Network Boosters in 4G LTE

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Abstract: Versatile systems have bit by bit advanced from 1980's till date to a level where the need of the general population request system of higher execution, higher limit and simplicity of getting to from anyplace on the planet. Because of this need of interest in the execution of versatile systems there are many reviews completed to discover the exit plan to surpass the points of confinement of the present system independent of the place from where it is gotten to. There is a fast progression in remote correspondence innovation giving the system benefits anyplace and at whatever time. 4G correspondence frameworks are being created to take care of the different issues the present correspondence frameworks (3G, 2.5G) are facing.4G will be a canny innovation that will decrease the quantity of various advances to a solitary worldwide standard. In this paper we give a general investigation of how to give better system administrations to the clients and fulfill their requirements. We talk about the innovations that exist in market and can be utilized to upgrade the system data transmission and execution of the right now living innovation in the market.

Keyword: Cognitive Radio, Femtocell, Bandwidth, Spectrum, 4G, 5G.

I. Introduction

The time of remote framework had progressed from 1980's. Directly in the present day we can see an all the more rapidly creating framework which is thought to comprehend the data correspondence with a speedier data rate and having far reaching framework scope around the globe. The season of remote framework started with unique (1G) towards 2G, 3G and 4G. A present survey in framework development advancement says that there will be enormous improvement in framework action by the year 2020. It is surveyed that number of supporters will create by 10 times and consistently there will be 100 times higher development in framework utilize [2]. There are more than 5 billion devices being utilized on the planet [1] and it is well ordered extending well ordered. The white paper report by Ericson shows that there will be an enormous advancement in number of contraptions which will challenge the correct now running framework to give a capable organization.

Without range, no remote media transmission or remote web administrations would be conceivable. Psychological Radio is not just a radio innovation; it likewise incorporates a progressive change in how the range is controlled. Intellectual Radio and 4G are two reciprocal advancements that will reframe the universe of remote correspondences. 4G systems utilizing subjective radios are an answer that alters the media transmission industry, essentially changing the way we plan our remote frameworks and administrations.
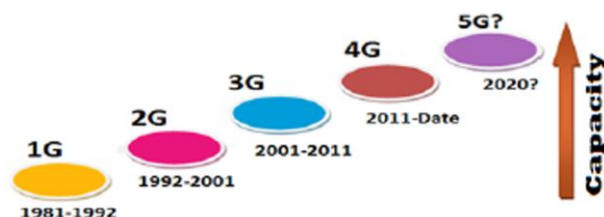

Figure 1: Evolution of wireless network

4G has dependably been assessed to bolster a wide and enhanced region of administrations and system scope in the method for correspondence. There are a few advances that are utilized to improve the transfer speed and range of 4G system to bolster an expansive number of gadgets to interface with the system. Some of them are, Cognitive Radio innovation, femtocell, MIMO, HetNet. Without range no web administrations or any correspondence administrations might be conceivable. The Cognitive Radio (CR) innovation is a progressive change of how the ranges are directed. It additionally demonstrates how adjustments should be possible in planning the specialized gadgets in a superior way. With 4G the subjective radio will set way to a smoother

period of remote innovation in future. Perfect CR is yet a test to be taken care of in next five years. The perfect or savvy CRs are the CR gadgets that will be able to take choices in view of their present circumstance. A few segments of perfect CR like are introduced in military supporter jammer, WLAN. Scientists have proposed another systems administration worldview: the subjective system [3], [4] which is prepared to do simple support and customary up degrees less depending on human mediations. It is said that the psychological systems are composed in a way that they can learn, think and recollect.

II. Methods

A. COGNITIVE RADIO (CR) TECHNOLOGY IN 4G

There is a vital part of intellectual radio innovation in 4G arrange. In this innovation a few associations can simultaneously give consistent administrations all through a vast geological territory. The specialist co-ops may initiate the intellectual radio innovation in their system to similarly circulate range [6] and activity productively. In 3G arranges there are a few benchmarks that disallow the system to wander comprehensively however because of intellectual radio innovation the 4G system is able to meander crosswise over internationally in different systems. As versatility administration bolster the correspondence foundation ought to be done through nonexclusive system interfaces and multimode terminals are utilized as a part of 4G frameworks for the same. The 4G frameworks don't require any additional range to be constructed. It can chip away at the beforehand manufactured range to give better administrations in a less expensive rate subsequently they can give more in less [5]. Henceforth, 4G has turned out to be better and less expensive as far as execution and cost than 3G.

Applications of Cognitive Radio
1) The CR innovation is utilized as a part of enhancement of interior systems which thusly understands the range shortage issues.
2) It leases itself to the heterogeneous correspondence systems, which envelops radio guidelines like BWA and WiMAX.
3) It can turn into an empowering influence for genuine heterogeneous situations where information relocation methods are executed to similarly share the range.
4) CR advancements are valuable for the inside streamlining of the systems, which are basic in unraveling the each genuine range asset shortage issue while the current 3G media communications systems are advancing to the all IP-based 4G media communications systems going for giving consistent, universal, end-toend, also, quality-ensured benefits inside a particular administrator and bearer.

B. USE OF FEMTOCELLS

Femtocell is a private cell which is little in size and goes about as a base station to extend and increment the banner quality and moreover helps in giving QoS at higher data rate. It is expected to use in minimal home or office circumstances [10], [11]. The femtocells use the present framework and the Femtocells Access Point (FAP) to give high data rate and more essential framework scope for smoother remote correspondence. An audit says that more than 23 % of calls and 90% of data is gotten to from indoor [8] and in view of poor framework scope the providers looses their customer base. To avoid this issue femtocells are used as they have updated restrain, higher banner quality, strong and exhaust less battery. It diminishes the cost of radio resources and BS structures [9] for the providers.

The femtocell innovation gives the better scope of system which for the most part utilized as a part of systems administration and makes them flawless of their scale.Femtocell has the higher ability to sort out the cell system and handle the network.In the type of versatile correspondence the femtocells innovation generally work for such a domain for creating the lower transmission control what's more, must be great quality.For the real handset sort the system must be give the draw out handset battery life.For the versatile client the Femtocell organize give the range anyplace to the versatile calling. The major advantage of this system is that it enhances the applicability of mobile phones.

B.1. Characteristics of femtocells [14]
- It gives scope at indoor where macrocells neglects to give scope.
- It is a superior answer for Fixed Mobile Coverage (FMC).
- It reuses the indoor ranges to improve the aggregate system limit.
- It devours less power.
- Reduces the utilization of radio assets.
- Provides better scope with dependable transmission.
- Another imperative trademark of femtocells is their capacity to control get to.

B.2. Interference of femtocells in 4G
There are only two categories of interferences in femtocells. They are:

i. *Co-layer:* this kind of interference happens when one femtocell interferes with another. This kind of situation arises due to low isolation among two apartments or when they are very closely built.

ii. *Cross-layer:* this problem arises due to interference of macrocells with the femtocells. This kind of problem occurs when the femtocell and macrocell users use the same frequency or same channel for transmission.
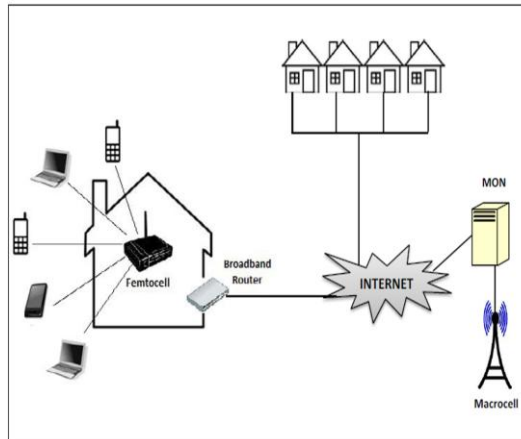

Figure 2: *basic architecture of femtocells*

As 4G gives better nature of calls and information rate to the clients consequently it needs solid system scope. Generally, the macrocells are utilized which now-a-days are not proficient to give the coveted administrations. The macrocells required an extensive number of base stations to give better scope which is unrealistic to set up in a populated zone. In this manner, we utilize femtocells for expanding the indoor scope of system in thickly populated territories [10].

B.3. TERMINOLOGY

FEMTOCELL TERMINOLOGY FOR 4G

General Terminology	3GPP Terminology
Femtocell or Femtocell Access Point (FAP)	Home eNodeB (HeNB)
FAP Gateway (FAP-GW)	Home eNodeB Gateway (HeNB-GW)
Auto Configuration Sever (ACS)	Home eNodeB Management System (HeMS)

Table 1: femtocell terminologies for 4G network.
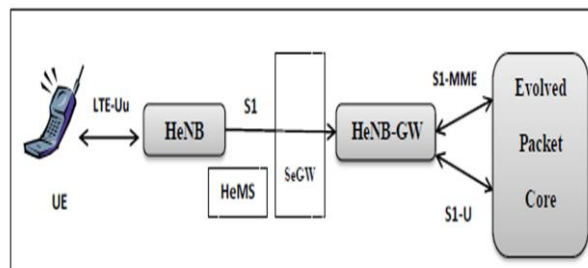
B.4. ARCHITECTURE

Figure 3: logical architecture of femtocell in 4G network

The logical architecture for 4G femtocell was proposed by the 3rd generation project partnership (3GPP). It is most similar to the LTE architecture but some more elements were added to it.

1) HeNB (Home eNodeB): it is a plug n play device that can be seamlessly used by users in the home or office environment.
2) HeNB-GW (Home eNodeB-Gateway): it maintains the core network functions like- security and control, aggregation, Authorization Authentication and Accounting (AAA) functions [12], [13].

3) HeMS (Home eNodeB Management Services): it permits the control and guide configuration of all HeNBs to the operator.
4) SeGW (Security Gateway): it is used in providing security to the network when a connection is established between HNBs and core networks.
5) S1 interface: the S1 interface is used to transfer data between HeNB and HeNB-GW during the communication with the help of IPv4 and IPv6.

B.5. ISSUES ANS CHALLENGES

1) Interference Issues: when the femtocells are developed the major issues with its implementation is it uses the same frequency band as that of macrocells which causes interference and degrades the performance of femtocells.

- Interference in femtocells due to the base stations are working on the same frequency.
- Interference in femtocells due to the base stations is having the same frequency.
- Interference occurred in femtocells when they are placed very near to each other.

2) Security: the security of data that is transmitted over the network is a major challenge.

- User Privacy: as a large variety of data is being transmitted over the communication network which is in a huge amount there is a need to provide security to these communications and prevent the data being monitored.
- Denial of service: as data is being transmitted or sent over a public network, there is a chance of attack that prevents the legitimate users to access the network.
- There is a chance that an unauthorized user accesses the femtocell and uses the services unlawfully.

III. Conclusion And Future Work

In this paper, we have examined about the remote systems that has advanced since 1980's till date. We have seen that, as the need of quicker system reaction from the suppliers are normal and requested as steadily we have created innovations and attempted our best to meet the same in time. Presently, we can extend the system ability to its most distant utilizing the current advances yet at the same time the development in the quantity of cell phones are expanding exponentially are there are more refined advances to be created to meet the same in not so distant future. Extending our work to upgrade the system limit in future may prompt the utilization of 5G system, as there are difficulties and issues in the current system which might be nullified in the up and coming system innovation.

References

[1] Ericsson White Paper (2013) 5G radio access.
[2] Raaf B., Tiirola, E., Marsch P., Wichman R., (2011) Vision for Beyond 4G Broadband Radio Systems 22nd *International Symposium on Personal, Indoor and Mobile Radio Communications* IEEE pp 2369 - 2373.
[3] D.D Clark, C.Partige, J.C. Ramming, J T Wroclawski, "A knowledge plane for the Internet", in:Proceedings of the SIGCOMM 2003, Karlsruhe,Germany, and August 25-29, 2003.
[4] Q, Mahmoud, Cognitive Networks-Towards Self-Aware networks, John Wiley and Sons, 2007, ISBN9780470061961.
[5] A.H.Khan, M.A.Qadeer,J.A.Ansari,S. Waheed, "4Gas a Next Generation Network", *International Conference on Future Computer and Communication*, 2009
[6] Jivesg Govil,Jivika Govil, " An empirical Feasibility Study of 4G's Key Technologies", 978-1-4244-2030-8/08/2008 IEEE
[7] IEEE 802.22 Working group, WRAN Reference Model, Doc Num. 22-04-0002-12-0000.
[8] Yidan Zhuang, Su Zhao and Xiaorong Zhu, "A New Handover Mechanism for Femtocell-to-Femtocell" IEEE communication magazine, 2012.
[9] Shih-Jung Wu ,"A New Handover Strategy between Femtocell and Macrocell for LTE-based Network" IEEE 4th International Conference on Ubi-Media Computing, 2012.
[10] Muhammad Farhan Khan, Muhammad Imran Khan, and Kaamran Raahemifar"Local IPAccess (lipa) enabled 3g and 4g femtocell architectures" ,IEEE CCECE 2011 – 001052.
[11] Mohammed Jaloun, Zouhair Guennoun "Wireless mobile evolution to 4G networks," Wireless sensor network,2010,2,309- 317.
[12] Muhammad Farhan Khan, Muhammad Imran Khan, and Kaamran Raahemifar"A Study Of Femtocell Architectures For Long Term Evolution(LTE)-Advanced Network" ,IEEE CCECE 2011 – 000817.
[13] Douglas N. Knisely, Airvana, Inc., Frank Favichia, Alcatel-Lucen "Standardization of Femtocells in 3GPP2"IEEE Communications Magazine ,September 2009.