Femtocell Technology

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Abstract— A FEMTOCELL is a compact, low-energy cellular stations that are commonly designed for to give benefit to small business or homes. It is being couple with the service provider's network through various network providers. Femtocell technology is designed to improve both capacity and coverage, especially for indoors. This technology is increasingly implementation by the providers of network services in their networks. It is a new development in networking technology which improves coverage, voice quality and battery life. Femtocell services have been already launched by many of the operators, along with Vodafone, SFR, AT&T, Sprint Nextel, Verizon and Mobile TeleSystems. So, it will be absorbing and obligatory to know about this new technology. This paper provides a thumbnail of the new femtocell technology, the comfort it provides by blending it into the existing wireless networks, dissimilarity between open and closed access Femtocells and the concern that prevent the mass deployment of Femtocells

Keywords— Femtocell, VoIP, 3G, 3GPP, HNB, DSL, RAN.

I. INTRODUCTION

The 3G networks of mobile cellular frequently suffer from poor impaling and acceptance in certain areas, such as underground , indoors or those having less tower for connectivity. This decreases the quality of video as well as voice communication and slows down high-speed services. The wireless coverage over small areas can be improved by this small device known as Femtocell . It is a low power cellular base station, also called a shortwave access point which is use to connects a service providers Internet connection which will be sent into radio waves to area under its coverage. The name Femtocell has the prefix 'Femto', meaning micro cell .It is called so, because Femto denotes a area which is calculatively represented by (10 raised to the energy of - 15) or a quadrillionth . In plain English, it is one separated by a figure with fifteen zeroes. Successfully, near limitlessly little.

II. NEED OF FEMTOCELL TECHNOLOGY

Before the implementation of 4G,we are suffering from inadequate indoor signal penetration in the existing third generation cellular network,leading to poor coverage in the environment.as their is no proper signal,their is no high speed data rate services ,diminishes the voice and video application.To keep customers satisfied, through additional microcell sites 3G carriers have increased capacity. This planing is becoming much less appreciable. Site procuration amount are outrageous and are in continuation of climbing as area on feasible towers is a difficult task . As the opposition on the large-scale base stations buildings by the people is increasingly common.

Half the clash is obtaining a site : Purchased, installed, insured, operated and maintainance of Sophisticated base station equipment must then be done.Which is a serious dilemma faced by the carriers.As the number of mobile user is increasing, even when there's a availability of fixed lines. However, it is ordinarily the case that deploying full or even proper residential coverage of mobile has been a cogent challenge for service providers.

From a competitive perspective, femtocells are essential because mobile operators require from fixed providers to embrace residential minutes , and reacts to emerging VoIP and WiFi offerings.Beyond the regulatory minimum 3G networks rarely extend due to high deployment costs .

With femtocells we can settles issues with a gadget that draw in power and backhaul through the client's overarching assets. The limit indistinguishable to an entire 3G organize

area is likewise given at low dispatch powers, significantly expanding battery life of existing telephones.

TABLE 1
ADVANTAGE OF FEMTOCELL TECHNOLOGY

Advantage	Description
Cost	Very low cost
Power	Very less power, Transmit at (10-100) Mw
Broad-band connected	By using a wired broadband Internet service (fiber optics etc)
Standard	UMTS, CDMA, WiMAX, UMB and LTE

III. WORKING OF FEMTOCELL TECHNOLOGY

Although they are come across at home or in business, Femtocells from part of the mobile action's network. The basic usefulness of a entire 3G dispose off area which is being compressed onto a chip, which simmillar a Wi-Fi access point, and is attached via wide-band DSL into the mobile promoter system. A Femtocell is attached to the ability of mains and a average wideband IP associate establish the at home through to the mobile promoter core system. Facilities like text messages,voice call and facilities of data is offered by the systems established for it.

Femtocells needs a small radiation capacity levels, and normally have 200 meters of range . Signals are not passing through walls particularly well,as it allows the density to be reused for calls other than required in close blocks this skill is beneficial . Where client walk experior or are not in range, habitually calls are given to the mobile network outside. If along by the mobile operator can use any standard 3G phone on the femtocell. Unlike wireless access points, 3G Femtocells administrativeby the spectrum permits and therefore must be quantized and made to work in coexistence with the service provider for mobiles diagram below displays the working of Femtocell technology.

The war is mostly to be occur within UMA ,which has new design structure coustmised to handle the IP attachment and a very huge number of cells versus change 3G RAN . SIP based answer can be of profit where the user wants to interfare with the administrator network.

Handing over to the Femtocell network is done accordingly ,when record handsets enter the scale of a Photocell, such that calls are channeled through the waveband link. Up to 5 mobile handsets can be handle by a FEMTOCELL.

Fixed-Mobile transformation concept,is grant by another block through Photocell scientific knowledge ,which is still developing and it is getting strong opposition by the UMA and wireless technologies. For example, one might query what for devote in Femtocells where there is a low Wi-Fi router can operate with a Wi-Fi helping sets, provided as handsets helping Wi-Fi is now more easily available and are being send in bundles.

IV. FEMTOCELL STUCTURE

Application of femtocells to handle between a diversity of networks a femtocell network is structure by order. The network structure of femtocell enables diversity of femtocells by the dissimilar makers to work in this area of dissimilar promotor. By this manner cost can be decrease to obtain the wealth of scale. As, there we are having higher levels of opposition within femtocell makers that is making the costs under command.

A. Femtocell Network Structure Need

From disparate cell computerization frameworks, there will be a prerequisite to be divergent methods for executing the fundamental system structure of femtocell.As we have,a number of conventional requirements for the system structure of femtocell and how of the cell framework can be utilized.

Essential necessities for the system structure of femtocell are for the gadget to act naturally , close-by inside the clients working (as some femto gadgets might be close-by outward to give neighborhood reportage in ranges where there is no other reportage).

We ought to have a shoddy cost and open type of backhaul. Regularly, this require the utilization of Internet by means of the client's wideband .

At last , there ought to be authorization a to make the heap from femtocells dispatching by the Internet to then get to promoter center system.

B. Network Architecture of femtocell for 3GPP HNB

From the need a far reaching standard for system design of femtocell, 3GPP is working with sellers, and administrators to give the best standard. Another interface is develpoed by

these new standard and furthermore the components are institutionalized inside the system engineering femtocell.

Define by 3GPP we have three elements to the network architecture of femtocell :

1) Home NodeB (HNB): 3G UMTS have a terminology Home Node B as the access point of femtocell in the houses, or anyother location. The capabilities of a standard Node B will be incorporated by the HNB and the radio asset administration capacities found inside a Radio Network Controller, RNC.

2) HNB Gateway (HNB-GW):This is the passage indicate the center system. The connection into the center system is given over Iu-cs and Iu-ps interface which are as of now utilized for connections from Radio Network Controllers to the rest of the center system.

- The HNB-GW has the accompanying capacities:
- It gives verification and confirmation to enable just information to and from approved HNBs.
- The HNB-GW totals movement from a substantial number of HNBs and gives a section point into the administrator center system.
- The HNB-GW gives a system to bolster improved elements, for example, clock adjust dissemination, other IP based synchronization (e.g. IEEE1588, IETF Network Time Protocol, NTP, and so on)

3) Iu-h Interface: TThe Iu-h interface is utilized to give the connection or interface that associates the HNB with the HNB-GW. The Iu-h interface incorporates another HNB Application Protocol, HNBAP that gives the abnormal state of versatility required for the HNB organization that will happen in a fairly impromptu manner.

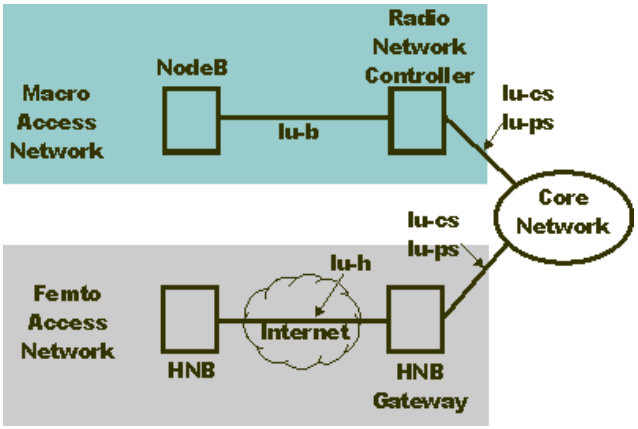

Fig. 1 3G Femtocell Network Architecture

C. LTE Femtocell Architecture

As the induction of femtocell innovation is route to the advancement of LTE, it was required to convey the institutionalized LTE femtocell organize engineering to take in consider of the LTE SAE, System Design Evolution needs.

The rationale behind the LTE SAE is to give a significantly compliment general system engineering. This has many advantages regarding system relexation and it is likewise a noteworthy component in giving much lower levels of inertia - a noteworthy component for LTE.

The femtocell framework engineering has been given to enable most extreme adaptability and measurablity to guarantee that the organization can be effectively led into the current structures. By its exceptionally nature, the improvement of femtocells is accomplished on a specially appointed premise, this structures an immense requirement for the framework.

V.FEMTOCELL INTERFERENCE ISSUE

The key issue associated with femtocell development is its interface. There are a numerous of issues associated with spoofing all of which have needed to be interogated and solutions should be provided to ensure for the successful devolopment of any femtocells will take place.

The problem arises from the fact that femtocells will use the spectrum already allocated for mobile telecommunications. An ad-hoc fashion is the term in which the deployment of femtocells takeplace, without the network planning that is normally undertaken for the deployment of cellular telecommunications base stations.

Due to which, there is very real the possibility that interference will arise. Poor levels of performance being encountered as a result of the interface issues in the main network, not only by those utilising the femtocell, but other users who may be interacting via the main cellular network.

As can be seen , a real issue for operators is interference may arise and deduce the levels of performance.While major achivements in terms of coverage improvements for a low cost is given by femtocells, if the overall performance of the connection was reduced these benefits could be negated .

As Thus, a lot of work has been attempted to guarantee that femtocell obstruction issues don't emerge and keep their broad sending. There are various techniques that have been created to guarantee the simple minimization of impedance so that femtocells can be introduced by clients without the need to consider about any specialized issue.

A. *Femtocell Interference Scenarios*

There are fewer femtocell interference problems when the femtocells use a different carrier frequency to the surrounding macro network for the cellular telecommunications architecture. The more complicated scenarios arise when the femtocells provides the same carrier frequency. This scenario also gives the greatest level of spectrum efficiency, but also the greatest challenges to the interuption management systems.

The fundamental impedance situations are nitty gritty underneath.

1) Femtocells meddling with construct stations in light of a similar recurrence: When various femtocells are working on an indistinguishable channel from a large scale base station, some level of obstruction might be created by the femtocells, decreasing the execution of the general system.

2) Base stations meddling with femtocells on a similar recurrence: Again, when the large scale system is working on an indistinguishable channel from the femtocell or femtocells, obstruction might be cause between the two.

3) Closely dispersed femtocells meddling with each other: If various femtocells are introduced near each other they will have a level of foundation clamor that will lessen the affectability of each femtocell.

4) User hardware transmitting with an adequately high power to such an extent that it is gotten by more than one base station: Even however the scope inside structures is poor and by induction the level of flag from the mobiles achieving the base stations from inside structures will be lessened, there will at present be motion from mobiles speaking with a femtocell that may achieve the base station. This will build the general level of clamor got by the base station.

Every one of these situations result in impedance that can bring about issues which can bring about a debasement of the level of administration. While impedance can be an issue inside typical full scale cell organizes, the circumstance is more intense when utilizing femtocells due to the way that they can be sent in a specially appointed manner without the system arranging that would ordinarily be embraced.

A. Solution to Interference Problem

Inperspective of the way that there are an assortment of types of femtocell impedance that emerge, various distinctive arrangements are required. Concentrates that have been embraced have concocted various strategies to decrease the execution debasement to underneath worthy levels. These are as of now being brought into the current femtocells being produced

1) Adaptive Pilot Power Control: Using this plan the femtocell recognizes the signs from encompassing cells and progressively changes its own transmitter control while as yet expecting to keep up its own particular scope zone.

2) Dynamic femtocell collector pick up administration: all together that femtocells can palatably work with mobiles, or client gear that are close to the femtocell or at a more prominent separation, an attractive type of programmed pick up or weakening much be introduced. This will empower the mobiles to work without expanding their transmitted yield control any more than is completely important. This will keep any expansion in commotion and obstruction to a base.

3) Mobile telephone uplink control topping: It is conceivable to top or farthest point the most extreme power yield of a portable when working in the femto condition. This guarantees the telephone will hand off to the large scale organize before its transmitter control ascends to a point where it adds commotion to the full scale arrange.

4) Extended femtocell collector dynamic range: so as to guarantee that femtocell outlines can work dependably even within the sight of adjacent high power cell phones associated with the large scale arrange, it is important to guarantee that their recipients can work within the sight of other exceptionally solid signs. To accomplish this, they need a high element extend. To guarantee they meet the required standard the significant test has been fused into Release 8 of the 3GPP benchmarks as 25.104.

Despite the fact that femtocell obstruction is an issue that should be tended to and remembered, there are techniques that have been created to defeat it. The femtocells being produced and conveyed have a few strategies for decreasing and overcoming the femtocell impedance issues that are probably going to happen. Therefore, it is foreseen that it is probably not going to be the issue many thought it could be.

V. FEMTOCELL HANDOVER

Handover is the method by which a cell phone shifts between different call sites in duration of a phone call, on going in both directions with seamless audio. One of the most difficult aspects of mobile phone systems. Femtocell users need this capacity when moving in or leaving their area– may be a rare use case, but essential regardless.

Femto devices do not deploy soft handover, nonetheless of the technology of radio implemented. Alternatively, all calls are shifting suddenly from or to the Femtocell and to the outdoor cellular network. This is known as “hard handover” which would generally not be audible or visible to the caller.

TheThe frameworks of 3G and 2G from the regular system of versatile exist together, which is same with UMTS and GSM, and after that likewise can happen handover in the vicinity of 3G and 2G . Organize suppliers support to utilize frameworks of 3G because of an expansive limit of movement and less expenses. These frameworks are henceforth kept up to pick naturally 3G where their is great gathering is given, moving to 2G when out of scope – by and large either in outland range or inside building where 3G signals can't so effortlessly proceed onward (because of working at higher frequencies and giving less 3G summon destinations consequently being up and coming).

Numerous 3G Femtocells are additionally productive of 2G GSM gathering. 2G regularly drive in structures superior to 3G, it gives the Femtocell to quantify where it is (by perusing the cell site distinguishing proof on its communicate channel), infer some planning/timing reference (as one contribution to its planning calculation), and work out which 2G cell destinations may be most appropriate to handover to when a cell phone move out of the Femtocell zone. Apparently, these 2G cell site break down can then be transmitted to the cell phone as potential handoff competitors (known as the neighbor list), and be extent amid any dynamic bring on the off chance that a handover is required.The frameworks of 3G and 2G from the regular system of versatile exist together, which is same with UMTS and GSM, and after that likewise can happen handover in the vicinity of 3G and 2G . Organize suppliers support to utilize frameworks of 3G because of an expansive limit of movement and less expenses. These frameworks are henceforth kept up to pick naturally 3G where their is great gathering is given, moving to 2G when out of scope – by and large either in outland range or inside building where 3G signals can't so effortlessly proceed onward (because of working at higher frequencies and giving less 3G summon destinations consequently being up and coming).

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V. CONCLUSION

The Femtocell are reaching us soon..As their is an increase in number of high data rate applications and signal coverage is unsatisfactory it is enforcing femtocell adaptation..With a need of high quality network access and femtocell has a potential to provide this as well as having huge capacity gain these forces femtocell development.Although it is not going to be an outright success it is likely to be adopted in couple of years.Before quality of services and usability are adequate we will probably be needed number of hardware evolution .Femtocells are beneficial for urban user ,improving in house coverage especially in rural regions and increasing 2G and 3G coverage

Femtocell innovation is still in the beginning phase of improvement. Femtocells are presently an inside piece of the arrangement procedure for portable broadcast communications administrators. Not exclusively do Femtocells give additional points of interest to clients as far as better execution inside the home, or business office, yet they likewise gives the odds for extra administrations and the guarantee of modest charges. They additionally offer the change of merging where a unit telephone can be utilized rather than the landline and in addition for meandering. For specialist organization, they give a financially savvy way in which they can build their scope and increase additional income by the arrangement of outside administrations. In like manner, the utilization of Femtocells will turn into an inegeral part in the cell broadcast communications guide for the up and coming time.

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