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## 5G MOBILE 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 also 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 paper throws light on network architecture of fifth generation technology. Currently 5G term is not officially used. In fifth generation researches are being made on development of World Wide Wireless Web (WWW), Dynamic Adhoc Wireless Networks (DAWN) and Real Wireless World. Fifth generation focus on (Voice Over IP) VOIP-enabled devices that user will experience a high level of call volume and data transmission. Fifth generation technology will fulfill all the requirements of customers who always want advanced features in cellular phones. 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. Fifth generation technology will offer the services like Documentation, supporting electronic transactions (e-Payments, e-transactions) etc.

**Keywords:** 5 G, 5G Architecture, Evolution from 1G to 5G, Comparison of all Generations, Why 5G?

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## INTRODUCTION

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. Now days different wireless and mobile technologies are present such as third generation mobile networks (UMTS-Universal Mobile Telecommunication System, cdma2000), LTE (Long Term Evolution), WiFi (IEEE 802.11 wireless networks), WiMAX (IEEE 802.16 wireless and mobile networks), as well as sensor networks, or personal area networks (e.g. Bluetooth, ZigBee). Mobile terminals include variety of interfaces like GSM which are based on circuit switching. All wireless and mobile networks implements all- IP principle, that means all data and signaling will be transferred via IP (Internet Protocol) on network layer. 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 Piconets. The fifth generation wireless mobile multimedia internet networks can be completely wireless communication without limitation, which makes perfect wireless real world – World Wide Wireless Web (WWWW). Fifth generation is based on 4G technologies. The 5th 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 technologies offers tremendous data capabilities and unrestricted call volumes and infinite data broadcast together within latest mobile operating system. Fifth generation should make an important difference and add more services and benefits to the world over 4G. 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.

## 2. EVOLUTION

Mobile communication has become more popular in last few years due to fast revolution in mobile technology. This revolution is due to very high increase in telecoms customers. This revolution is from 1G- the first generation, 2G- the second generation, 3G- the third generation, and then the 4G-the forth generation,5G-the fifth second generation.

#### 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). 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 [3].

#### B. Second Generation (2G)

2G emerged in late 1980s. It uses digital signals for voice transmission and has speed of 64 kbps. 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 [3]

#### C. Third Generation (3G)

It uses Wide Band 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. 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[3].

#### 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 [3]. 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. [2]

### 3. COMPARISON OF ALL GENERATIONS OF MOBILE TECHNOLOGIES [5].

Technology	1G	2G	3G	4G	5G
<b>Features</b>					
<b>Start/Deployment</b>	1970 – 1980	1990 - 2004	2004-2010	Now	Soon (probably 2020)
<b>Data Bandwidth</b>	2kbps	64kbps	2Mbps	1 Gbps	Higher than 1Gbps
<b>Technology</b>	Analog Cellular Technology	Digital Cellular Technology	CDMA 2000 (1xRTT, EVDO) UMTS, EDGE	WiMax LTE Wi-Fi	WWWW(coming soon)
<b>Service</b>	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
<b>Multiplexing</b>	FDMA	TDMA, CDMA	CDMA	CDMA	CDMA
<b>Switching</b>	Circuit	Circuit, Packet	Packet	All Packet	All Packet
<b>Core Network</b>	PSTN	PSTN	Packet N/W	Internet	Internet

### 4. 5G NETWORK ARCHITECTURE

Fifth generation mobile systems model is all-IP based model for wireless and mobile networks interoperability. The All-IP Network (AIPN) is capable to fulfill increasing demands of the cellular communications market. It is a common platform for all radio access technologies. The 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) [1]. In 5G Network Architecture all IP based mobile applications and services such as Mobile portals, Mobile commerce, Mobile health care, Mobile government, Mobile banking and others, are offered via Cloud Computing Resources (CCR). Cloud computing is a model for convenient on-demand network access to configurable computing resources (e.g., networks, servers, storage, applications, and services). Cloud computing allows consumers to use

applications without installation and access their personal data at any computer with 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. Core changes its communication functions depending on status of the network and/or user demands. 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. Interoperability process-criteria and mechanisms enable both terminal and RMTC to select from heterogeneous access systems [6].

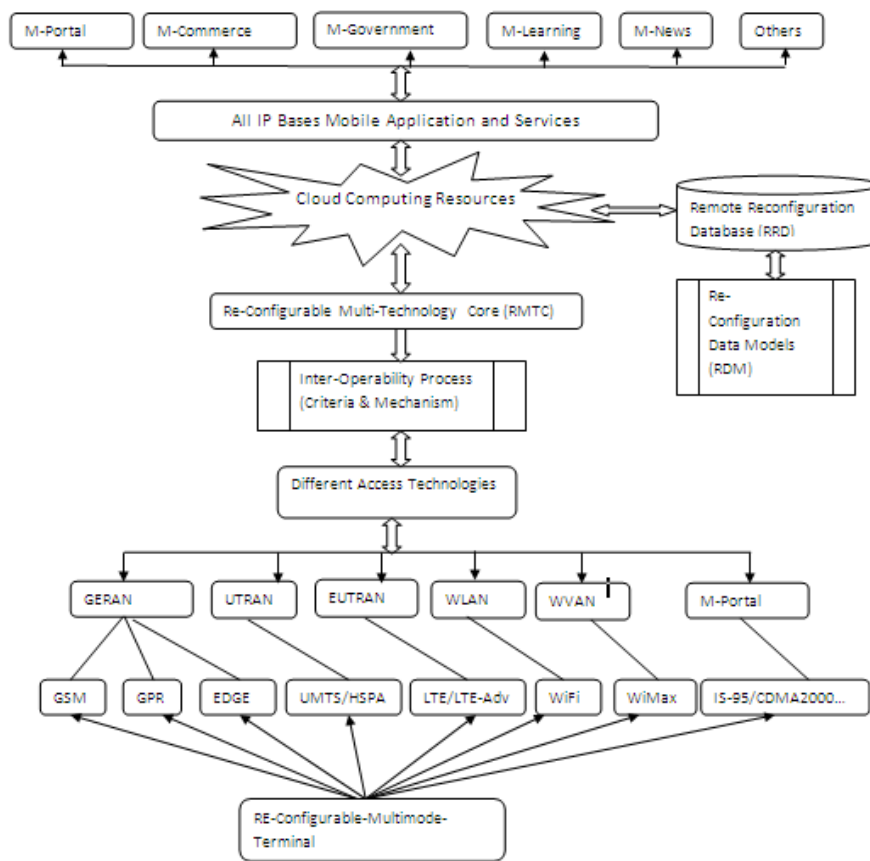


Fig. 1 5G Network Architecture [6]

## 5. VISIONS AND REQUIREMENTS FOR 5G NETWORK

5G mobile and wireless communication necessitates mix of new system concept which contains the spectral and energy efficiency. The requirements and visions are outlined below.

### 5.1 Data Rate and Latency

For condensed metropolitan areas, 5G networks are suggested to enable in 95% of location and time an experience data rate of 300Mbps, 60 Mbps in downlink and uplink, respectively. The detailed requirements for different circumstances are listed.

### 5.2 Machine Type Communication Devices

MTC devices are outnumbered the number of traditional human centric devices with internet connectivity. Which may be utilized in vehicles, home appliances and sensors.

### 5.3 Millimeter Wave Communication

To satisfy requirement of increase in traffic and addition of different services, additional frequency band beyond what was previously assign to 4G standard is required for. The use of millimeter wave frequency bands is necessary to overcome the problem of rare spectrum resources since it permits transmission at wider band widths than conventional 20MHz channel for 4G system.

### 5.4 Multiple RATs

5G is not about substituting the existing technology but, it is about augmenting and supporting them with new technology. In 5G systems the GSM (Global System for Mobile communication) and LTE will continue to develop and provide a system with more performance. They were also accompanied by other technologies.

### 5.5 Base Station Densification

BS densification is an effective technology to meet the requirements of 5G networks. Specifically in 5G network there will be distributions of a large number of low power nodes, device to device communication links with much higher density than today's macrocell network. Following figure shows multitier network within a macrocell overlaid by relays picocells, device to device communication (D2D) links. The implementation of multiple tiers in cellular network will result in better performance provided that the inter-tier and intra-tier interferences are managed.

## 5.6 Prioritised Spectrum Access

The concepts of both traffic and tier based significances will be based on 5G network. Traffic based priority arises from different requirements of users. Whereas, the tier based priority is based on different network tier. In the uplink network direction the macrocell user at the cell superiority usually transmits with high powers which produces with high uplink interference to nearby femtocells.

## 5.7 Network Assisted Device to Device[D2D] Communication

In the LTE Rel-12 focus will be on network controlled device to device communication where the macrocell base station performs control signaling in terms of synchronization signal configuration, providing uniqueness and safety management. This feature will be utilized in 5G network to allow other nodes instead of macrocell base station, to have control.

## 6. WHY NEED OF 5G?

Very High speed, high capacity, and low cost per bit [7].

It supports interactive multimedia, voice, video, Internet, and other broadband services, more effective and more attractive, and have Bi-directional, accurate traffic statistics [7].

5G technology offers Global access and service portability.

It offers the high quality services due to high error tolerance.

It is providing large broadcasting capacity up to Gigabit which supports almost 65,000 connections at a time.

More applications combined with artificial intelligence (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones [6].

5G technology uses remote management that users can get better and fast solutions.

The uploading and downloading speed of 5G technology is very high.

5G technology offers high resolution for crazy cell phone users and bi-directional large bandwidth shaping [3].

5G technology offers transporter class gateway with unparalleled consistency [3].

## 7. 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. 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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