

## An overview on 5G technologies

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**Abstract** - The objective of this paper is comprehensive study related to 5G technology of mobile communication. Existing research work in mobile communication is related to 5G technology. In 5G, researches are related to the development of World Wide Wireless Web (WWWW), Dynamic Adhoc Wireless Networks (DAWN) and Real Wireless Communication. The most important technologies for 5G technologies are 802.11 Wireless Local Area Networks (WLAN) and 802.16 Wireless Metropolitan Area Networks (WMAN), Ad-hoc Wireless Personal Area Network (WPAN) and Wireless networks for digital communication. 4G technology will include several standards under a common umbrella, similar to 3G, but with IEEE 802.xx wireless mobile networks integrated from the commencement. The major contribution of this paper is the key provisions of 5G (Fifth Generation) technology of mobile communication, which is seen as consumer oriented. In 5G technology, the mobile consumer has given utmost priority compared to others. 5G Technology stands for 5th Generation Mobile Technology. 5G technology is to make use of mobile phones within very high bandwidth. The consumer never experienced the utmost valued technology as 5G. The 5G technologies include all types of advanced features which make 5G technology most dominant technology in near future.

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

### INTRODUCTION

The present cell phones have it all. Today phones have everything ranging from the smallest size, largest phone memory, speed dialing, video player, audio player, and camera and so on. Recently with the development of Piconets and Bluetooth technology data sharing has become a child's play. Earlier with the infrared feature you can share data within a line of sight that means the two devices has to be aligned properly to transfer data, but in case of blue tooth you can transfer data even when you have the cell phone in your pocket up to a range of 50 meters. The creation and entry of 5G technology into the mobile marketplace will launch a new revolution in the way international cellular plans are offered. The global mobile phone is upon the cell phone market. Just

around the corner, the newest 5G technologies will hit the mobile market with phones used in China being able to access and call locally phones in Germany. With the emergence of cell phones, which are similar to a PDA, you can now have your whole office within the phone. Cell phones will give tough competitions to laptop manufacturers and normal computer designers. Even today there are phones with gigabytes of memory storage and the latest operating systems. Thus one can say that with the current trends, the industry has a real bright future if it can handle the best technologies and can produce affordable handsets for its customers. 5G Network's router and switch technology delivers Last Yard Connectivity between the Internet access provider and building occupants. 5G's technology intelligently distributes Internet access to individual nodes within the building. 5G is not officially defined term or technology but people refer technologies that can deliver the speed beyond 4G as 5G. It is expected to be finalized somewhere in 2012 or 2013. New standard proposals or releases beyond 4G are submitted to standard bodies like 3GPP, WiMAX Forum or ITU-R. Ideal 5G model should accommodate the challenges and accommodate the short falls of the 4G Technology and 4G deployment experiences. To understand the necessities and uses of

5G could be raised once the 4G rollout is completed and experienced. Thus typical 5G concept would be raised in somewhere around 2013-2015. The 5<sup>th</sup> wireless mobile internet networks are a real wireless world which shall be supported by LASCMA (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. The world of universal, uninterrupted access to

information, entertainment and communication will open new dimension to our lives and change our life style significantly.

### **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 fourth generation, 5G- the fifth second generation.

#### **First Generation (1G)**

They were analog based and evolved in early 80's. They were called AMPS --- Advanced Mobile Phone System, released in 1983 [3] and employed in North and South America, China, Australia etc.

#### **Features of 1G Systems**

Base station Tx band 869 – 894 MHz U Tx band 824 – 849 MHz Channel Bandwidth 30 KHz No of voice channels 790 No of control channels 42 M U max power 3 W Cell size radius 2 – 20 km Modulation voice channels FM Modulation control channels FSK

#### **Limitations of 1G systems**

It has limited capacity, Low calling capacity, No room for spectrum growth, Poor data communications, Minimal privacy, Inadequate fraud protection.

#### **2G Systems**

They are based on digital technology. They are either TDMA or CDMA based. TDMA is used in GSM (Global System of Mobile Communication).

#### **Features of 2G Systems**

Make use of CODEC (compression and multiplexing algorithm) to compress and multiplex digital voice data. It can handle more calls per amount of bandwidth vis a vis 1G systems. Handsets are usually smaller, lighter and more robust. It emits less radio power. It is safer for consumers to use. The battery life of hand-sets lasts longer. It offers additional services like SMS, and emails. The error checking has improved sound quality. There is reduction in noise levels. The digital voice encoding has made calls less susceptible to eavesdropping from third parties due to use of radio scanner. It ensures rapid call set up. It enables talking to number of parties simultaneously. It enables to place a call on hold while one accesses another call. It notifies one of another call whilst on a call Encrypted conversation that cannot be easily tapped. It provides ability to use same phone in number of countries. In GSM carrier bit rate is 270.8 kbps speech coding bit rate is 13 kbps, Channel Bandwidth 200 kHz in GSM, 8 users per channel, Mobile Unit max power is 20 W.

#### **3G Systems**

The 3G system represents convergence of 2G wireless systems into a single global system. It was first

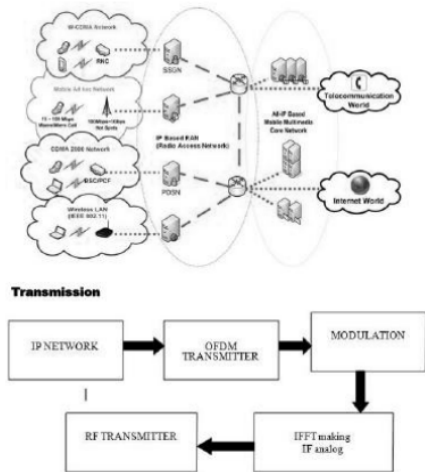
adopted in Japan and South Korea in 2001 and in USA in 2003. It was launched in India in 2008. Upto Mar 2010, as many as 380 cities had been covered under 3G systems.

#### **Features of 3G Systems**

Enhanced multimedia (voice, data, video and remote control), Usability on all popular models (cellular phones, e-mails, pagers, fax, video conferencing and web browsing), Broad bandwidth and high speeds (upwards of 2 MBPS), Bandwidth 5 – 20 Mbps, Access WCDMA / CDMA 2000, Frequency Band 16 – 25 GHz, Component Design Optimized antenna multiband adapters, Has both circuit / packet switching, Routing flexibility (repeater, satellite and LAN), International roaming capability, Excellent quality of voice, Applications include: Still photography, video data transmission service, file transfer from internet, multimedia e-mail, Web Browsing, on-line services, time schedules.

#### **4G Network**

Figure shows the basic concept of 4g network. The future 4G infrastructure will consist of a set of various networks using internet protocol. As a common protocol so that the users are in control as they will be able to choose every application and environment. Accessing information anywhere, anytime with seamless connection to a wide range of information, obtaining services, receiving a large volume of information, data, pictures, video and so on are the key of 4G infrastructure. An OFDM transmitter accepts data from an IP network, converting and encoding prior to modulation. An IFFT (inverse fast Fourier transform) transforms the OFDM signal into an IF signal, which is sent to RF transmitter. With orthogonal sub-carriers, the receiver can separate and process each sub-carrier without interference from other sub-carriers. OFDM provides better link and communication quality. It is more impervious to fading and multi-path delays than other transmission techniques.



**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, EVDO, CDMA2000...etc.

Interoperability process-criteria and mechanisms enable both terminal and RMTC to select from heterogeneous access systems.

**5G WIRELESS ACCESS**

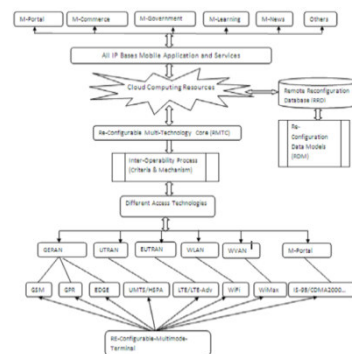
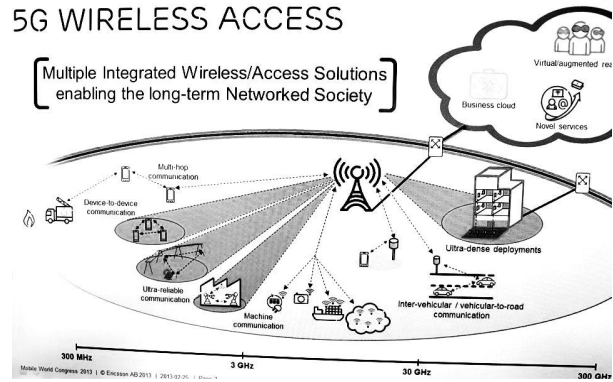


Fig 5G Architecture

**COMPARISON**

Technology → Features ↓	1G	2G	3G	4G	5G
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	WWW (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

**WHY NEED OF 5G?**

1. Very High speed, high capacity, and low cost per bit.
2. It supports interactive multimedia, voice, video, Internet, and other broadband services, more effective and more attractive, and have Bidirectional, accurate traffic statistics.
3. 5G technology offers Global access and service portability.

4. It offers the high quality services due to high error tolerance.
5. It is providing large broadcasting capacity up to Gigabit which supporting almost 65,000 connections at a time.
6. More applications combined with artificial intelligent (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones.
7. 5G technology use remote management that user can get better and fast solution.
8. The uploading and downloading speed of 5G technology is very high.
9. 5G technology offer high resolution for crazy cellphone user and bi-directional large bandwidth shaping.
10. 5G technology offer transporter class gateway with unparalleled consistency.

#### **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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