



A Review on the Deeper Aspects of 5G Wireless Technology

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ABSTRACT: 5G Technology stands for fifth Generation Mobile technology. From generation 1G to 2.5G and from 3G to 5G this world of telecommunication has seen a number of improvements along with improved performance with every passing day. This fast revolution in mobile computing changes our day to day life that is way we work, interact, learn etc. This paper throws light on network architecture of fifth generation technology. Currently 5G term is not officially used. Fifth generation focus on (Voice Over IP) VOIP-enabled devices that user will experience a high level of call volume and data transmission. The main features in 5G mobile network is that user can simultaneously connect to the multiple wireless technologies and can switch between them. This forthcoming mobile technology will support IPv6 and flat IP. In fifth generation researches are being made on development of World Wide Wireless Web (WWW), Dynamic Adhoc Wireless Networks (DAWN) and Real Wireless World.

KEYWORDS— 5 G, 5G Architecture, Evolution from 1G to 5G, Comparison of all Generations, Why 5G?

I. INTRODUCTION

Mobile and wireless network Technology have developed very much now a day. 5G has come through the continuous evolution of 1G, 2G, 2.5G, 3G and 4G. 5G is a packet switched wireless system with wider area coverage and high throughput. Simply saying- 5G technologies will provide consumers with the same abilities of 4G, but with more power and features in hand held phone [1]. It will lead to tremendous change in wireless technology and provide high efficiency to mobile communication. 5G, which is being called the Real world wireless or WWW that is World Wide Wireless Web, allows complete wireless communication with almost no limitation, Multi-Media Newspapers, watch TV programs with the clarity as to that of an HD TV. The 5G wireless mobile internet networks are real wireless world which shall be supported by LAS-CDMA (Large Area Synchronized Code-Division Multiple Access), OFDM (Orthogonal frequency-division multiplexing), MCCDMA (Multi-Carrier Code Division Multiple Access), UWB (Ultra-wideband), Network-LMDS (Local Multipoint Distribution Service), and IPv6. Fifth generation should make an important difference and add more services and benefits to the world over 4G. 5G wireless uses OFDM and millimetre wireless that enables data rate of 20 mbps and frequency band of 2-8 GHz. 5G technology will change the manner in which cellular plans are offered worldwide[2]. The main features in 5G mobile network is that user can simultaneously connect to the multiple wireless technologies and can switch between them Fifth generation should be more intelligent technology that interconnects the entire world without limits. This generation is expected to be released around 2020. The world of universal, uninterrupted access to information, entertainment and communication will open new dimension to our lives and change our life style significantly [3]. Thus the 5G is the future of the world for instance proving itself a biggest achievement in the field of wireless communication when implemented.



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II. EVOLUTION OF WIRELESS TECHNOLOGIES

A. First Generation (1G):- 1G emerged in 1980s. It contains Analog System and popularly known as cell phones. It introduces mobile technologies such as Mobile Telephone System (MTS), Advanced Mobile Telephone System (AMTS), Improved Mobile Telephone Service (IMTS), and Push to Talk (PTT) [4]. It uses analog radio signal which have frequency 150 MHz, voice call modulation is done using a technique called Frequency-Division Multiple Access (FDMA). It has low capacity, unreliable handoff, poor voice links, and no security at all since voice calls were played back in radio towers, making these calls susceptible to unwanted eavesdropping by third parties.

B. Second Generation (2G):- 2G emerged in late 1980s. It uses digital signals for voice transmission and has speed of 64 kbps [5]. It provides facility of SMS (Short Message Service) and use the bandwidth of 30 to 200 KHz. Next to 2G, 2.5G system uses packet switched and circuit switched domain and provide data rate up to 144 kbps.e.g. GPRS, CDMA and EDGE.

C. Third Generation (3G):- It uses Wide Brand Wireless Network with which clarity is increased. The data are sent through the technology called Packet Switching. Voice calls are interpreted through Circuit Switching. Along with verbal communication it includes data services, access to television/video, new services like Global Roaming [3]. It operates at a range of 2100MHz and has a bandwidth of 15-20MHz used for High-speed internet service, video chatting. 3G uses Wide Band Voice Channel that is by this the world has been contracted to a little village because a person can contact with other person located in any part of the world and can even send messages too.

D. Fourth Generation (4G):- 4G offers a downloading speed of 100Mbps. 4G provides same feature as 3G and additional services like Multi-Media Newspapers, to watch T.V programs with more clarity and send Data much faster than previous generations [4]. LTE (Long Term Evolution) is considered as 4G technology. 4G 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), minimal services like voice and data, and other services that utilize bandwidth.

III. ARCHITECTURE OF 5G

Fifth generation mobile systems model is all-IP based model for wireless and mobile networks interoperability The All-IP Network (AIPN) is capable to fulfil increasing demands of the cellular communications market. It is a common platform for all radio access technologies. Fifth generation mobile systems model is all-IP based model for wireless and mobile networks interoperability [8]. AIPN uses packet switching and its continuous evolution provides optimized performance and cost. In fifth generation Network Architecture consist of a user terminal (which has a crucial role in the new architecture) and a number of independent, autonomous radio access technologies (RAT).

In 5G Network Architecture all IP internet access. CCR links the Reconfigurable Multi Technology Core (RMTC) with remote reconfiguration data from RRD attached to Reconfiguration Data models (RDM). The main challenge for a RMTC is to deal with increasing different radio access technologies. The core is a convergence of the nanotechnology, cloud computing and radio, and based on All IP Platform.

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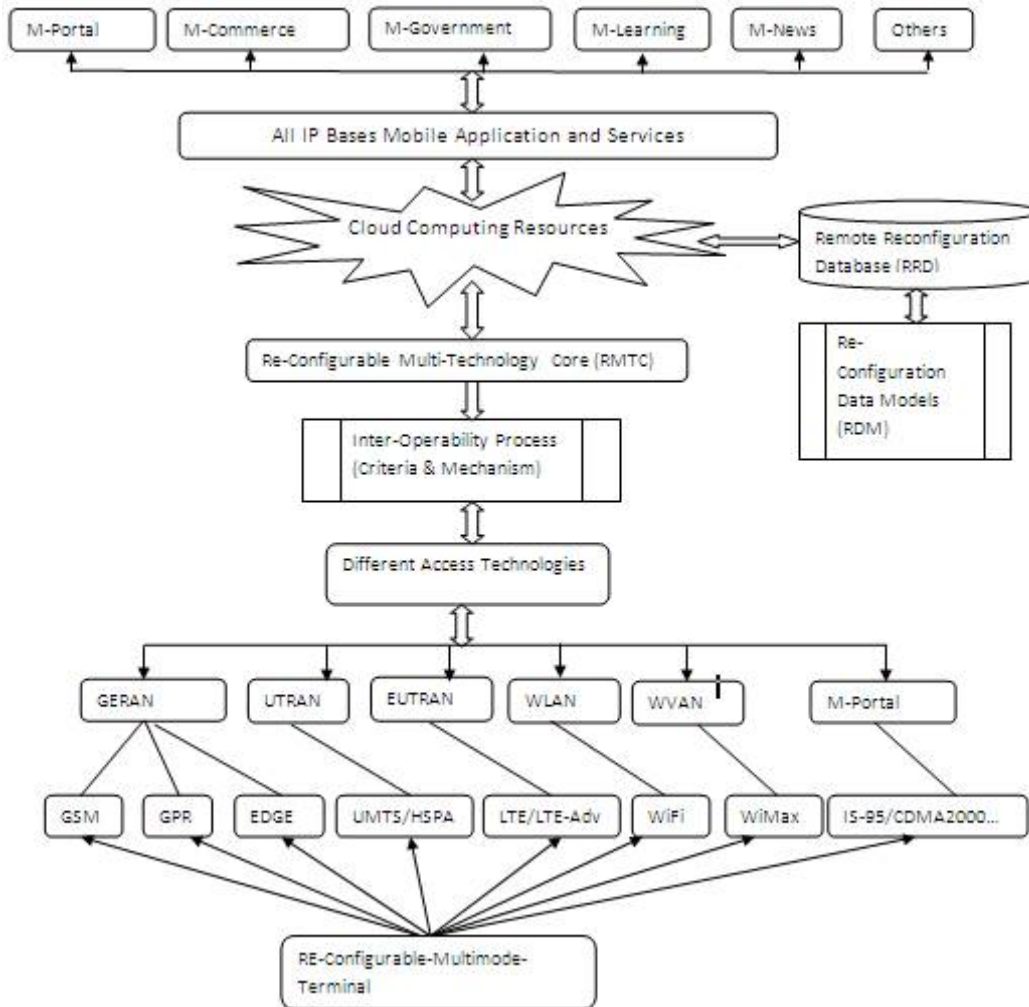


Figure 1: Flowchart of Architecture

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RMTC is connected to different radio access technologies ranging from 2G/GERAN to 3G/UTRAN and 4G/EUTRAN in addition to 802.11x WLAN and 802.16x WMAN. Other standards are also enabled such as IS/95, EV-DO, CDMA2000.etc.

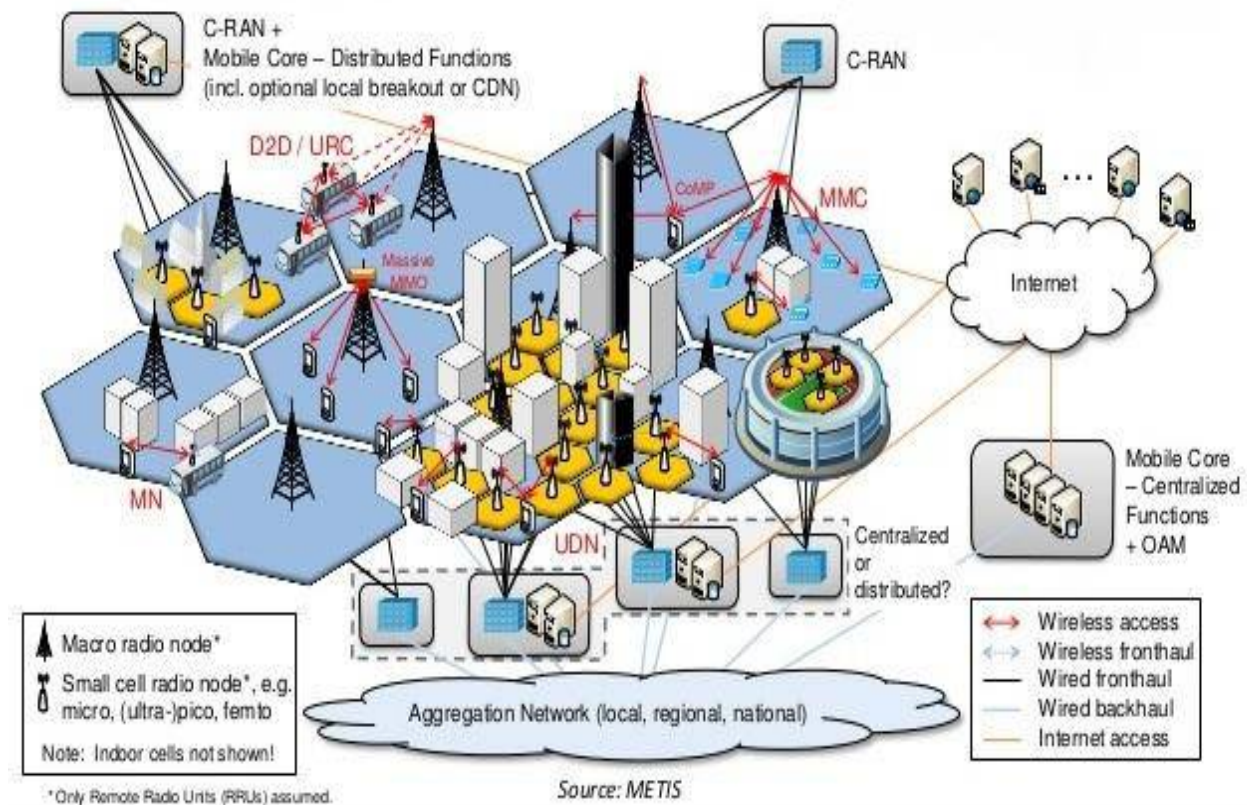


Figure 2: METIS E2E Reference Network (Courtesy: METIS-“Mobile & wireless communication enablers for the twenty-twenty information society”).

The model includes devices, e.g., terminals and D2D groups, antenna sites, e.g., small cells, relay nodes, cluster nodes, as well as radio base station (RBS) sites. In addition, data centers with data processing and storage capabilities at access and aggregation level are depicted [5]. An E2E reference network that is used when functional placement within the network topology is discussed. This reference network shows how the different types of sites are located along the access, aggregation and core networks within a typical telecom operator system and this shows how much 5G wireless technology helps for the development of wireless networks. 5G technology offer high resolution for crazy cell phone user and bi- directional large bandwidth shaping[9].

The advanced billing interfaces of 5G technology makes it more attractive and effective. 5G technology also providing subscriber supervision tools for fast action [6].



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IV. COMPARISON OF ALL GENERATIONS OF MOBILE TECHNOLOGIES

| Technology | 1G | 2G | 3G | 4G | 5G |
|----------------------|----------------------------|---|---|--|---|
| Features | | | | | |
| Start/ Deployment | 1970 – 1980 | 1990 - 2004 | 2004-2010 | Now | Soon (probably 2020) |
| Data Bandwidth | 2kbps | 64kbps | 2Mbps | 1 Gbps | Higher than 1Gbps |
| Technology | 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 |

Table 1: COMPARISON OF ALL GENERATIONS OF MOBILE TECHNOLOGIES

V. WHY 5G?

A. Multi Mode User Terminals -The 4G technology is based on single station single user operated system but 5G is a single station multi operated system. This is the major achievement of this technology [11].

B. Security -Security level increases in this technology. Reconfigurable and lightweight protection mechanisms are designed.

C. Data Encryption -There is data encryption technique in this technology. Due to this it is difficult to encrypt the data from the transmitter to receiver [10].

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D. A Super-Efficient Mobile Network -It delivers a better performing network for lower investment cost. It addresses the mobile network operates need at unit cost of data transport falling at roughly the same rate as the volume of data demand is rising.

E. A Converged Fiber-Wireless Network -This uses wireless Internet access having bandwidth 20 to 60 GHZ in millimeter so as to allow very wide bandwidth radio channels able to support data access speeds of up to 10 Gbit/s.

F. Speed of Delivery -One of the main benefits of 5G technology over 4G will not be its speed of delivery – which is about between 10Gbps and 100Gbps but it is low[19]. At present, 4G provides speed between 40ms and 60ms, which is very low and not enough to provide real-time response.



Figure 3: Features of 5G technology

VI. CONCLUSION

The development of the mobile and wireless networks is going towards higher data rates and all-IP principle. Mobile terminals are obtaining each year more processing power, more memory on board, and longer battery life for the same applications. After having a deeper insight of the scopes and applications as well as various other highly convenient aspects of 5G, it clearly shows the calling of future and it is 5G which will provide an enormous shift in the wireless world. So 5G will come up with a new way of transformation and will connect the world in a much smoother way and provide the user a larger space to explore the 5G wireless services. 5G include latest technologies such as cognitive radio, SDR, nanotechnology, cloud computing and based on All IP Platform. It is expected that the initial Internet philosophy of keeping the network simple as possible, and giving more functionalities to the end nodes, will become reality in the future generation of mobile networks, here referred to as 5G.

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