International Journal of Engineering & Technology, 7 (2.13) (2018) 62-66

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research Paper



Emerging trends in mobile technology: a 5g perspective

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Abstract

Fifth Generation technology is proposed to be launched in India around 2020 and it is estimated to resolve the technological barriers to 4G technologies. The increased use of digital technology in all spheres of life has necessitated the use of efficient and reliable mobile communications. 5G has advantage over 4G in optimum use of technology. The paper discusses the legal and regulatory issues, feasibility in rural areas and architectural framework. The article highlights about the proposed 5G Architecture requirements, need of 5G, its launch in India and other suitable innovative technology that will suffice 5G operations smoothly. The article is basically written as a twofold. Extensive literature reviews on past studies of 5G and its assumed to be architectural features in near future are discussed based on current technological trends, innovations. Moreover, it is a descriptive and conceptual perspective. It is purely based on secondary data available in Internet and various other topic related research article publications. Lack of empirical data and 5G is not officially released worldwide, but except in some countries, it is given on a basis of beta testing unit. Practically 5G Mobile Technology will be launched in India around 2020 and only after that, comments would be taken into account. This paper discusses vividly about 5G penetration in rural India and its use in Big Data Analysis as small-scale cells called Heterogeneous networks.

Keywords: 5G; Mobile Technology; Networks

1. Introduction

Technology has galloped many horizons of difficulty, ambiguity and complexity. In today's alienated and fragmented world; whatever we do or everything we go for finally starts and ends up in technology. It gives light to the darker aspects and side of doing any activity. Any domain wherever we may opt for such as be it Banking, FMCG, Automotive, Electronics, Education and Computer Services sector; it is the technology which rules the world of doing any business at ease. Technology bolsters the contours of our civilization.

When technology marches towards any unprecedented places of the world by make it simpler to access, convenient, handy and haulable to use is called mobile technology. Mobile Technologies have left behind many age old, disruptive technological legacies to come up with new trending and portable technologies for a gamut number of tasks. Centuries, years and decades have passed but mobile technological renovations happen to roll on the obsolete technology with the new one. It makes the communication in remote areas much freely. Mobile Technology has given voice to those otherwise that are trapped with disastrous event from the world. We have comrades who are truthful and loyal without knowing them personally. It is the mobile technology, which acts an enabler to know the unknown comrades through various e-chat and social media platforms. Wars, army, military and regiment base which seems to be devoid of major connectivity; where mobile technology is the key to unlock all the facets of communication with near and dear ones. Mobile Technology sprinkles joy & laughter to those unconnected in the uncovered areas of technological radar. It makes every possible of doing daily routine activities much faster and easier. With the advancement of technology, 5G makes payments, browsing, surfing, listening to songs, buffering of bandwidth without any interference but of course there are minor distortions in signal, connectivity, etc. to some extent.

The name itself categorizes to laptops, palmtops, notebooks, global positioning devices (GPS), debit/card payout terminals, wireless fidelity, and hotspots. Portability, reliability and smartly being able to wrap up work, tasks, routine tasks in anywhere of the unperceived corner of the world is known to be mobile technology of the 21st century. Mobile Technology has touched in all sectors of everyday life like education, healthcare sector, transportation, restaurant, etc. In educational sectors, mobile technology is simpler the forerunner where students can access learning content from anywhere in the world. With the help of cloud, remote computing, video-conferencing; clarification of doubts, concepts on any subject is just a click away. App based technology driven learning's make teaching more interactive. Mobile Technology seems to change the aura from simple education to E-education, where teachers role have changed from carriers of knowledge to facilitators of learning. Students learn while they play even. Learning is fun and interesting in these technologies. Foreign countries have deployed students to bring their own devices (BYOD) to speed up their use of leanings. Health care industry has been revolutionized by technological advancement but yet its legacy, nuances, paper-pushing and archaic procedures do exist even today. Philips Vital Signs camera (measures heart and breathing rate), Skin Scan (measures the risk of skin cancer from your iPhone) and Alive Cor (measures the heart rate from your phone) are some of the recent advances in healthcare industry. A big boom is in transportation sector where ticket booking and cancellations-catering procurement, live tracking systems are some of the latest technological innovations. The introduction of application based cab services like Ola, Uber has added colors to any one's difficulty of finding out drivers or cars for their own or business purposes. Zomato, Trip advisor, Makemytrip are the 5th

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generational wanders to serve the credentials of hotels, travel, restaurants and their ratings.

2. Overview

The current scenario is still using 4G LTE mobile technology and 5G mobile technology has not seen the light of the day.5G would answer all the questions pertaining to the heavy weight users of cellular mobile phones. The horizons of 5G would definitely be widened from the problems faced by 4G LTE consumers [1], [2]. The private and public use of 5G mobile technology would be put in reality in around 2020.Many companies embark upon network operators to mix spectrum with disparate radio frequency bands to propel bandwidth and data rates [3]. High data rates, easy synchronization, unlimited buffering are the features of the 5th generational technology. The concept would be based on 4G LTE network technology but would engulf all obsolete, errors present in previous networks to go for the new one [4], [5]. Technology has got a new name which is actually in the form of 5G mobile technology. Although 5G is not yet released but in some foreign countries like UK,US;it is given out on a beta testing license. Evolution from 1G to 4G had seen number of changes but 5G associates phenomenal and revolutionary technological advancement in terms of reliable broadband connectivity, buffering, documentation and supporting E-Payments,E-transactions. Recent advances in research from fifth generation mobile technology focuses on World Wide Web (WWWW),Dynamic Adhoc Wireless Networks (DAWN),Real Wireless World, Voice Over IP. It is presumed that 5G will entail and fix the bugs which were present in 4G LTE networks like switching to more than one networks.5G is said as to be from IEEE point of view will cover IPv6 and flat IP architecture formats [6], [7]. Generational use of Long Term Evolution has crossed all the boundaries. The center of attraction is 5G mobile technology. With a rapid increase in mobile traffic from 2011 to 2015;5G would be the viable solution for the bandwidth-craving consumers who always demand for faster data access. Research work says that the future of wireless mobile technology would be categorized on a twofold factor such as rate of data and efficiency. Mobile Techie stalwarts like Qualcomm & Siemens are planning to push forward the technologies that cater and sustain the mobile traffic conundrum in a smooth way. Assumption would envisage that 5G would be consisting of various interlinked connections starting from-MAN,WAN,LANtoWPN, Remote Sensing & thereby providing adequate latency,bandwidth,throughput,connectivity [8].

3. Concept

Historical developments stem from 1G to 5G, which are enlisted in the below mentioned. (Table1)

Table1: 4.Differential Technology Advancement View from 1g to 5g

Technology Features	1G	2G	3G	4G	5G
tart/ Deployment	1970 – 1980	1990 - 2004	2004-2010	Now	Soon (probably 2020)
ta Bandwidth	2kbps	64kbps	2Mbps	1 Gbps	Higher than 1Gbps
echnology	Analog Cellular Technology	Digital Cellular Technology	CDMA 2000 (1xRTT, EVDO) UMTS, EDGE	WiMax LTE Wi-Fi	WWWW(coming soon)
Service	Mobile Telephony (Voice)	Digital voice, SMS, Higher capacity packetized data	Integrated high quality audio, video and data	Dynamic Information access, Wearable devices	Dynamic Information access, Wearable devices with AI Capabilities
Multiplexing	FDMA	TDMA, CDMA	CDMA	CDMA	CDMA
Switching	Circuit	Circuit, Packet	Packet	All Packet	All Packet
Core Network	PSTN	PSTN	Packet N/W	Internet	Internet

Probably the deployment of 5G mobile technology as a service to the consumers would be done around 2020 or 2022 in India. Assumed research suggests that 5G networks would use flat IP concept for better accessibility of a new RAN to shift to a Nano Core network. Nanotechnology as a defensive tool for security concern is the fundamental principle governing the blueprint of flat IP network. To make 5G service instantly available for open access applications; operators are slowly and steadily moving towards flat IP networks. The architecture of flat IP networks builds a pseudo way to recognize devices using names comprising of symbols unlike the conventional IP address architecture. The conceptual and assumed pictorial review of 5G model has been shown in Figure 1.

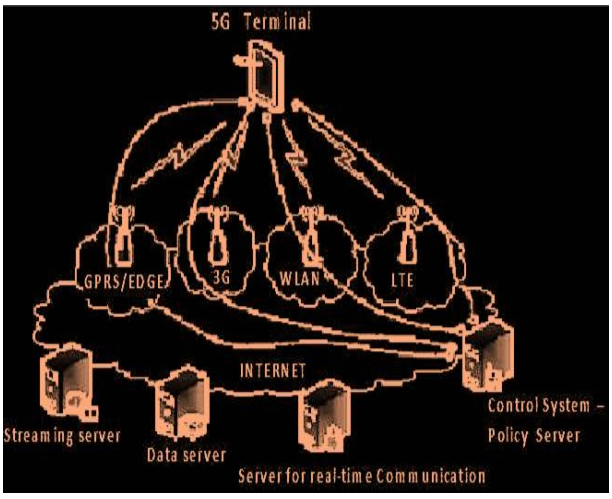


Fig. 1: (Patil, 2013).

Flat IP networks would make the flexibility index of mobile operators soar high enough by lowering the number of network elements and thus resulting in low costs & capital expenditure. Decoupling the cost of delivering service from the volume of data to align infrastructure, latency minimization, stabilizing applications with a very low tolerance level. With the involvement of radio access, packet core, flexible core network; will create a competitive market for competitors to vie for. Voice centric hierarchy gets eradicated

out where there is no delay of packet data core for a voice network but flat IP network would provide a separate data architecture that will filter out multiple distorted network elements from a group of networks depicted in figure 2:

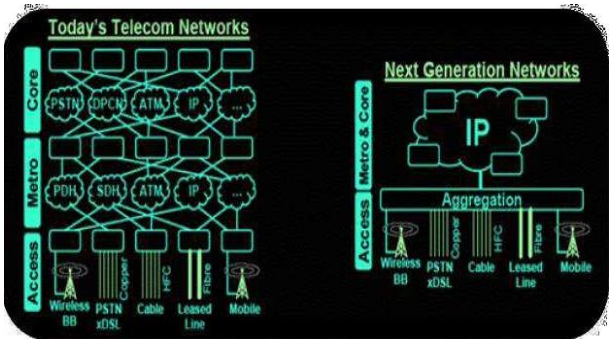


Fig. 2: (Patil, 2013).

4. 5G Architectural Features:

5G architectural features ensembles the mixture of Nano Core Technology, Cloud Computing and All IP Platform. (Figure 3).

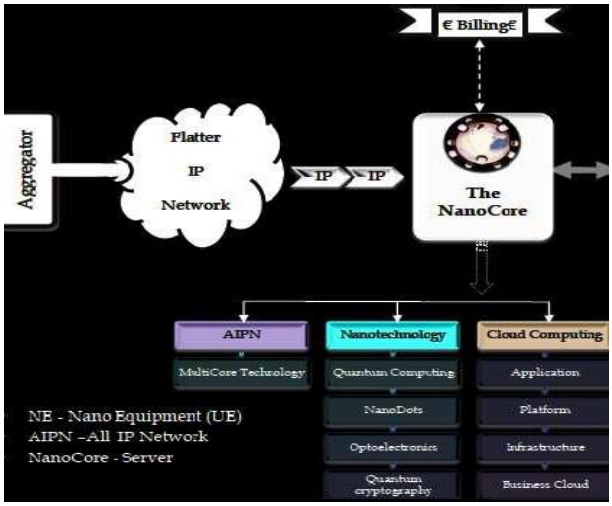


Fig. 3:

The trio of science, technology and engineering which makes use of Nano scale is all about of 0 to 100 nanometres.Molecular Nanotechnology (MNT) has got interlinked with each particle by particle, atom by atom and molecule by molecule engineering. Focus and attention would be more on sensor at the same time, also on security. Self-Technology would be garnered to 5G networks, which would be having intelligence according to surrounding environment, portability of devices. This will create a strong sensing, computing and communicating without any interference. Several newly invented mechanisms like self-cache cleaning, self-power battery, sensing the type of weather (environment),flexible cellular mobile phones (bend but not break) and being used as a mirror to see through Nanotechnology.

A technology that basically makes use of Internet as well as a remote server, which is centrally located, anywhere outside to manage data and applications is known as to be cloud computing. The remote server located centrally outside would be the crux of the information content from 5G perspective. This technology is user-friendly as consumers and employers are free from installation, operational and maintenance costs. One of the similar contents is Nanocore Technology where a user tries to use his or her own access from a central content provider through this technology. Cloud computing heavily depends upon the networks, thereby highlighting the importance of the former. Clod computing would bring down the capital expenditure of 5G.This needs good, reliable and high security driven mobile operators who have got excellent efficacy in handling it.Operators have the capability to create the new aura of market, find out new value added services by combining industrial content and applications in the digital supermarket model.5G networks would be more secure and reliable. This is possible through the help of Quantum Cryptography. Nanocore Trademark Technology accompanied by 5G would minimize resource cost and pay only for what has been used.CCR mixed with Reconfigurable Multi-Technology core for increasing various radio access strength. Applications which are completely based upon demand software services platform such as Net Suite ,Amazon,Google,Microsoft continue to have highly developed, synchronized interfaces from where users can have access through centralized servers. Robust & Effective infrastructure is the ultimate figurehead for implementing 5G mobile technology.

Optimized costs, all over mobile 24*7 seamless access, more developed user interface, curtailed system latency, decoupling of radio access & core network evolution are the some advantages of using Flat IP architecture, which is the brainchild of 3GPP system. While using this; the concept of BDMA (Beam Division Multiple Access) comes into picture. (Figure 4)

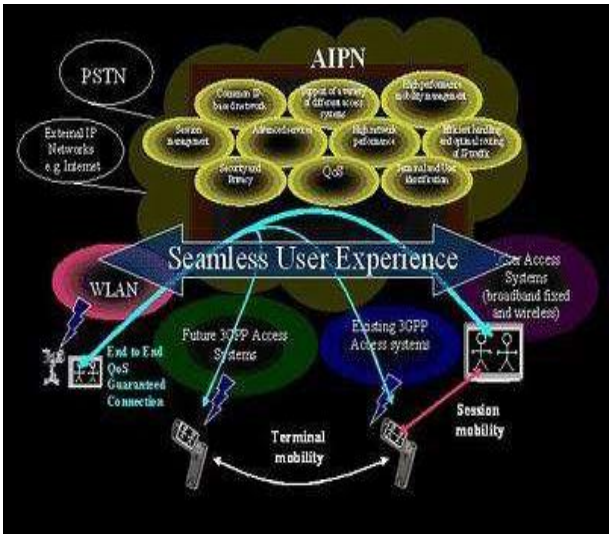


Fig. 4:

Many Korean researchers have predicted and suggested BDMA (Figure 5) as a radio interface for 5G platforms. When an originating station starts communicating with the destination stations, an orthogonal beam is assigned to each mobile station.

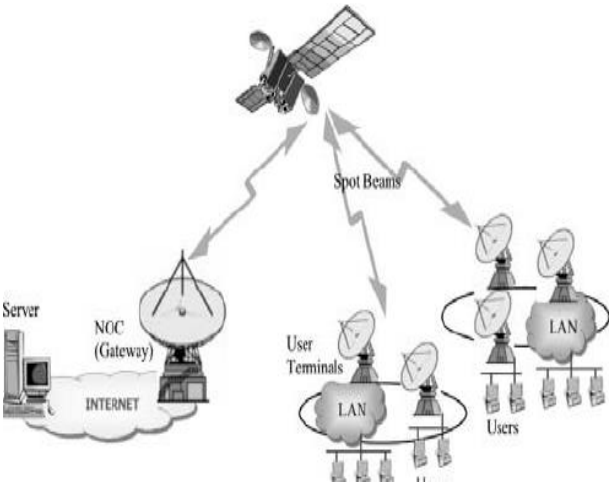


Fig. 5:

The BDMA technique as such divides the whole antenna receiving signals on the basis of mobile station locations to go for multiple accessibility and simultaneously expanding the volume of the system. Both the system station i.e. mobile and base know each others

position so that transmission is an easy go towards each respective stations without any distortion, noise entering to it at the cell-edge. When both stations do not know each other others position then base one transmits to respective angles. Exclusive beam is not used but instead splitting is done which ultimately does make use of orthogonal resources.

The various other different standards, which are enabled such as 1S/95,EVDO,CDMA2000. In between operation ability processes criteria, mechanisms that accept both terminal & RMTC to select from heterogeneous access systems. This is because the heterogeneous networks are small cells. With the use of these small cells, spectral efficiency is increased through frequency reuse while transmission of power is low as power lost through propagation can be lowered. Small cells such as macro, pico and femta have different flavours.Low femta cells are used in residential areas and enterprise systems where as higher ones are used for wider coverage. This would be taken into consideration due to flexibility of coverage and improvisation of spectral frequency. Challenges are like no-coordination between WLAN,inter-cell interference (unplanned ,unmatched) and no effective medium access control are yet to thought with possible solutions.

Software Defined Networking (SDN) has gathered a lot of attention since its inception from Stanford University Open Flow System, which gathers low-level information abstraction to flow into virtual services. This also has some fallacies like no correct definition of how to write the correct execution code and maintaining it.Massive Multiple Input /Multiple Output (MIMO) allows for high resolution beam to pass in one direction and 3D MIMO in both horizontal and vertical direction. The purpose of using this for high-energy efficiency but low power consumption through antenna. But this has not seen the light of the day because of its complexity of building algorithms, pilot contamination and knowing the channel or medium to be through is still yet to be worked upon. Assumed Diagrammatic Representation of 5G architecture is shown in Figure 6

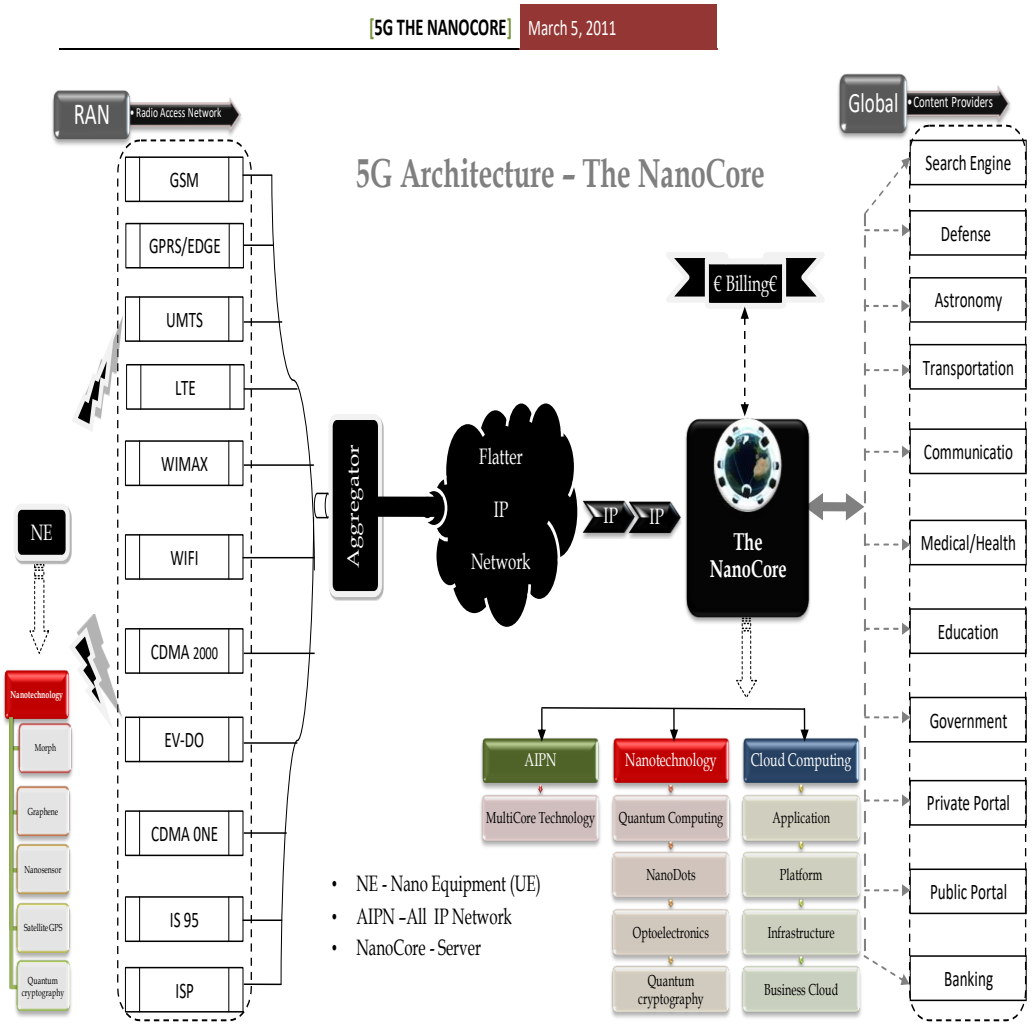


Fig. 6:

5. Legal & regulatory framework for 5g use in India

Since 4G and 5G had some loops due to network traffic, India will need to pay attention and focus in building secured, safe and robust networks to support this.5G comes in the category league of CDMA, LTE,GSM, Broadband. So, matching of spectrum with dual bands like 800,700,1800 is a must where both licensing, unlicensing of TD-LTE and FD-LTE technologies must be present. The quest of using 5G is for industrial purposes where real time applications would just be a cakewalk for consumers. Morever Smart city and Digital India projects will bolster the accessibility of 5G.As India is a competitive, complex oriented technology market; a lot of innovation & development needs to be categorically done on Radio frequency access of R & D.900 billion subscribers are going to be 1.4 billion by 2022.One such development can happen through able carrier aggregation where the ominous is on with the ecosystem partners. For this base and device eco-system has to be there. Leveraging is another idea, which the Indian Telecom Operators

can embark upon. Small cells (HE-NETS) can be utilized in macro-micro layer but there is still obstruction with the intent of focus on green building; more reflection of glass. So it is cumbersome to have good penetration from outside as of only indoor solution is the most way out so far.

6. Feasibility of 5g in rural areas in India

The respective state and central governments should take the full responsibility to upgrade to some extent of technology in rural areas where nothing can be reached. Millimeter waves can be utilized as feasible solution for penetrating into rural areas of India, which can travel, more than 10km from the respective transmitter station. Until now, millimeter waves have been used for seamless broadband Internet service through fixed wireless in which information travels between the two stationary points but this has never been used in cellular communication. When waves are released from transmitting stations, they might get absorbed by molecule in the air and could not go into the required rural areas. Natural Calamity like rain, thunderstorms would also shorten the length of waves. For this solutions have to be taken out.

Big Data Analytics would cater a number of problems and solutions as a 5G perspective. Firstly Infrastructure should be robust, universal and strong to support the implementation of Beam Division Access (BDA).Convergence of cloud computing, SDN, Network function virtualization to provide a solid platform for case of BDA through 5G.Make of informed decisions and intelligence extraction is a non-trivial task; which is possible when cellular network operators of various customer networks access data to reduce the churn rate.

5G mobile technology have many got features (proposed) to be unlocked and looked after using 4G-LTE platform. They are as follows:

- Offers transporter class gateway with excellent consistency.
- Multifaceted access and portability.
- Quality is high because of tolerance level of error is maximum.
- High Speed, Gigantic Capacity and Optimization of Cost.
- High multiple connections at a single time (65,000 aprox.)
- Supports interactive multimedia applications, bi-direction, and accurate data traffic statistics.

7. Conclusion

The world beckons about the official launch of 5G mobile technologies, as that will silence the critics who are still passing through the fallacies of 4G LTE networks.5

G would be the befitting answer for all heavy mobile phone users where there are already complains of mobile traffic, slowing of buffering bandwidth, multiple connectivity. Perhaps 5G being regarded as small heterogeneous networks. Being small it has very bandwidth latency, efficiency and thereby consuming less power, which is a great asset for all the daily users of mobile data. Networks infrastructures have to be stronger, reliable, and robust in order to facilitate the smooth execution of 5G mobile technologies in India.

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