Five Distruptive Technologies in 5G

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***Abstract* - As the cellular technology is growing at a rapid pace, users always seek for a set of appropriate packages all together, including all the current features in use. Hence, the search for a new technology is always the main concern of the foremost cell phone companies to out innovate their competitors. The main purpose of the fifth generation wireless technology (5G) is formulated to design the ultimate wireless world that is free from limitations and impediments of the previous technologies. 5G technology will mend the way most users access their mobile networks. So, this paper presents the evolution of 1G (First Generation) to 4G yielding 5G, introduction to 5G technology- its need, advantages and architecture.**

Keywords: 5G, BDMA(Beam Division Multiple Access)

I. INTRODUCTION

In this modern world, we cannot think a single day without smart gadgets like mobiles, tabs. Communication makes our life comfortable and simple. The Modern world is being shortened due to the development of the technology. During the past few decades, the world has seen astonishing changes in the telecommunication industry due to advancement in the science and technology. Wireless and mobile communication technologies have been mass deployed, such as Long Term Evolution , 3G like CDMA2000, 4G, Wi-Fi, WiMax , personal area networks, Bluetooth, ZigBee and sensor networks. The Mobile terminals include various interfaces, such as GSM, the most effective technology that is going into its decade of existence. The cellular technologies differ from each other based on the four main aspects: 1 switching schemes, 2 bandwidth, 3 data rates and 4 radio access. Such differences have been noticed in all the previous wireless generationsThe most advance cellular technology in the coming years might be 5G. Mobile phones in 5Gare configured to use very high bandwidth and are packet switched based wireless system. Area coverage under 5G is very large and throughput of the system is also very high. 5G technology uses CDMA (code division multiple access) and BDMA (beam division multiple access) that enables data rate greater than 100 Mbps at full mobility and higher than 1Gbps at low mobility. 5G includes some advance features like it is the most powerful and high demanding in the near future. By this time following features of the 5G technology have come to existence- High resolution for extreme mobile users, higher data rates and Quality of Service (QoS), bidirectional high bandwidth [4]. Now a day all the wireless and cellular networks are forwarding to all-IP network principle, means all data and signaling will be transferred to network layer via Internet Protocol.

II. ARCHITECTURE

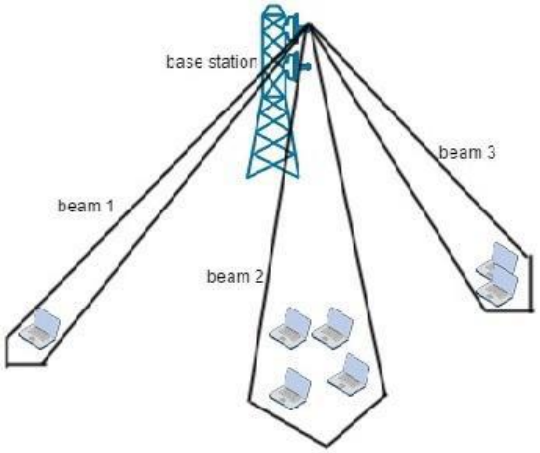
Fig 3.1: 5G mobile phone design

Fig.3.1 shows 5G mobile phone design. [12] 5G is being developed to accommodate the QoS and rate requirements set by forthcoming applications like wireless broadband access, Multimedia Messaging Service (MMS), video chat, mobile TV, HDTV content, Digital Video Broadcasting (DVB),[18] minimal services like voice and data, and other services that utilize bandwidth. The definition of 5G is to provide adequate RF coverage, more bits/Hz and to interconnect all wireless heterogeneous networks to provide seamless, consistent telecom experience to the user

BEAM DIVISION MULTIPLE ACCESS

Beam Division Multiple Access (BDMA) is the latest allocation technique in which an orthogonal beam is allocated to each mobile station. According to BDMA concept, the antenna beam is divided and allocated to the locations of the mobile stations to provide multiple accesses in order to increase the capacity of the system. As mobile stations and the base stations are in Line of Sight, both can transmit beams that directed to each other's position for proper communication, and reducing interference. But when the mobile stations are positioned at different angles compared to the base station, the base station will transmit beams at different angles.

Fig: BDMA



III. RELATED WORK

"A Study on 5G Evolution and Revolution" paper by Priya Goyal ,Avtar Singh Buttar gives the complete survey on the 5g technology and its evolution and limitations. It also gives the advantages of 5g. It compares this technology with previous cellular technologies. It provides maximum throughput and other requirements of 5g technology

IV. METHODOLOGY

DEVICE-CENTRIC ARCHITECTURES: Cellular designs have historically relied on the axiomatic role of "cells" as fundamental units within the radio access network. Under such a design postulate, a device obtains service by establishing a downlink and an uplink connection,carrying both control and data traffic, with the base station commanding the cell where the device is located. Over the last few years, different trends have been pointing to a disruption of this cell-centric structure:

MILLIMETER WAVE COMMUNICATION:
Microwave cellular systems have precious little spectrum: around 600 MHz are currently in use, divided among operators. There are two ways to gain access to more microwave spectrum: To repurpose or *refarm* spectrum. This has occurred worldwide with the repurposing of terrestrial TV spectrum for applications such as rural broadband access. Unfortunately, repurposing has not freed up that much spectrum, only about 80 MHz, and at a high cost associated with moving the incumbents. To share spectrum utilizing, for instance, cognitive radio techniques. The high hopes initially placed on cognitive radio have been dampened by the fact that an incumbent not fully willing to cooperate is a major obstacle to spectrum efficiency for secondary users.

MASSIVE MIMO:
Massive MIMO (also referred to as "Large-Scale MIMO" or "Large-Scale Antenna Systems") is a form of multiuser MIMO in which the number of antennas at the base station is much larger than the number of devices per signaling resource. Having many more base station antennas than devices renders the channels to the different device s quasi-orthogonal and very simple spatial multiplexing/de-multiplexing procedures quasi optimal. The favorable action of the law of large numbers smoothens out frequency dependencies
in the channel and, altogether, huge gains in spectral efficiency can be attained
In the context of the Henderson-Clark framework, we argue that massive MIMO has a disruptive potential for 5G:
At a node level, it is a scalable technology.
This is in contrast with 4G, which, in many respects, is not scalable: further sectorization there in is not feasible because: There is limited space for bulky azimuthally directive antennas. There is an inevitable angle spread of the propagation; in turn, single-user MIMO is constrained by the limited number of antennas that can fit in certain mobile devices. In contrast, there is almost no limit on the number of base station antennas in massive MIMO provided that time-division duplexing is employed to enable channel estimation through uplink pilots.

SMARTER DEVICES:
D2D: In voice-centric systems it was implicitly accepted that two parties willing to establish a call would not be in close proximity. In the age of data, this premise might no longer hold, and it could be common to have situations where several co-located devices would like to wirelessly share content (e.g., digital pictures) or interact (e.g., video gaming or social networking).

LOCAL CACHING:
The current paradigm of cloud computing is the result of a progressive shift in the balance between data storage and data transfer: information is stored and processed wherever it is most convenient and inexpensive because the marginal cost of transferring it has become negligible, at least on wire line networks . For wireless devices, though, this cost is not always negligible. The understanding that mobile users are subject to sporadic abundance of connectivity amidst stretches of deprivation is hardly new, and the natural idea of opportunistically leveraging the former to alleviate the latter has been entertained since the
1990s. However, this idea of caching massive amounts of data at the edge of the wireline network right before the wireless hop only applies to delay-tolerant traffic, and thus made little sense in voice-centric systems. Caching might finally make sense now in data-centric systems.

NATIVE SUPPORT FOR M2M COMMUNICATION:

A massive number of connected devices: Whereas current systems typically operate with, at most, a few hundred devices per base station, some M2M services might require over 104 connected devices. Examples include metering, sensors, smart grid components, and other enablers of services targeting wide area coverage.
Very high link reliability: Systems geared at critical control, safety, or productions have been dominated by wire line connectivity largely because wireless links did not offer the same degree of confidence. As these systems transition from

wire line to wireless, it becomes necessary for the wireless link to be reliably operational virtually all the time.

Low latency and real-time operation: This can be an even more stringent requirement than the ones above, as it demands that data be transferred reliably within a given time interval. A typical example is vehicle-to-X connectivity, whereby traffic safety can be improved through the timely delivery of critical messages

V. CONCLUSION

3G- Operator Centric, 4G- Service Centric whereas 5G- User Centric. We have proposed 5G wireless concept designed as an open platform on different layers. The new coming 5G technology will be available in the market at affordable rates, high peak future & much reliability than preceding technologies

VIII. REFERENCES

[1] A Study on 5G Evolution and Revolution"paper by Priya Goyal ,Avtar Singh Buttar

[2] Millimeter-Wave Beamforming as an Enabling Technology for 5G Cellular Communications: Theoretical Feasibility and Prototype Results by Wonil Roh, Ji-Yun Seol, JeongHo Park, Byunghwan Lee, Jaekon Lee

[3] Five Disruptive Technology Directions for 5G by Federico Boccardi, Robert W. Heath Jr., Angel Lozano, Thomas L. Marzetta, Petar Popovski

[4] Jeffrey G. Andrews, Stefano Buzzi, Wan Choi, Stephen V. Hanly, Angel Lozano, Anthony C. K. Soong, Anthony C. K. Soong, Jianzhong Charlie Zhang, " What Will 5G Be?," in Vol. 32, No. 6, IEEE Journal on selected Areas in Communications, JUNE 2014.

[5] Dr. Anwar M. Mousa, "Prospective of Fifth Generation Mobile Communications," in Vol.4, No.3, International Journal of Next-Generation Networks (IJNGN) ,September 2012

[6] Chen,YP;Yang,YH(2007), "A new 4G architecture providing multimode terminals always best connected services," in Volume: 14 Issue: 2 pp. 36-41 IEEE Wireless Communications