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A NEW ERA OF FIFTH GENERATION COMMUNICATION TECHNOLOGY

B Dodda Basavanagoud[1,] Geetha H Y[2], K Raghavendra Prasad[3], Shambulingana Gouda[4], Sharanagouda V Patil[5], Veera Reddy[6]

[1,3]Assoc. Prof, [4]Asst. Prof, Dept. of EEE, RYM Engineering College, Ballari, Karnataka, India
[2]Asst. Prof., Dept. of E&CE, Ballari Institute of Technology & Management, Ballari, Karnataka, India
[5,6]Asst. Prof, Dept. of E&CE, RYM Engineering College, Ballari, Karnataka, India

ABSTRACT

5G simply stands for fifth generation and refers to the upcoming and latest mobile wireless standard based on the IEEE 802.11ac standard of broadband technology. This paper throws light on the Architecture of fifth generation technology. 5G is the proposed next telecommunications standards beyond the current 4G/IMT-Advanced standards, rather than faster peak Internet connection speeds. 5G planning aims at higher capacity than current 4G. This paper mainly focuses on all preceding generations of mobile communication along with fifth generation technology. Fifth generation network provide affordable broadband wireless connectivity (very high speed). The new 5th generation, 5G technology for cellular systems will probably start to come to fruition around 2020.

Keywords: 5G, 4G, RAN, Wifi, VoLTE, WLANIP

I. INTRODUCTION

5G falls broadly into two way of thoughts: a service-led view which sees 5G as a consolidation of 2G, 3G, 4G, Wi-fi and other innovations providing far greater coverage and always-on reliability and a second view driven by a step change in data speed and order of magnitude reduction in end-to-end latency. Wireless communication has started in early 1970s. In next four decades, a mobile wireless technology has evolved from 1G to 5G generations. Fifth generation technology offer very high bandwidth that user never experienced before. The Fifth generation technologies offer various new advanced features which makes it most powerful and in huge demand in the future.The future of mobile communications is likely to be very different to that which we are used to today. While demand for mobile broadband will continue to increase, largely driven by ultra high definition video and better screens, we are already seeing the growing impact of the human possibilities of technology as the things around us become ever more connected[1,2].

5G innovation will change the way in which cellular plans are offered around the world. Another unrest is going to start. The worldwide phone is around the corner. The route in which individuals are imparting will by and large overhaul. The usage of this contraption will doubtlessly advance a stage with enhanced and available network around the globe. 5G technology is on it s way to change the way by which most of the users access their handsets. Fifth generation technology provide facilities like camera, MP3 recording, video player, large phone memory, audio player etc. that user never imagine and for children rocking fun with Bluetooth technology and Pico nets.

The features and its usability are much beyond the expectation of a normal human being. With its ultra-high speed, it is potential enough to change the meaning of cell phone usability. Other significant features that fascinate people are more gaming options, wider multimedia options, connectivity everywhere, zero latency, faster response time, and high quality sound. 5G Technologies have an unprecedented capacity to bolster Software and Consultancy. The Router and switch innovation utilized as a part of 5G system giving high network. The 5G innovation conveys web access to hubs inside the building and can be sent with union of wired or Wireless connections. The present pattern of 5G innovation has a shining future [3].

II. 5G SPECIFICATIONS

The guidelines bodies have not yet characterized the parameters expected to meet a 5G performance yet, a few associations have set their own points that may eventually influence the final specifications.

Typical parameters for a 5G standards are explained in Table. 1.

TABLE I. Specifications of 5G

Suggested 5G Wireless Performance	
Parameter	***Suggested Performance***
Network Capacity	10,000 times greater than present network
Peak data rate	10gbps
Cell edge data rate	100 Mbps
Latency	< 1ms

III. RESEARCH & DEVELOPMENT TOWARDS 5G

There are several key areas that are being investigated by research organizations. These include:

A. *Millimetre-Wave technologies:* Using frequencies much higher in the frequency spectrum opens up more spectrums and also provides the possibility of having much wide channel bandwidth. For 5G, frequencies of above 50GHz are being considered and this will present some real challenges in terms of the circuit design, the technology, and also the way the system is used[5].

B. *Future PHY / MAC:* The new physical layer and MAC presents many new interesting possibilities in a number of areas like Wave forms, Multiple Access Schemes & Modulation etc.

C. *Massive MIMO:* Although MIMO is being used in many applications from LTE to Wi-Fi, etc, the numbers of antennas is fairly limited -. Using microwave frequencies opens up the possibility of using many tens of antennas on a single equipment becomes a real possibility because of the antenna sizes and spacings in terms of a wavelength.

D. *Dense networks:* Reducing the size of cells provides a much more overall effective use of the available spectrum. Techniques to ensure that small cells in the macro-network and deployed as femto cells can operate satisfactorily are required[4,11].

IV. 5G ARCHITECTURE

Architecture of 5G is highly advanced; its network elements and various terminals are characteristically upgraded to afford a new situation. Upgradeability is based upon cognitive radio technology that includes various significant features such as ability of devices to identify their geographical location as well as weather, temperature, etc. Cognitive radio technology acts as a transceiver beam that perceptively can catch and respond radio signals in its operating environment.

As shown in the fig.1, the system model of 5G is entirely IP based model designed for the wireless and mobile networks.

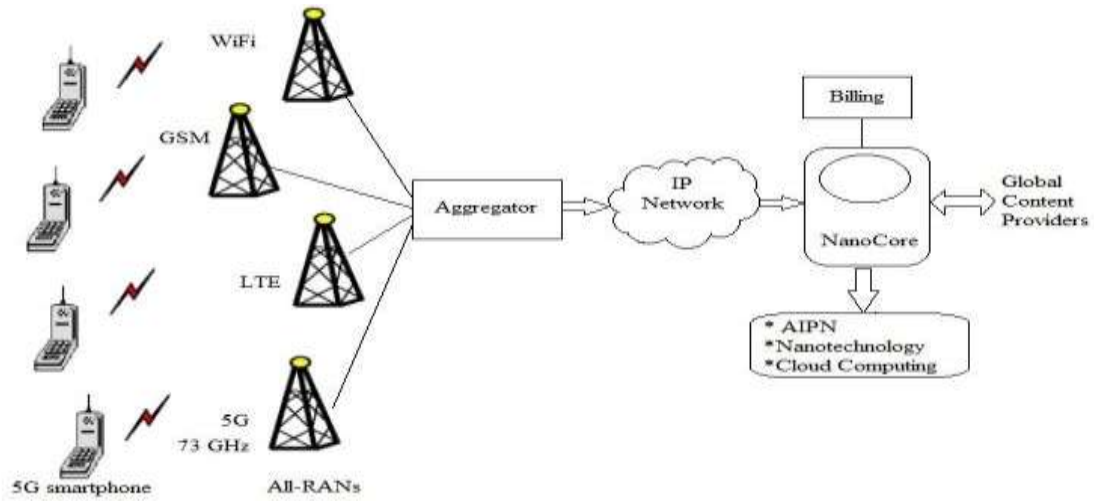

Fig.1 Architecture of 5G Technology

The system comprising of a main user terminal and then a number of independent and autonomous radio access technologies. Each of the radio technologies is considered as the IP link for the outside internet world. The IP

technology is designed exclusively to ensure sufficient control data for appropriate routing of IP packets related to a certain application connection.

Figure-1 depicts 5G network architecture. As shown 5G network uses flat IP concept so that different Radio Access Networks (RANs) can use the same single Nanocore for communication. RANs supported by 5G architecture are GSM, GPRS/EDGE, UMTS, LTE, LTE-advanced, WiMAX, WiFi, CDMA2000, EV-DO, CDMA One, IS-95 etc[6,7]. Flat IP architecture identifies devices using symbolic names unlike hierarchical architecture where in normal IP addresses are used. This architecture reduces number of network elements in data path and hence reduces cost to greater extent. It also minimizes latency. 5G aggregator aggregates all the RAN traffics and route it to gateway. 5G aggregator is located at BSC/RNC place. 5G mobile terminal houses different radio interfaces for each RAT in order to provide support for all the spectrum access and wireless technologies.

Another component in the 5G network architecture is 5G nanocore. It consists of nanotechnology, cloud computing, All IP architecture. Cloud computing utilizes internet as well as central remote servers to maintain data and applications of the users. It allows consumers to use applications without any installation and access their files from any computer across the globe with the use of internet[8-10, 13].

Table.2 shows the Comparison of 1G to 5G Technologies

TABLE II. Comparison of 1G-5G Technologies

Technology	1G	2G	3G	4G	5G
Deployment	1970/1984	1980/89	1990/2002	2000/2010	2014/2015
Bandwidth	2kbps	14-64 kbps	2 mbps	200 mbps	>1gbps
Technology	Analog Cellular	Digital Cellular	CDMP/ IP Technology	Unified IP & LAN/WAN/WLAN/PAN	4G+WWWW
Service	Mobile Telephony	Digital Voice, Short Message	Integrated High quality Audio, Video & Data	Dynamic Information access, Variable Devices	Dynamic Information access, Variable Devices with all capabilitie
Multiplexing	FDMA	TDMA/CDMA	CDMA	CDMA	CDMA
Switching	Circuit	Circuit for access air Interface	Packet for access air Interface	All packet	All Packet
Core Network	PSTN	PSTN	Packet Network	Internet	Internet
Hand off	Horizontal	Horizontal	Horizontal	Horizontal Vertical	Horizontal Vertical

V. 5G CHALLENGES

Challenges are the inherent part of the new improvement, we can be classified as

Technological Challenges

Common Challenges

A. **Technological Challenges:**

- *Inter-cell Interference* − It is one of the foremost technological issues that need to be resolved is variations in size of traditional macro cells and concurrent small cells that will lead to interference.
- *Efficient Medium Access Control* − In a situation, where dense deployment of access points and user terminals are required, the user throughput will be low, latency will be high, and hotspots will not be competent to cellular technology to provide high throughput. It needs to be researched properly to optimize the technology.
- *Traffic Management* − In comparison to the traditional human to human traffic in cellular networks, a great number of Machine to Machine M2M devices in a cell may cause serious system challenges i.e. radio access network RAN challenges, which will cause overload and congestion.

B. **Common Challenges**

- *Multiple Services* − Unlike other radio signal services, 5G would have a huge task to offer services to heterogeneous networks, technologies, and devices operating in different geographic regions. So, the challenge is of standardization to provide dynamic, universal, user-centric, and data-rich wireless services to fulfill the high expectation of people.
- *Sensing, Navigation & Communication* − these services largely depend upon the availability of radio spectrum, through which signals are transmitted. Though 5G technology has strong computational power to process the huge volume of data coming from different and distinct sources, but it needs larger infrastructure support.
- *Privacy & Security* − this is a standout amongst the most essential difficulties that 5G needs to ensure the protection of personal data. 5G should characterize the instabilities identified with security threats including trust, privacy, cyber security, which are developing over the globe [12-14].

VI. ADVANTAGES OF 5G OVER 4G

It takes quite a while to create, test and reveal another era of remote innovation. We are as of now anticipating the new advantages of 5G innovation in Wireless telecommunications. In spite of the fact that the Wireless industries will probably start taking off 5G innovation by 2020 and Some of the advantages of 5G over 4GG are recorded beneath.

- It provides faster data connections
- Low latency & High capacity
- More effective & efficient
- Most likely, will provide a huge broadcasting data (in Gigabit), which will support more than 60,000 connections

- Technological sound to support heterogeneous services (including private network)
- 1000x bandwidth per unit area
- Perception of 100 percent coverage.
- Innovation to assemble all networks on one platform.

VII. CONCLUSION

5G is the Fifth Generation technology. It has many advanced features potential enough to solve many of the problems of our mundane life. 5G include latest technologies such as cognitive radio, SDR, nanotechnology, cloud computing and based on All IP Platform. This forthcoming mobile technology will support IPv6 and flat IP It is expected that the initial Internet philosophy of keeping the network simple as possible, and giving more functionalities to the end nodes. It is beneficial for the government, as it can make the governance easier; for the students, as it can make available the advanced courses, classes, and materials online; it is easier for the common people as well, as it can facilitate them the internet everywhere.

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