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CONGESTION AVOIDANCE AND QOS IMPROVEMENT IN BASE STATION WITH FEMTOCELL

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Abstract - *The remarkable development of wireless communication with faster data rate transmission and higher channel capacity has depended on antennas that are able to cope with the challenges of a wireless environment. Currently, a cellular base station in a home or small business connects each user with the service provider's network to extend service coverage indoors and reduce the shadow area where the signal is low. A femtocell network improves wireless services by closing the gap among network cells and correcting signal loss. Femtocells are an alternate way to deliver the benefits of fixed mobile convergence (FMC).In telecommunications, a femtocell is a small low power cellular base station, typically designed for the use in home or small business. A broader term which is more widespread in the industry is small cell, with femtocell as sub cell. It is also called femto access point.*

Keywords: Femtocells, quality of service (QoS), admission control, resource allocation, orthogonal frequency division multiple access (OFDMA), convict graph.

1. INTRODUCTION

Wireless sensor networks are a subset of wireless networking applications, which focus on enabling connectivity without, the need, generally, of wires to connect to the sensors and actuators (Gutierrez et al. 2004). Due to the length of the name ''wireless sensor and actuator networks'' or ''wireless sensor and control net-works'', most people have adopted the shorter ''wireless sensor networks'' instead. In any case, it is important to remember that the design of this type of network is meant to collect information from wireless sensors and send control commands to actuators attached to the wireless network.

Micro Electro Mechanical System (MEMS) have matured to the point where they enable the integration of wireless communications, sensors and signal processing together in a single low-cost package, named as a sensor node (Schurgers and Srivastava2001). Such a sensor node is equipped with data processing and communication capabilities. A set of such sensor nodes forms a wireless sensor network.

The Open Systems Interconnection (OSI) seven-layer model, proposed by the International Organization for Standardizations (ISO), forms the basis for the design of the WSN protocol stack

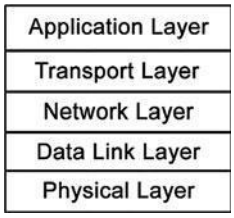


FIG 1.2 WSN PROTOCOL STACK

The first layer of the protocol stack, the physical layer, is responsible for defining and managing the connections between individual devices and their communication medium.

The second layer of the protocol stack, the data link layer, is responsible for providing services that allow multiple nodes to successfully access and share a communications medium.

The third layer of the protocol stack, the network layer, is responsible for establishing the communications paths between nodes in a network and successfully routing packets along these paths.

The fourth layer, the transport layer, is responsible for providing a higher level layer of the protocol stack and consequently providing the users with transparent and reliable communications between end-users.

The fifth and final layer, adopted by most WSN, is the application layer. The application layer resides close to the users of the system.

1.1 Existing system

1.1.1 Hedonic Regression Model

Hedonic regression model is a discovered method for forecasting the value of a Network. It distinguishes the thing being penetrate into its constituent qualities, and acquires evaluations of the contributory estimation of every property. This needs the composite great being evaluated can be cut down to its constituent parts and that the current

measured to those constituent parts. Hedonic models are mostly usually assessed utilizing regression analysis. Regression analysis is a class of predictive modelling method which enquire the relationship between a target (dependent) and predictor (independent variable). This method is utilized time series modelling, for forecasting, and finding the causal and enquires the causal effect relationship among the variables. Regression analysis is a significant tool for analyzing data and modelling. Here, we fit a line/ curve to the data points, in such a way that the difference among the distances of data points from the line or curve is minimized.

There are several welfares of utilizing regression analysis. They are given below as:

It shows the important relationships among the independent variable and dependent variable.

It shows the force of impact of several independent variables on a dependent variable.

Regression analysis also permits us to equate the effects of variables evaluated on different scales. A Hedonic Regression model technique utilized to determine the value of power consumption and channel allocation by breaking it down into a series of equipment. The value share of each equipment is then calculated through regression analysis, and at times through additional general models such as SNR, power, capacity analysis etc.

For micro user equipment a received signal-to-noise ratio (SNR) is given as

$$SNR_m = \frac{P_r^m}{\sigma^2}$$

Where, the received power of the MUE is P_r^m and the noise variance is σ^2, which is adopted as unity. In a macro cell, the received power at UEs is represented as

$$P_r^m = \sum_{q=1}^{M_t} \frac{P_q \sigma_q}{\left(D_q^{j,k}\right)^{\beta q}}$$

Where the transmitted power of the macro cell antenna is represented as P_q and the fading coefficient in macro tier is σ_q which is described from corresponding to the squared envelope with unit mean.

Likewise, the signal-to-interference plus noise ratio (SINR) for a SAP can be measured as

$$SINR_s = \frac{P_r^s}{1+\sum_{i \in I} P_i \alpha_i \left(D_i^{j,k}\right)^{-\beta_i}}$$

Where the received power for SAP is P_r^s, the interfering power from i-th SAP is P_i, which is an co-tier interference.

The set I represents the set of all interferers. α_i Represents the Rayleigh fading channel gain from the interfering transmitter, while $D_i^{j,k}$ is represented as the distances of the receiver from the interferer and the received power at a SAP equipment is given as

$$P_r^s = \frac{P_s \alpha_s}{\left(D_f^{j,k}\right)^{\beta_s}}$$

Where, the transmit power of SAP is P_s and the fading channel gain in the SAP is α_s.The scheme capacity can be simulated for both macro and small cell on the basis of $SINR_s$ and $SINR_m$ given by

$$C_l = Blog_2(1 + SNR_l)$$

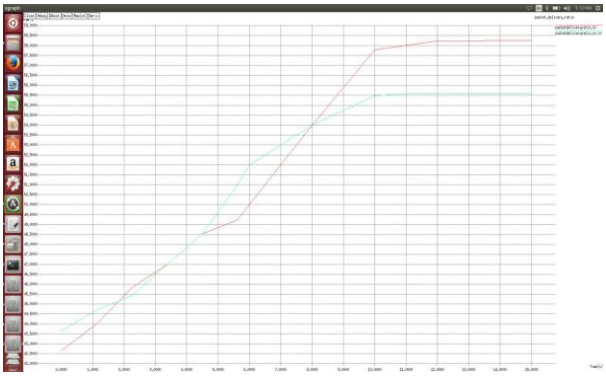
Where, the capacity is C_l and the system bandwidth is B.

1.2 Packet Delivery Ratio(PDR)

This network performance metric is defined as the ratio between the number of data packets successfully delivered to the destination and the number of packets transmitted by the source.

$$\text{PDR} = \frac{P_{\text{Received}} * 100}{\sum_{i=1}^{n} P_{\text{Generated}i}} \quad (1)$$

In the equation (1), PReceived represents the total number of packets received by the sink node, PGenerated is the total number of packets generated by the source nodes and n represents the number of sensor nodes.



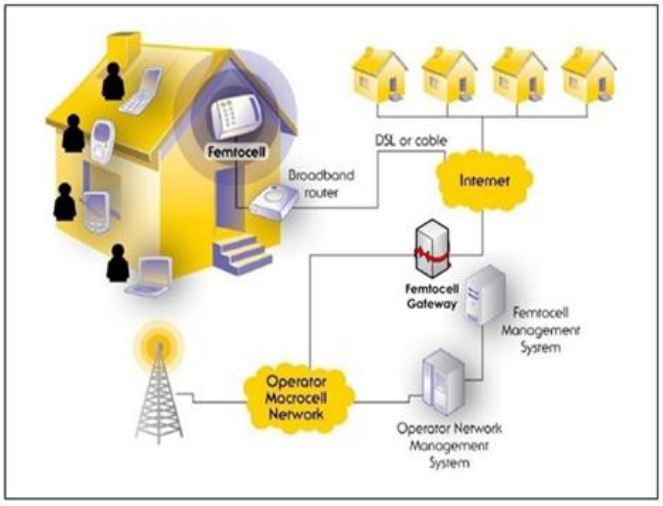
2. Proposed System:

2.1 Femtocells overview:

The femtocell has been characterized as one of the solutions proving the problems of coverage and capacity for users. , the CAPEX and OPEX for the microcells and nanocells cannot be substantial for cost reduction as this is a major target for reduction.

In the 3G, the femtocell is refers to as the Home NodeB and in the LTE and LTE-Advanced, it has been named as the Home enhanced NodeB (HeNB).

The use of femtocells is the use over the licensed spectrum and the use of the operators' network coupled with the use of the internet connections at home or office.

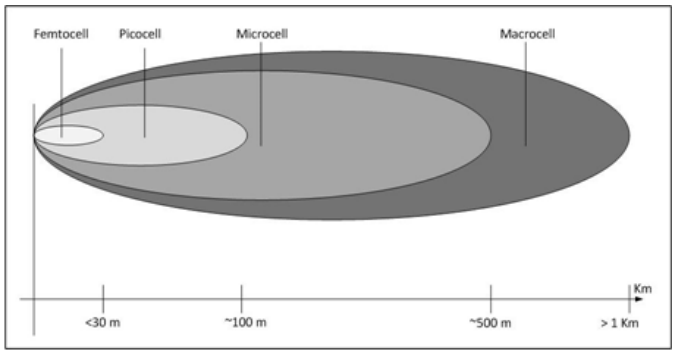


Femtocell Basic Network

2.1.1.Basic Definition of Femtocell:

Femtocells (or Femto Base Station, FBS) are small, low-power cellular base station (or access points) that are user-installed which sufficiently enhance the conventional mobile communication for extended coverage area and improved capacity in cellular networks.

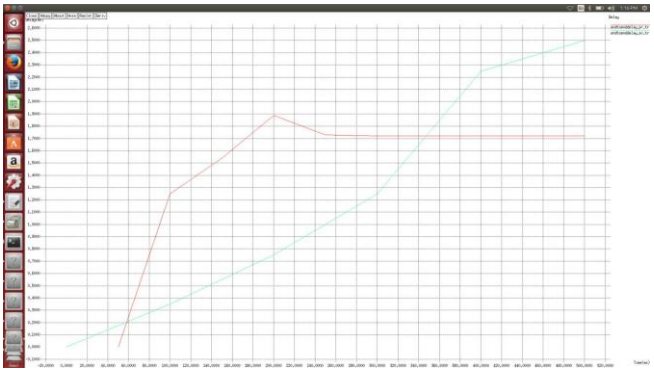
Femtocells as compared to the broader macrocells.



Small cell comparisoin

3. Packet loss:

Packet loss occurs when one or more packets of data travelling across a computer network fail to reach their destination. Packet loss is either caused by errors in data transmission, typically across wireless networks or network congestionzPacket loss is measured as a percentage of packets lost with respect to packets sent.



4. Throughput:

The amount of samples generated by the network as response to a given query is equal to the number of sensors, k, that are present and active when the query is received. As a consequence, the average number of data samples-per-query area.

Now denote by G the available area throughput, that is the average number of samples generated per unit of time, given by

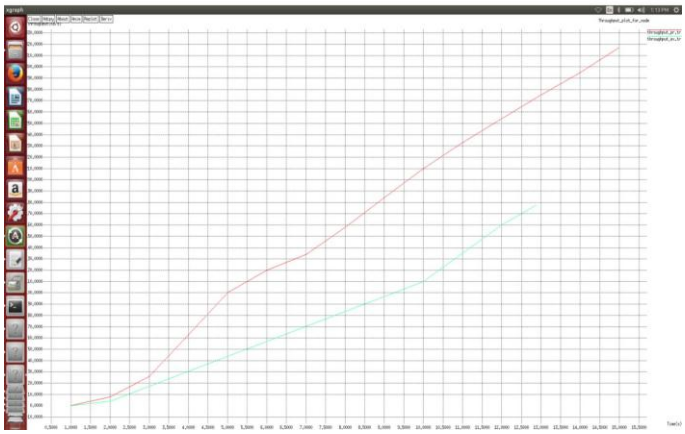
$$S = \sum_{k=0}^{+\infty} S(k) \cdot g_k \ \text{[samples/sec]},$$

where

$$S(k) = \frac{k}{T_q} P_{s|k},$$

g_k as in (1) and $P_{s|k}$ as in (42).
Finally, by means of (42), (43) and (44), equation (45) may be rewritten as

$$S = \frac{1 - e^{-IA_n/A}}{T_q} \cdot \sum_{k=1}^{+\infty} \frac{\sum_{n=1}^{k} P_{MAC}(n) \frac{\bar{n}^n e^{-\bar{n}}}{n!}}{\sum_{n=1}^{k} \frac{\bar{n}^n e^{-\bar{n}}}{n!}} \cdot \frac{(GT_q)^k e^{-GT_q}}{(k-1)!}.$$



5. Advantages:

- coveragewhen there is no existing signal or poor coverage
- Higher mobile data capacity, which is important if the enduser makes use of mobile data onhis mobile phone (may not be relevant to a large number of

subscribers who instead use WiFi where femtocell is located)

- Special tariffs at home can be applied for calls placed under femtocell coverage
- For enterprise users, having femtos instead of DECT phones enables them to have a single phone, so a single contact list, etc.
- Femtocells can be used to give coverage in rural are

6. Conclusion:

Femtocells are low range ,low power mobile base stations deployed by the end consumers, which underlay the macrocell system and provide a solution to the problem of indoor coverage for mobile communications. However the deployment of femtocells may introduce extra interference to macrocell base stations. An effective interference system performance management mechanism is required to optimize the system performance

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