagation distance between nodes, hence reducing the transmission power.

II Effects Of Joint Macrocell / Microcell And Residential Picocell / Femtocell For Deployment of Green Cellular Networks

MACROCELL:

A macrocell is a cell in a mobile phone network that provides cognitive radio coverage served by a high power cellular base station or cell site (tower). Macrocells provide coverage larger than microcell. The antennas for macrocells are mounted on ground-based masts, rooftops and rooflines and other existing

structures, at a height that provides a clear view over the surrounded buildings and terrain. Macrocell base stations have power outputs of typically tons of watts. Macrocell performance can be increased by increasing the energy efficiency of the transreciever.

PICOCELL:

A picocell is a small cellular base station or cell site typically covers up a small area, such as in-building (offices, shopping malls, train stations, schools, stock exchanges, etc.), or more recently in-aircraft. In cellular networks, picocells are typically used to extend coverage to outdoor areas where indoor signals do not reach well, or to add network capacity in areas with very high dense phone usage, such as train stations or stadiums. Picocells provide coverage , efficiency and capacity in areas difficult or expensive to reach the goal using the more traditional macrocell approach.

FEMTOCELL:

In telecommunications or wireless network, a femtocell is a small, low-power cellular base station, typically designed for the user in a home or small business people. A broader term which is more widely spread in the industry is small cell with femtocell as a subset. It connects to the service provider's network via broadband using cell. A femtocell allows the cell to service the providers to extend service coverage area to indoors or at the cell edge, especially whereas access would otherwise be limited or unavailable.

SMALL CELL:

Small cells are low-powered cognitive radio access cell nodes that operated in licensed and unlicensed spectrum. Spectrum have a range of 10 meters to 1 or 2 kilometers. They are "small" comparing a mobile macrocell, which may have a range of a few tens of kilometers. With these mobile operators struggling to support the growth in mobile data traffic. Many are using mobile data offloading and downloading as a more efficient use of radio spectrum and cognitive. Small cells plays an vital role to an element to 3G data offloading, and many mobile network operators see small cells as vital to manage LTE Advanced spectrum more efficiently compared to use macrocells.

CELL DEPLOYMENT:

The requirements of green cellular network or O2 network can be fulfilled with the known architectures of cellular (macro, femtocells micro, picocells) led to the conceptual idea of a hierarchical cell structure. The key issue for this type of cell architecture is to apply multiple layers of cell or cell nodes to each and every service area, with the size of each cell layered tailored to match the needed requirements of traffic demand and environmental constraints. In this essence of this survey, microcells will be able to provide the basic radio coverage but they overlaid with Umbrella cells to maintain the unambiquitous and continuous coverage area required.

DEPLOYMENT SCENARIOS:

A.SPECTURM:

Different types of frequency bands are separately assigned to macro and small-cell layered structure. The macro and small cell layers share the same carrier should be considered (co-channel deployment) to

deploy the cells.This Small cell enhancements is applicable to all existing as well for future cellular bands of all frequency.

B.TRAFFIC PATTERNS:

In small cell deployment, the traffic will fluctuate greatly since the number of users per small cell node is typically not large due to the small coverage area. The user distribution is very non-uniform and fluctuate between the small cell nodes. The traffic could be highly asymmetrical, either downlink - or uplink-centric.

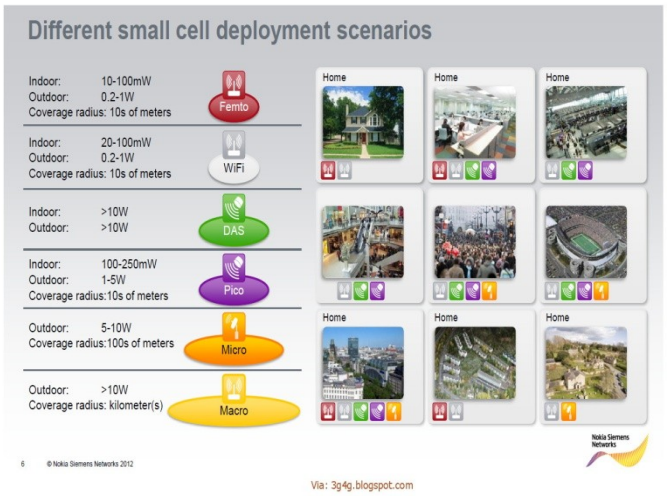

Figure 3. Different small cell deployment scenarios.

1 OUT DOOR MACRO-PICO DEPLOYMENT:

Picocells are deployed on the macrocell edge or hotspot to improve covered area throughput.

Pico cell are open to all UEs(User Equipment). Picocells can be used for both outdoor and indoor purpose.

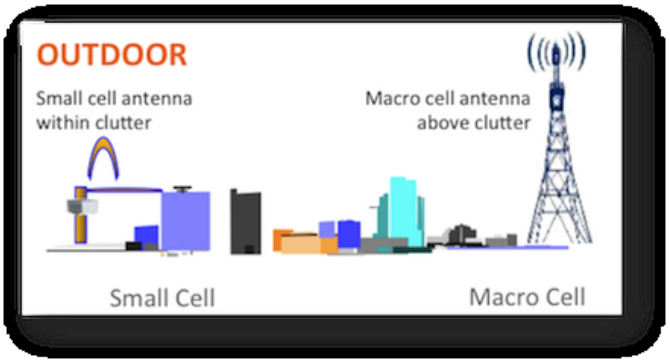

Figure 4. Outdoor small cell deployment scenarios

Pico can be used for both outdoor and indoor purpose. Their coverage area is around in the radius of 200 mtrs. Usually they serve around 32 to 100 users. The growth of smartphones has multiplied mobile data consumption. Capacity has become an issue of key importance in deploying cells. Because of congestion in the network, with both dropped data and voice sessions, users' experiences are degraded. Purchasing additional spectrum, which is a finite resource, is impractical for cost and timing reasons. One of the most efficient ways to improve capacity within a network is to reduce the cell size radius, and place the cell sites closer to each other, resulting in a more densely packed network of smaller cells. Outdoor small cells include femtocells, picocells, and microcells. They have an large economic advantages, as well as network advantages to deployments small cells. This study of survey explores the advantages. As well as the problems that are associated with these deployments. It also addresses other outdoor small cell topic state of the market and its direction over the next five years, as many as drivers and barriers. Forecasting for small cells are segmented by group of region, power output, location, and radio interfacing the both shipped units and revenue.

2. INDOOR MACRO-FEMTO DEPLOYMENT:

Femtocells are deployed indoor to enhance the throughput and power efficiency. Femtocells are open to specific UEs – CSG(Closed Subscription Group). A UE is close femtocell can connected to femtocell if it is not in (CSG connects to macro instead). Usually serve 4 to 16 users. Coverage area in the radius of 10 to 50 meters.

Enabling all types of small cell deployments.

To cost-effective deploying small cell on a large scale, we have to bring the benefits and uses of more unplanned/ad-hoc deployments to all scenarios; residential, NSC, enterprise, pico/metro. Dense deployments also pose multiple configured, mobility and coordinating challenges of all the cell nodes. Qualcomm Technologies, Inc.'s UltraSON is a suit of self-organizing and management algorithms designed to address these challenges and to realize the vision of plug-in and play, self-configuring and self-optimizing hyper-dense networks. Ultra SON enables all deployment scenarios; from residential and NSC, enterprise to metro/pico.

Pros and cons of small cells:

Within mobile data traffic are expected to be double the annual, small cell base stations are set to play an important role in expanding the ability of the wireless networks. Mobile operators realizes that to meet the demands for big data, video and application are to be accessed and it causes smart phones and other devices, there is a real beauty to going small. Small cells provide flexibility and increased QoS capabilities at an low cost. Implementing a small cell infrastructure is also more environmentally friendly as it will reduce the number of cell towers (maybe even eventually eliminate them) and it provides a cleaner signal with less power. But going small is the answer to just one part of the equation. The ability to interact with today's macro networks as well as effectively backhaul small cells is another. Compact base stations (C-BTS) have been referred to by several nomenclatures such as micro and pico base stations. They are small size, fully integrated base stations that include base station bandwidth processing and radio module in to a physical unit. They are accurately in light weight (e.g. a few kilograms) and are made easy to deploy and maintain the required needs. They will come with varying throughput power ranges from a half-watt to a few watts. They provisioned to support a limited number of subscribers that range in the tons of subscribers. These features separate them from

larger to lower 'macro' base stations. That typically have a split or all-indoor heterogeneous architecture in addition to larger capabilities.In terms of output power efficiency and number of supporting subscribers. It is common to deploy the compact base stations at an all relatively level of low height (e.g. 10-15 meters) to cover a limited area (e.g. 100 meter) to provide capacity to a coverage area in dead zone or base station. Macrocell base stations on the other hand are mounted at the higher end at 30-45 meters. Despite the differences in architecture and form-factor, the data rate that a large or small base station can support is the same. This is the link-level data rate that is measured in a lab environment, in the absence of interference. The link-level rate is determined by the capability of the wireless access technology such as WCDMA or LTE. However, what matters to wireless network operators and subscribers alike is the actual performance of a wireless network. Hence, network-level performance is the real measure with link-level performance being an upper-bound that's only reached in ideal scenarios seldom present in a real deployment. Small cell base stations provide higher capacity than macro cells because of the deployment scenario. Because these base stations are mounted low above ground, they are less susceptible to interference. This translates directly into higher capacity higher signal quality leads to better throughput because it allows the system to use a more spectrally efficient transmission scheme where more bits can be transmitted at the same time. Therefore, the areas where users can transmit and receive at higher data rate are larger in a small cell than a macro cell. This is significant because it leads directly to a large increase in overall capacity: the capacity of small cell base station is about 89 per cent higher than that of a macro cell.

Additional benefits include:

Lower delay: users and the end users will experience lower latency for data services and will enjoy faster download and upload in and on time. In-building coverage: small cells provide better outdoor-to-indoor coverage. Considering that 40 % of mobile traffic originates and emerges from home and 25 % from work, this can represent a significant source of revenue for network operators. Better cell-edge coverage: Macro base stations provide poor service at the cell edge which includes a large percentage of the cell area with the wide area of coverage . Small cells provide better cell-edge performance, particularly for the uplink than large cells.The fact that small cells provide allows alomost double the capacity of a macro cell is why they are set to become an important part in addressing the capacity crunch in wireless networks. These base stations are mounted on a low above ground level, typical microwave systems are not technically effective as they require a clear and line-of-sight between the two nodes of all the microwave link – which is difficult and easy to provide in urban areas where small cells are deployed below building rooflines comparing the other cell deployment. Almost all alternative, fiber is expensive in building the arichitecture to lay as it may not be available in all the circumstances at the spot where the small cell is required in addition to large monthly fees that make it unattractive from an economical perspective.

III RESULT

Generally speaking, green cellular network or 02 is a related work on new area of research. Each and every models existing publications are based and depends on ideal models. The fundamental aim, as its name implies, is to the make cellular networks "greener" by reducing total power consumption is through the various approaches and deployment described in this survey. The more survey information on the entire field of green technologies in wired and wireless communication networks. The small cell base stations have an additive information with challenges from a business case respective even though

they can be made cost of larger sub stations. The issue on which this deals how to be improved backhaul such as the base stations and the cost effective and efficient of the backhaul. This survey deals with energy emission is reduced with implementing smallcell, macrocell, picocell and femtocell depolyment.

IV CONCLUSION

Heterogeneous network deployment in green cellular networks are based on smaller cells such as micro, pico and femtocells is one of the important and effective technique that can possibly and cost effective to reduce the power consumption of a cellular network through the deployment of the various cells. However, as some of the recent research suggests the trends of deploying the typical heterogeneous network, carefully network design is required as deploying too many smaller cells may in fact reduce the power efficiency of the central BS. Alternatively when a large number of BSs with small cell are sized and deployed, with the embodied energy consumption in the heterogenous network will dominate and lead to effective and an increase in total energy consumption.

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