Femtocell Technology

Priyanka Garg[1], Ajmeet Singh[2]
[1]Dept of Electronics and Communication
[2]Assistant Professor, Dept of Electronics and Communication
[1, 2] Poornima College of Engineering, Jaipur- India

Abstract- *Femtocell is only a little cell station implied that to improve benefit quality and bear the cost of significant worth included benefits inside a home or an independent venture. Femtocells associate with specialist co-op's system by means of broadband, for example, DSL or link. Femtocell basically courses portable brings over web. A Femtocell permits specialist co-ops to expand benefit scope inside, uniquely where access would somehow or another be limited or involved. This is valid in numerous homes where remote flag can't reach inside or there is poor flag quality because of security or physical deterrents. For Fixed Mobile Coverage (FMC) femtocells assumes a critical part. Customary Fixed Mobile union requires make utilization of double mode (Wi-Fi) handsets yet with Femtocell, conventional cellphones can be utilized for FMC. A standout amongst the most extensive preferences of Femtocell for the remote administrator is that by coordinating home versatile approaches the web, administrators can free of energize the remote system. In rising markets, remote system clog rates point to the possibility that Femtocells would be a shelter in such areas. On the console of Femtocells, one can accept of them as on a very basic level "versatile going up against Wi-Fi". Femtocells High Speed Download Packet Access (HSPDA) inside or pack rapid 3G innovation, which can have 7Mpbs downloading speed.*

Keywords- Communication network, 3G, mobile core network, Broadband Router, HNB

I. INTRODUCTION

"Would you be able to hear me now?" was a prevalent expression for a while among individuals who were taunting poor people sound and scope of their cell phones. In spite of the fact that it transformed into something of a joke, it's no giggling matter when your mobile phone all of a sudden loses its capacity to enable you to appreciate clear correspondence. Sadly, this is regularly the case in homes and structures where scope diminishes significantly as before long as you go inside. Since an ever increasing number of individuals are jettisoning their landlines for cell phones, and also in view of the basic actuality that individuals need to have the capacity to chat on their mobile phones wherever they are, it has turned out to be important to chip away at new innovation that will encourage calling scope both indoor and open air. Femtocell innovation could be the appropriate response. Furthermore smoothening better indoor call scope, this developing innovation decreases the extract that best in class portable administrations, (for example, versatile broadband) are setting on the limit offered by telephone organizations. One of the arrangements that individuals have begun to utilize is femtocell innovation. This innovation might be better referred to the client as an Access Point Base Station, a little gadget which is introduced in the home or office keeping in mind the end goal to offer better help to cell phones there. These base stations can suit up to five phones which implies that you can get expanded scope for your entire family. Basically, we set up the femtocell innovation in your home and it serves to upgrade the phone flag that you get inside with the goal that your call quality isn't diminished when you're talking inside. Presently numerous administrators, for example, AT&T, Sprint and Verizon in USA, Vodafone in UK are giving Femtocell benefit. Meaning of femto cell: "Femtocell" is a remote get to point that enhances cell gathering inside a home or office building." A femtocell is a scaled down cell tower for homes or independent companies that broadens a transporter's conventional system's range. Femtocells interface with a transporter's organize over the client's broadband web association and give a solid neighborhood flag that cell telephones in the building can use for any of the run of the mill voice or information applications. Femtocells require bearer bolster with a specific end goal to be of any utilization. The Samsung Ubicell1 (Sprint Airwave) is a case of a financially accessible femtocell. Femtocells were initially called get to point base stations. The term was gotten from cell and "femto," a metric prefix that stands for 10^-fifteenth, or one quadrillion, six requests of greatness littler than nano. The advancement of femtocells is credited, in part, to craft by a skunk works group at Motorola in the UK, where they made the world's littlest full power UMTS base station. In media communications, a femtocell is a little cell base station, normally intended for use in a home or independent company. It interfaces with the specialist organization's arrange by means of broadband, (for example, DSL or link); current outlines ordinarily bolster 2 to 4 dynamic portable telephones in a private setting, and 8 to 16 dynamic cell phones in big business settings. A femtocell permits specialist co-ops to broaden benefit scope inside,

particularly where access would some way or another is restricted or inaccessible. Albeit much consideration is concentrated on WCDMA, the idea is relevant to all principles, including GSM, CDMA 2000, TDSCDMA, Wi-MAX and LTE arrangements.

II. LITERATURE SURVEY

Following are the wordings should have been talked about alluding to Femtocell innovation

2.1 Early Origins

Right off the bat in a metropolitan territory, "little cells" term used to depict the cell measure, where a large scale cell that which cell split into various littler cells with transmit control lessening, known as small scale cells, and having a sweep of a few hundred meters in its inclination. At the same time, cell repeaters or "promoters" were being explored as a contrasting option to little base stations. These re-transmitting gadgets were planned to help enhance the flag quality in poor scope areas, while lessening costs by not requiring a wire line back pull. Be that as it may, their reuse of the authorized range for back pull constrained the achievable throughput, and consequently these repeaters were neither useful to the framework limit nor easy to send. In the 1990s, a forerunner to cell Pico cells started to show up with cell sizes running from tens to around one hundred meters.

2.2 The Birth of Modern Femtocells

New reasoning on the arrangement cost parts of little cell organization and setup of cell frameworks started to address the operational. These methods have been connected effectively to exceptional Femtocells where taken a toll issues are enhanced inside the uncommon system. A femtocell is particularly unique in relation to the customary little cells in their self- ruling and self-exactness. Furthermore, the back pull interface back to the cell arrange – which is IP-based and likely backings a lower rate and higher idleness than the standard interface associating full scale and pico cells commands the utilization of femtocell entryways and other new system foundation to fittingly course and serve the activity to and from what will soon be a great many new base stations. Perhaps more essential than the need to give cell scope in field of private utilize, the portable information blast require another cell design with no less than a request of greatness greater limit.

2.3 Modern Femtocell Research

There is a developing nature of research on femtocells, of which we quickly report a few notable early outcomes which were stretched out to self-streamlining procedures and numerous radio wires in the blink of an eye a short time later. On the introduced side, early demonstrate included new numerical models and examination, particularly taking a gander at the up connect impedance issue in CDMA - based systems with shut access. The exceptional model and approach was led with down connection and with numerous receiving wires. Other early work proposed versatile access control to alleviate the cross-level obstruction issue, which was given further consideration in researched the switch connect limit of femtocells, displaying between cell impedance as expanding capacity of the femtocell innovation and the exhibited organize availability. This work was reached out in which grew new investigative methods to inflate the advancement for WCDMA femtocell frame works. A few people groups have likewise considered obstruction coordination in OFDMA based systems, including co-channel impedance administration.

III. REVIEW OF FEMTOCELL

3.1 Idea of Femtocell

Femtocells are low-control remote access focuses that work in authorized range to interface standard cell phones to a versatile administrator's system utilizing private DSL or link broadband associations. A femtocell is a little base station. So little, taint that can be set in a client's habitation.

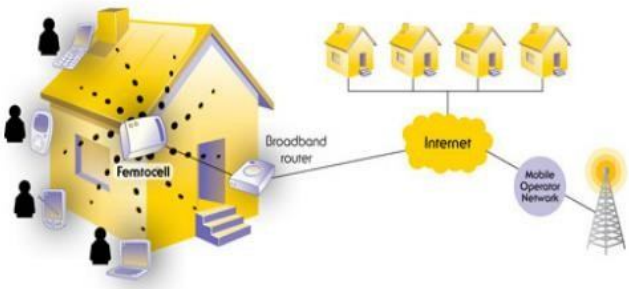

Figure 3.1: Femtocell Idea

The femtocell unit produces an individual cell phone motion in the home and interfaces this to the administrator's system utilizing standard broadband DSL on Cable administration and ordinarily underpins 2 to 5 cell phones in a private setting. This will permit enhanced scope and limit with regards to every client inside their home.

3.2 System Architecture

Interfacing femtocells to existing administrator systems requires a system design that tends to the security needs of administrators and versatile clients, while supporting the adaptable organization of a great many femtocells. What's more, it must enable common purchasers to introduce them with fitting and-play effortlessness and guarantee that basic administrations, for example, crisis calling are additionally upheld with an indistinguishable unwavering quality and exactness from settled line crisis calling.

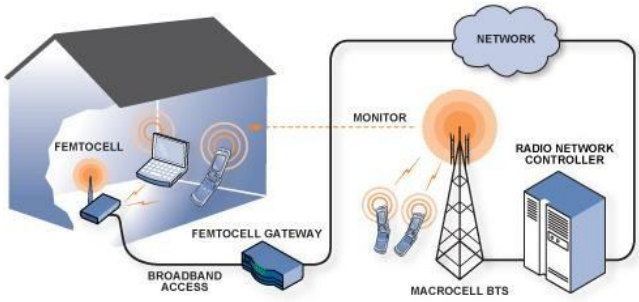

Figure 3.2: System Architecture

The femtocell arrange design portrays the real hubs and associations in a femtocell system, and how they accomplish the destinations of versatile endorsers and administrators. The femtocell arrange engineering underpins the accompanying key necessities:

(a) Service Parity: Femtocells bolster a similar voice and broadband information benefits that portable clients are right now getting on the macrocell organize. This incorporates circuit- exchanged administrations, for example, content informing and different voice highlights, for example, call sending, guest ID, voice message and crisis calling.

(b) Call Continuity: Femtocell systems are all around incorporated with the macrocell organize so calls beginning on either macrocell or femtocell systems can proceed when the client moves into or out of femtocell scope. Femtocell arrange engineering needs to incorporate the essential availability between the femtocell and macrocell systems to help such call congruity.

(c) Security: Femtocells utilize the same over- the-air security systems that are utilized as a part of macrocell radio systems. In any case, extra security capacities should be upheld to shield against dangers that begin from the Internet or through messing with the femtocell itself. Femtocell arrange design gives organize get to security, and incorporates supporter and femtocell confirmation and approval methodology to ensure against extortion.

(d) Self-Installation and Simple Operational Management: Femtocells are introduced by end- clients. Along these lines, the femtocell arrange design must help a to a great degree basic establishment method with programmed setup of the femtocell and mechanized operational administration with "zero-touch" before the end- client.

(e) Scalability: Femtocell systems can have a large number of access focuses. In this way the femtocell organize engineering must be versatile to develop into such extensive systems, while in the meantime keeping up unwavering quality and sensibility.

IV. WORKING

Femtocells are sold by a Mobile Network Operator (MNO) to its residential end-users or enterprise customers. A femtocell is typically the size of a residential gateway or smaller, and connects into the end-user's broadband line. Integrated femtocells (which include both a DSL router and femtocell) also exist. Once plugged in, the femtocell connects to the MNO's mobile network, and provides extra coverage in a range of typically 30 to 50 meters for residential and output power — usually 20 mW which is five times femtocells (depending on the existing coverage less than a Wi-Fi router). From an end- users' perspective it is plug and play, there is no specific installation or technical knowledge required anyone can install a femtocell at home. Femtocell device consists of a radio receiver and transmitter for the connection between the mobile phone and Femtocell device. It also have an Application Specific Integrated Circuit or Digital Signal Processor to handle the physical connectivity between handsets and Femtocell and between the femtocell and the mobile network. Chip makers design the ASIC or DSP to work with the specific carrier's network. The Femtocell consists a host processor which supports software based task such as security, encryption, and connectivity to the broadband network via Internet Protocol, or technologies such as the Dynamic Host Configuration Protocol. The end-user must then declare which mobile phone numbers are allowed to connect to his/her femtocell, usually via a web interface provided by the MNO. This only needs to be done once. When these mobile phones arrive under coverage of the femtocell, they switch over from the macrocell (outdoor) to the femtocell automatically. Most MNOs provide means for the end-user to know this has happened, for example by having a different network name appear on the mobile phone. All communications will then automatically go through the femtocell. When the end-user leaves the femtocell coverage (whether in a call or not), his phone hands over seamlessly to the macro network. Femtocells require specific hardware, so existing Wi-Fi or DSL routers cannot be upgraded to a

femtocell. Once installed in a specific location, most femtocells have protection mechanisms so that a location change will be reported to the MNO. Whether the MNO allows femtocells to operate in a different location depends on the MNO's policy. International location change of a femtocell is not permitted because the femtocell transmits licensed frequencies which belong to different network operators in different countries. One of the key elements of the femtocell configuration occurs at the first start up when the femtocell equipment is being installed. It is essential that this operates smoothly for the concept to gain acceptance by the user. After acquiring a femtocell the customer should only need to plug the femtocell into the power and connect it to the Internet connection to provide the backhaul connection. With power applied, the first element of the registration is for the femtocell to register within the network. When a user makes a call inside the range of Femtocell, the mobile phone uses its radio to connect to the Femtocell. The Femtocell will attempt to gain access to the core network via the gateway. Femtocell is connected to the security gateway via wired connection to the user's broadband, typically DSL or cable. To achieve this it will utilize the femtocell ID - a unique identifier given to the each femtocell. Additionally the operator is likely to have obtained the address where the user will base the femtocell. The connection between the femtocell and the femtocell host processor uses secure IP encryption (IPsec), which avoids interception. Additional functions are also included such as some of the RNC (Radio Network Controller) processing, which would normally reside at the mobile switching center. Some femtocells also include core network element so that data sessions can be managed locally without needing to flow back through the operators switching center (local break out). The extra capabilities of a femtocell demand it to be self-installing and self-configuring. This requires considerable extra software which scans the environment to determine the available frequencies, power level and/or scrambling codes to be used. This is a continuous process to adapt to changing radio conditions, for example if the French windows are opened in a room containing the femtocell. Within the operator's network, femtocell gateways aggregate large numbers of femtocell connections (typically 100,000 to 300,000) which are first securely connected through high capacity IP security firewalls.

V. ADVANTAGES, DISADVANTAGES & APPLICATION

5.1 Advantages

(a) Independent or incorporated femtocells: Early femtocell items look especially like Wi-Fi broadband modems, requiring just two links - one for power and one web association. A few sellers, for example, Thomson, Netgear, Pirelli, Cisco and others have incorporated the femtocell with different highlights, for example, DSL modem, Wi-Fi and even IPTV into a solitary box. It is normal that in the more drawn out term, most femtocells will be sold in this shape.

(b) Low power yet astounding: Femtocells work at low radio power levels not as much as cordless telephones, Wi-Fi or numerous other family gear. This significantly builds the battery life, both on standby and talk time. Since they are such a great amount of nearer to the handset or cell phone, call quality is astounding and information gadgets can work at full speed. Standard units can deal with up to 3 or 4 concurrent calls from various clients relying upon the model. Bigger femtocell plans planned for business (endeavor) utilize can deal with 8, 16 or even 32 simultaneous call.

(c) Secure and self-dealing with: The femtocell scrambles all voice and information sent and got from cell phones and would ordinarily not enable access to the home PC arrange, so outside clients can't break into your PC. So as to lessen cost, these units are self- introducing and utilize an assortment of astute traps to detect which recurrence to transmit on and control level to utilize. Not at all like outside cell phone base stations (poles), femtocells don't require master RF arranging specialists to configuration, align or design themselves - limiting the continuous cost of looking after them. They do have remote administration from the system administrator, who can redesign the arrangement and programming as required.

(d) Doesn't require exceptional telephones: They are perfect with existing standard portable telephones, despite the fact that in future some minor improvements would permit clear sign of when the telephone is utilizing the nearby femtocell (and therefore utilizing a free call remittance) - right now this can be given by tones toward the beginning of each call.

(e) Neighborhood Breakout: Femtocells additionally bolster a component known as nearby breakout, which permits a femtocell client to interface their cell phones to the neighborhood home or office organize without navigating the portable administrator's center system. For movement bound to the worldwide Internet, nearby breakout additionally sidesteps the administrator center system, subsequently lessening the system stack.

(f) A Femtocell is utilized for remunerating poor cell scope inside the homes – in a few spots.

(g) A Femtocell can likewise give bring down call charges while the guest calling from home, utilizing the Femtocell as it specifically interfaces with the center system through the web.
(h) A few merchants are likewise wanting to fuse all the three highlights – Wi-Fi, cell and DSL into a similar box to accomplish most extreme usefulness.

(i) The voice calls/information calls through the Femtocells are scrambled and the PDAs consequently changes over to the Femtocells when they come in their range – e.g. in homes, where they are introduced.

(j) Femtocell units can deal with up to three or four concurrent calls, from a similar administrator, contingent upon the model. They can work with typical cellphones, with no improvements.

(k) Femtocell units can enable related cell administrations to like 3G by offering a superior speed and information rate when inside structures, where the scope and information rate is by and large lesser than outside.

5.2 Disadvantages

(a) High cost ($300).
(b) Difficult to install (Cabling, rooftop get to and so forth)
(c) Dependent on motion from closest cell town.
(d) Requires broadband association.
(e) More complex to set up, requires another/unique telephone number, more potential for blunders.
It does not give great scope in outside.

5.3 Applications

(a) DSL Modem: The step is to integrate the femtocell into an existing DSL broadband modem design. No additional external connections are needed – the modem will already have power and data connectivity, and usually a list of other standard features too. The femtocell module is hardwired into the modem and can be given priority of voice calls to ensure improved performance. The overall cost of the combined unit is much less than two separate boxes, it is the ease of installation and remote management which benefits this option. Many mobile operators have started offering DSL broadband as an additional service, particularly in Europe. If the additional cost of a combined modem/femtocell is acceptable, then this could be shipped to customers as part of a package.

(b) Cable Modem: More households in the USA receive their broadband internet service from their cable TV supplier than from the phone company (as is more common in Europe and elsewhere). The modem can be separate from the TV Set-top box or a combined unit. This appears to have been discontinued. Although Cable TV companies do own some spectrum (via the Spectrum Co) business, and so could legally launch and operate a rather than traditional mobile phone.

(c) The Domestic applications of femtocell technology in a condensed residential area. The same characteristics as a crowded shopping center or CBD may be applied here. Due to condensed living spaces, the demand for cellular network connections and data transfer (for internet etc.) is constantly increasing. One cellular tower may be able to handle the majority of the traffic but during peak times it may lag or slow dramatically. Then you also have problems with connecting in some poor coverage areas. This may be due to objects or structures decreasing the signal strength. 3G networks supply high speed internet connections to those using it. It also improves the quality of voice calls over a mobile phone. With the assistance of a cellular provider or an ISP, a femtocell router or two can be placed in appropriate spots where the load is significantly more. This connection can be paid for through either the strata or Telco Company providing the connection. These routers could easily take the demand and as the cost to purchase and install one is about the same as a domestic wireless router. Condensed living always present problems for telecommunications but it can be overcome by practically apply domestic level products to areas where it is needed the most. This would save the cost of both your back pocket and health of having a second communications tower installed in an attempt to cover the black spots.

VI. CONCLUSION

Femtocell innovation is still in the beginning periods of advancement. Femtocells are currently an essential piece of the improvement methodology for cell broadcast communications administrators. Not exclusively do femtocells give extra favorable circumstances to clients as far as enhanced execution inside the home, or business office, yet they likewise give the likelihood to extra administrations and the guarantee of lower charges. They additionally offer the difference in joining where a solitary telephone can be utilized rather than the landline and additionally to roam. For administrators they give a savvy way in which they can enhance their scope and increase additional income by the arrangement of extra administrations. In like manner the utilization of femtocells will turn into a pillar in the cell media communications guide for what's to come. Femtocells are on a street to now here. Femtocells can possibly give superb system access to indoor clients requiring little to no effort. Unsuitable scope and the expanding number of high-information rate application are two main thrusts for femtocell advancement.

Potential to give top notch arrange get to. Give colossal limit pick up. Not prone to be a quick and through and through progress. Number of equipment developments will most likely be required before shape factor, ease of use and nature of administration are satisfactory.

VII. FUTURE SCOPE

Research is being done on femtocells that work on 4G organize for business ventures that can deal with more calls all the while. Since a femtocell centre is essential utilized as a part of home and using web connect it bodes well to in the end observe it with home apparatuses too. The femtocell idea, and the extensive innovative work that has brought about early trials of femtocell innovation offers some energizing looks of one variant of the portable administrator's future system. There is impressive enthusiasm for the business, however an acknowledgment that numerous impediments should be overcome before the innovation increases across the board achievement. Wi-Fi is undeniably the innovation for the in-home remote system. The larger part of homes in created nations as of now utilize a Wi- Fi arrange for Internet access, and interactive media home stimulation gadgets utilizing Wi-Fi are in large scale manufacturing, despite the fact that they are still ahead of schedule in the selection cycle.

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