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5G Future Wireless Communication Technology-A Survey

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ABSTRACT: 5G Technology is a fifth generation of cellular network, before the 5th generation there is an some evolutions of cellular network that are 1G, 2G, 3G, 4G and now 5G. After the each evolution there are some issues and challenges. 5G systems are built upon the evolution of existed technologies contribute extra features by new radio Frequency band such as 6 GHz.

In modern world, use of mobile devices and smart phone increasing very vastly and they need to communicate each other (Digital World). It needs huge size frequency band and adaptive network. The 5G has many advanced features that help to solve many problems in human life, like audio/video streaming, slow network connection, buffering and loading, mobility and switching network. This paper tries to clarify emerging technologies comparative study, revolution and evolution of the wireless network and existing research work in mobile communication is related to 5G technology.

KEYWORDS*:* 1G, 2G, 3G, 4G, 5G,6G,LTE.

I. INTRODUCTION

As the developing and growing technology new inventions and research are continuously done and it also need. After the 1G to 4G and 5G many improvements are done.5G fifth generation cellular network very clear that as compare to 4G, 5G will give better response in various factors like bandwidth, spectral efficiency, energy efficiency, etc. 1G-analog FM cellular systems in 1981.2G-digital technology in 1992, 3G in 2001, and 4G LTE-A Basically 5G is improvement over the 4G and 4G LTE as shown in Fig.1. 5G enable a perceived fully ubiquitous connected world [1].

The cellular network system based on radio frequency. Radio spectrum having specific band i.e., limited and costly. To improve the communication system, it need huge frequency band to handle heavy network traffic.

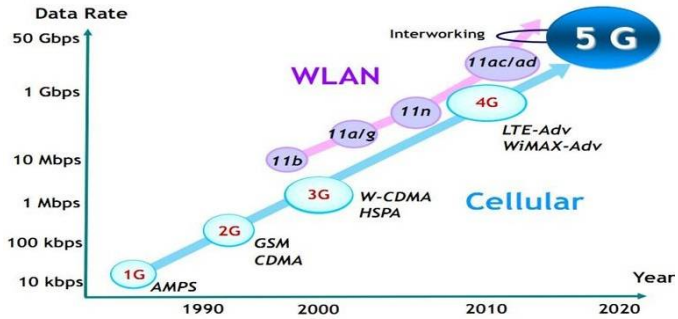

Fig.1. Evolution of Wireless Communication Technologies [1].

The 4G Technology is deployed in between 2000-2010.it provides high speed as 2Mbps to 100Mbps.It is completely IP based system, with the main aim to provide high speed, QoS and low cost servies.4G uses LTE (Long Term Evolution) and Wi MAX standards. It uses CDMA multiplexing technique with packet switching.

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5G Technology will be deploy by 2020.It provides great feature to users, having higher data rate 1Gbps or higher.5G support 4G+WWWW (4th Generation + World Wide Wireless Web). It operates on IPv6 protocol.5G aim to provides unlimited access and information at anywhere anytime with high speed.

II. LITERATURE SURVEY

TABLE 1.
Literature Survey On 5G wireless communication Technology.

Sr. No.	PAPER NAME	AUTHORS	WORK DONE
1.	Emerging Technologies and Research Challenges for 5G Wireless Networks.(IEEE)	Woon Hau Chin, Zhong Fan, and Russell Haines	In this paper Research challenges and other merging technologies are Explained along with their new research problems[2].
2.	A Survey of 5G Network: Architecture and Emerging Technologies.	Akhil Gupta, *Student Member, IEEE*, Rakesh Kumar Jha, Senior *Member, IEEE*	This Paper introduced 5G technology with 5G cellular network architecture in detail. Author's done comparatively study with various parameters and also pose different issues & challenges in 5G technology[1].
3.	An Overview on Resource Allocation Techniques for Multi-User MIMO Systems	Eduardo Castaneda, Member, IEEE, Adao Silva, Member, IEEE, Atılio Gameiro, and Marios Kountouris, Senior Member, IEEE	This paper provide a overview of the various methodologies used to approach the aforementioned joint optimization task in the downlink of MU-MIMO communication systems[3].
4.	Next Generation 5G Wireless Networks: A Comprehensive Survey	Mamta Agiwal, Abhishek Roy and Navrati Saxena	In this survey paper 5G archiecture, mm-wave, beamforming, channel model, CRAN, SDN, HetNets, massive MIMO, SDMA, IDMA, D2D, M2M, IoT, QoE, SON, sustainability, field trials-terms are describe in detail and gives emerging application of 5G communication[4].

III. ARCHITECTURE & WORKING OF 5G

It is necessary to look thoughtfully for 5G network in the market now, it is clear that the multiple access techniques in the network are still available and requires some improvement. The current technologies like OFDMA will be work at least for next 50 years. By taking this into consideration, it is not necessary to have a change in the wireless setup which had come about from 1G to 4G. Correspondingly, it only needs the improvement to be done at the fundamental network to fulfill user requirements. To fulfill user requirements and to reduce the challenges that has been introduced in the 5G system, an effective change in the technique of designing the 5G wireless cellular architecture is needed. According to observation of the researchers, most of the wireless users stay inside for up to 80 % of time and outside for up to 20 % of the time. In these wireless cellular network architecture, for a mobile users wish to communicate either inside or outside, an outside base station located at the middle of a cell helps in communication. When the inside users wants to communicate with the outside base station, the signals has to travel through the walls of the indoors, and it will result in very high penetration loss, which alternatively reduced the spectral efficiency, data rate, and energy efficiency of wireless communications. To overcome these challenges, a new designing technique that has come in to market for implementing the 5G cellular architecture is to distinct outside and inside setups. With the help of this designing technique, the penetration loss through the walls of the building will be slightly reduced. This technique will be implemented with the help of some standard technologies like massive MIMO technology, which deployed geographically distributed array of antenna's which include tens or hundreds of antenna units. Not only MIMO systems are using either two or four antennas, but also the idea of massive MIMO systems has come up with utilization of the advantages of large array antenna elements in terms of huge capacity gains.

To implement a large massive MIMO network, basically it having two stages- First, the outside base stations will be attached with large antenna arrays and they are distributed around the some hexagonal cell and connected to the base station via optical fiber cables, which are aided with massive MIMO technologies. The mobile users present at

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outside are basically attached with few number of antenna units but a large virtual antenna array can be built with cooperation, which antenna arrays of base station will together form virtual massive MIMO links.

Second, for every building their will be large antenna arrays from outside, to communicate with outdoor base stations using line of sight components. To communicate with indoor users the wireless access points being installed inside the building which will be connected with the large antenna arrays via cables. This will improves the energy efficiency, cell average throughput, data rate, and spectral efficiency of the cellular system but at the high rate of increased infrastructure cost. As larger antenna arrays remained installed outside the buildings, the inside users will only have to communicate with inside wireless access points.

For small range communications (Indoor communication) having large data rates there are some of technologies like Wi-Fi, Small cell, ultra wideband, millimeter wave communications, and visible light communications[6,7] are very useful. But there are some of the technologies like millimeter wave and visible light communication they requires higher frequencies which are not useful for cellular communications. But these high frequency waves are not efficient for outside and long distance applications because these waves will not infiltrate from dense materials efficiently and can easily be dispersed by rain droplets, gases, and flora. As millimeter waves and visible light communications technologies come up with large bandwidth can improve the transmission data rate for indoor setups[6,7]. As we seen with the introduction of new spectrum, which is not being efficiently used for wireless communication, there is one more method to solve the spectrum shortage problem by improving the spectrum utilization of current radio spectra through cognitive radio (CR) networks.

The 5G cellular network architecture explained [8] above, having equal importance in terms of front end and backhaul network. In this paper, we introduced general 5G cellular network architecture as shown in Fig. 2. It shows the interconnectivity between different emerging technologies will be like Massive MIMO network, Cognitive Radio network, mobile and static small-cell networks. It also explains the role of network function virtualization (NFV) cloud in the 5G cellular network architecture. Similarly this 5G cellular network architecture has also included the concept of D2D communication, small cell access points and IoT. In short, this 5G cellular network architecture may provide a very good platform for future 5G standardization network [1].

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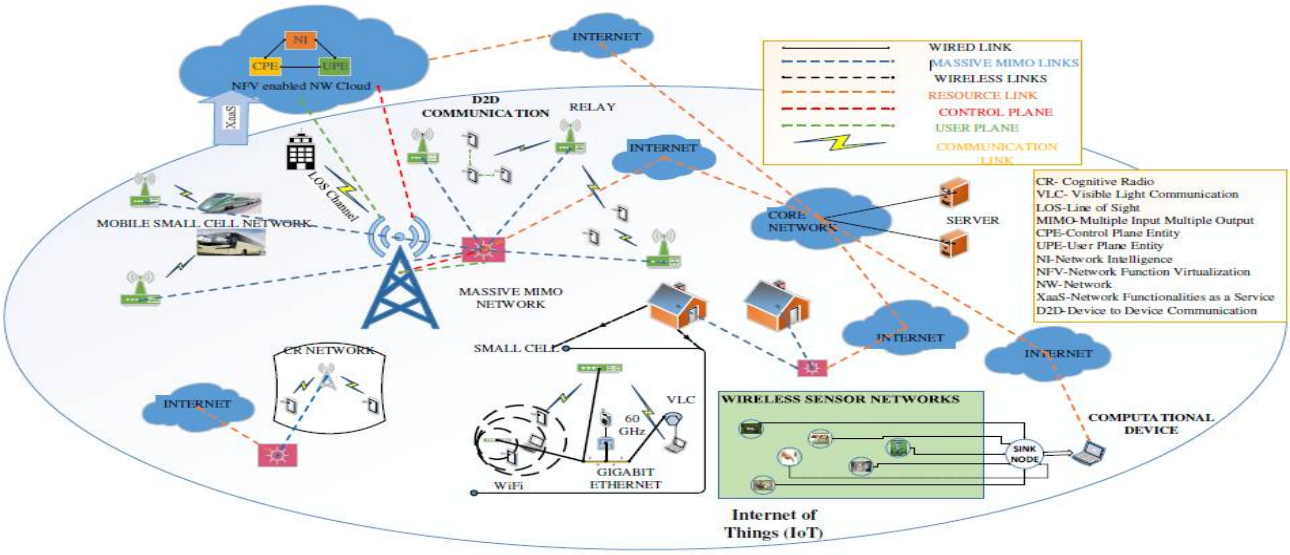

Fig. 2. 5G cellular network Architecture [1].

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IV. COMPARATIVELY STUDY OF 4G AND 5G

TABLE II.
TECHNICAL COMPARISON BETWEEN 4G AND 5G[2,3,4,5]

Sr. No.	Specification	4G (Fourth Generation)	5G (Fifth Generation)
1.	Data Bandwidth	Up to 100Mbps	Greater than 1Gbps
2.	Frequency Band	2GHz to 8GHz	3GHz to 300GHz
3.	Standards	OFDMA, MC-CDMA, N/W-LMPS	CDMA and BDMA
4.	Technologies	unified IP, seamless integration of broadband LAN/WAN/PAN and WLAN	4G and advanced technologies based on OFDM modulation used in 5G
5.	Service	Dynamic information access, wearable devices, HD streaming, global roaming	Dynamic information access, wearable devices, HD streaming, any demand of users with all Capabilities
6.	Multiple Access	CDMA	CDMA,BDMA
7.	Core Network	All IP network	Flatter IP network, 5G network Interfacing(5G-NI)
8.	Hand Off	Horizontal and vertical	Horizontal and vertical
9.	Initiation Form	year-2010	year-2015
10.	Multiplexing	CDMA	CDMA
11.	Switching	Packet	Packet
12.	Antenna Type	Sub wavelength antenna	Array antennas
13.	Radiation Pattern	Omnidirectional	Directional fan-beam
14.	Diversity and MIMO	Present	Present
15.	Deployment	2000-2010	By 2020

V. FEATURES OF 5G TECHNOLOGY

- Increase in Capacity -1000x Higher data volumes and 10-100x higher data rates to end user[2].
- Low Latency –Latency decrease by a factor of 5 in order to enable remote presence, tactile internet, etc. services.
- Increase in number of connected device- up to 300,000 will be served per access point[1].
- Increase in Efficiency- Energy, Spectrum like resource utilization higher.
- Increase in reliability- 5G will be deliver extremely reliable connections (Typically 99.999% Availability).
- 5G support to Internet of Thing, Smart Home Appliances, Autonomous Car and it also applicable in following area- Health, Transport, Agriculture and Education[1].
- 5G provide uniform, uninterrupted, and consistent connectivity across the world[5].

VI. CHALLENGES IN 5G CELLULAR WIRELESS NETWORK

A. *HETEROGENEOUS NETWORK*

The 5G network have heterogeneous network with including picocells, macrocells, small cells to reduced the energy consumption and increasing the cost efficiency. Heterogeneous network offer numerous access point with their efficiency and various spectrum that may use different transmission power level to deliver higher data rate[2]. It also consist of following sub-challenges are Inter cell interface, efficient medium access control, Distributed Interface coordination, Device discovery and link setup, etc.

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B. *DEVICE-TO-DEVICE COMMUNICATION*

Device-to-Device communication high end user mobility will be considered, while communicating with directly terminal to terminal or sharing radio frequency connection to exchange data with reduce interference in communication. 5G is a full duplex system[1], at the same time devices can transmit and receive signals and reduce the time complexity. It uses simplest two-tier architecture and base station traffic free[2].

C. *MASSIVE MIMO*

Massive MIMO include very large antenna array at each base station connected with multiple tens of users. Massive MIMO offer large number of users are served simultaneously without consuming more radio spectrum and also decreases the dead radio spectrum and decrease the dead zones and gives high quality data[4].

D. *RADIO WAVES*

Radio waves enables to cellular network communication, But Capacity, Efficiency, Availability and Security are major issues in radio waves. Radio waves having limited spectrum and expensive band. 5G use new spectrum above 6GHz to achieved very high data rates, low latency, energy efficiency, ultra- high reliability[7].

VII. EMERGING APPLICATIONS

A. *D2D Communication* – Peer to Peer[2] or direct device to device communication[2], eliminate IP based or Base station oriented connectivity.
B. *M2M Communication*- Intelligent machines automatically done all data operations, like data generation, processing and Transfer[2].
C. *Internet Of Things*- Supports IoT concept which is large scale development smart homes as well as smart objects connected together via Internet. Internet of Things Connecting “Anytime, Anyplace, Anyone, Anything”[1].
D. *Internet Of Vehicles*- Supports vehicle to vehicle communication through Internet and traffic, collision reduces[1,4]. It provides low latency and high mobility connectivity.
E. *Health Care*-Advance sensor and communication technology enables health monitoring, real time communication, data storage[1]. Wearable technology provides health care solution.
F. *Smart Home And Smart City*- Applicable for smart homes and cities in Automation, Appliances, Embedded system and security.

VIII. CONCLUSION

In this survey paper we explain fifth generation (5G) technology in shortly which mainly includes architecture, challenges, emerging application and comparatively study of 4G and 5G.This will helps to understand easily and motivate to researchers to improvement outcome for next generations issues and challenges.

This technology is in research field so, there is lot of issues and challenges. 5G will be completely developed in 2020 or before. It will improve the communication as well as digital life with higher performance.

REFERENCES

[1] Akhil Gupta and Rakesh Kumar Jha “A Survey of 5G Network: Architecture and Emerging Technologies” 2169-3536 (c) 2015 IEEE.
[2] Woon Hau Chin, Zhong Fan, and Russell Haines, “Emerging Technologies and Research Challenges for 5G Wireless Networks” Toshiba Research Europe Limited, Bristol, BS1 4ND, United Kingdom.
[3] Eduardo Casta˜neda, Ad˜ao Silva, At´ılio Gameiro, and Marios Kountouris, “An Overview on Resource Allocation Techniquesfor Multi-User MIMO Systems”, 1553-877X (c) 2016 IEEE
[4] Mamta Agiwal1, Abhishek Roy2 and Navrati Saxena, “Next Generation 5G Wireless Networks: A Comprehensive Survey” 1553-877X (c) 2015 IEEE.
[5] Jing WANG & Chih-Lin , “Recent advances and future challenges for massive MIMO channel measurements and models”, from science china February 2016, Vol. 59 021301:1–021301:16
[6] H. Haas, “Wireless Data from Every Light Bulb,” TED website, Aug 2011; http://bit.ly/tedvlc
[7] Gaikwad Vaibhav Vitthal and Bhor Pooja Vijay, “Review of Light fidelity”, International Journal for Scientific Research & Development| Vol. 4, Issue 02, 2016 | ISSN (online): 2321-0613
[8] Kwadwo, P., Agyapong, et al.: Design considerations for a 5G network architecture. IEEE Commun. Mag. 52(11), 65 (2014).

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International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 1, January 2017

[9] G. Wunder et al., "5GNOW: Non-orthogonal, asynchronous waveforms for future mobile applications," IEEE Communications Magazine, vol. 52,pp. 97–105, February 2014

[10] K. Davaslioglu and E. Ayanoglu, "Quantifying potential energy efficiency gain in green cellular wireless networks," IEEE Communications Surveys and Tutorials, vol. 16, pp. 2065–2091, Fourth Quarter 2014.

[11] 5G WIRELESS TECHNOLOGIES-Still 4G auctions not over, but time to start talking 5G Future Generations of Mobile Communication Networks Engr. Muhammad Farooq, Engr. Muhammad Ishtiaq Ahmed, Engr. Usman M Al.

[12] Bikos, Sklavos. LTE/SAE Security Issues on 4G Wireless Networks, Published in IEEE Security & Privacy, March/April 2013.