

# Overview of Fifth Generation Networking

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**ABSTRACT**-Fifth generation wireless system plays the major role in the telecommunication standard. This technology is the latest advance of 4G/IMT-advance standard. It was mainly for the enhancement of speed more than the current 4G networks. The next generation has the following advancements: (i) Data rates which in about ten of megabits per second must be changed to ten of thousands of users. (ii) For the regular working on the same official floor, 1 gigabit per second is to be offered. Spectral efficiency, coverage and signaling which are few of the more important features of networking are to be upgraded or enhanced from the 4G networking. At the same time latency should be eventually reduced when compared to LTE. Thus the next generation mobile networking is expected to break out in about 2020 to accomplish the demands of business and consumers. They eventually think that this technology might increase the speed as well meet the requirements such as internet of things which is used for web accessing buildings or vehicles and broadcast devices such as lifeline on the natural disaster. All these latest updates are still considerations and has been grouped under ITU-T 4G standards.

**Keywords**-Network protocols, Wimax, Wi-Fi, WiGig, LI-FI

## 1. INTRODUCTION

The Swedish finish mobile service provider, TeliaSonera as well as Swedish telecommunication are ready to release the 4G successor networking model. The next upgradation “5G” is yet to being. There is a clear cut answer for our question such as wants, how, advantages, complexities and advantages in 5G networking. Complete evolution of 5G starts as follows. It traces its origin from early 2016 January 22 by “TeliaSonera and Ericsson” to first 5G launch in Swedish and Estonia as well as the same time “Fran Shammo” neck to neck planned to launch 5G in US before at the end of 2016. Both of these statements are from the highest ranking officials of the sector who are owner of real fact that 5G is still under development and experimental zone. It has not still standardized its policies on which it has to work up

on some of the popular companies like “VODAFONE” and “DOCOMO” are about to move this networking standard to next new upgraded level around 2020. 2k20 must be the extreme deadline for the implementation of 5G technology and factual questions is “which company is going to launch this big technology at its farthest soon?”. The result stays hidden.

## Top facts of 5G

There exist six most important facts about fifth generation mobile networking. They are:

- i. The next generation is a broadband technology that shakes hand to the mobile network providing about more than 1Gbps internet speeds. Reaches are far ahead to increase the speed about 10-20 Gbps.
- ii. The time taken by a data to move from our mobile to the service. When we open our websites, which is the latency if 4G is about 50ms which is almost the half of 3G networks. Eventhough the delay time is in, millisecond, the user will not be able to feel the delay. 5G is trying to reduce it to about less than 1ms which is almost 0 latency.
- iii. In a most advanced model/version of mobile that supports 5G one can watch 4K, 8K or any 3D videos online without buffering.
- iv. Field like VR (Virtual Reality [screen less display]), AR (Augmented Reality) and IOT (Internet Of Things) are trying to implement such a huge technology on them for more emphasizing on its quality and clarity.
- v. This technology is able to connect 10 lacks of 1 million within a square kilometer. This eventually means connecting anything and eventually to internet.
- vi. 5G is working on the highest frequency which is about more than 60000 Mhz. Researches and experiments are moving on with 73000 MHz which is almost the greatest frequency that could not be imagined. Greater frequency higher is the data rates that are provided which are the basic need of 5G. Now comes the greatest drawback of 5G which is its frequency again. Such a high

frequency cannot even penetrate a few feet. Thus many mobile towers are to be built next to the buildings for proper connectivity. This process could be more expensive for the mobile companies and thus all the cost lies on the monthly mobile bill. 54 recharge pack. Still after a huge expense people will have to move top of the building or near windows for good expected speed of internet which is the worst part of this technology.

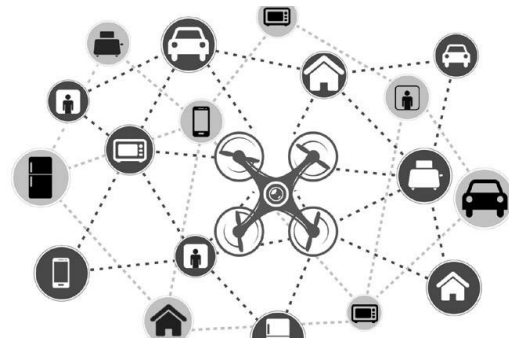
### 1.1. Behind 5G

Now the exact origin of 5G networks begins. As we see there is marked uniqueness among each networking generations. All of the previous mobile networking generation evolved exactly in 10 years of gap. The first generation networking 1G was introduced in 1982. The next generation was 2G the second generation networking which came into existence in 1992. Next level was the third generation of networking process 3G evolving in about 2001. The most advanced level update is the 4G that came into existence is about 2012. The predecessor technology such as pre 3G system CDMA one/1895 in US in 1995 and pre 4G system mobile wimax in south-Korea 2006 and also the first release LTE in Scandinavia 2009 have been present in markets just a few years ago before the how mobile generations. Exactly on the year 2008 NASA joined hands with m2mi corp to develop 5G communication technology.

Always mobile generation point out the non backward compatible cellular standards and their need were started by ITU-R. Their needs were like IMT-2000 for 3G and IMT-advanced for 4G. Hand-to-hand there existed a great development in IEEE and some of the other standardizations bodies. All these eventually led to the development of wireless communication technology “Wi-Fi”. This technique is about to offer following features

- High data rates.
- Higher frequencies.
- Shorter transmission ranges.
- Non-supportability for roaming between access points and
- Comparatively limited multiple access schemes.

Probably the first gigabit IEEE standards were IEEE 802.11ac, commercially available since 2013. This is almost near to follow multi gigabit standard WiGig or IEEE 802.11ad.



*Figure 1 A network Topology*

## 2. RESEARCH AND DEVELOPMENT PROJECT

“A 5G mobile communication system based on beam division multiple access and relay with group cooperation” was initiated by the year 2008 by South Korean.[1] Its R&D program. A completely individual research center was built only for 5G research at the university and was invoked by the government of United Kingdom by the year 2012.[10] At the same instance, NYU Wireless a multidisciplinary research centre, took 5G wireless communication and also traces its application over science fields as its core. This centre for research of Wi-Fi was supported and financially helped by the “National Science Foundation” as well as the crew of ID major Wi-Fi enterprises.[3] These ten companies have an individual affiliates board of the centre. Hereby various advancement of 5G technology comes with the millimeter wave frequency and WiGig.

The midway diverted project of METIS 2020 in 2012 by European commission which was needed by Neelie Kroes which spend 50 million euro on research led to the project of 5G. At the initial stage METIS 2020 project was enhanced by telecommunication companies and focused on world. Wide customers and their Wi-Fi usage. The project eventually provided 1000 times high mobile networking speed than the other latest LTE's. Around 2013 the project of 5G started and concentrated on 5G networking. This project laid a path of new generation which gave more focus on energy efficiency, sustainability and affordability.

Around November 2012, European Union under the governance of ICT programme FP7 was out-broken with IMDEA networks (Madrid, Spain) i-join coordinate. i-joined to the invention of RAN (Radio Access Network) which is completely flexible under the IT platform and which is new update. Its main goal is to build a combined design, reducing the access and backhaul, operations and management

algorithms, architectural elements, integrating small cells, heterogeneous backhaul as well as centralizing processing with addition to it experts in and around PHY, MAC, network layer and i-join will eventually have a clear study about its needs, its IT sector factors and implications for existing mobile network specification 3GPP LTE-A.

CROWD (Connectivity Management for Energy Optimized Wireless Dense Networks) which was a project of EU headed by IMDEA networks institute set up to prepare a software technique for a high dense Wi-Fi network in the year 2013 January. This team mainly aimed on the cost efficiency and energy efficiency as well as high dense mentioned here is about 1000 times more than the present time. Thus it includes multiple dimensions from coverage radius to technologies to deployments. Deployments refers to the planned and station and not spots.

Now on the same year by around September a new project on dynamic provision and allocating under the emerging C-RSN (Cloud Radio Access Network) was developed by Cyber Physical System (CPS) at Rutgers University. It has eventually proved that with the dynamic provision and allocation the energy utilized is reduced as well as the resources is incremented too. This project has a west test segment for interpreting even more cloud based technique for future of interference cancellation. This team is financially supported by the National Science Foundation.

Around November 2013, Huawei a Chinese telecommunication vendor announced that he would provide a fund of \$600 million for project that research on 5G in five years. It specified that the fund would not include the marketing of this new technology globally. It has a research center at Malta. From about 2015 both Hawaii and Ericsson conducted testing at rural sectors on 5G testing and related technologies in northern Netherlands.

5G NORMA which was commenced by July 2015 aimed mainly on developing conceptual novel, adaptive and future proof for 5G networking. The networking architecture is able to provide an expected level of customizability, ensuring stringent performance, security, cost and energy requirement as well as giving APS-driven architectural openness, gearing the economic growth etc, with present technology in the mobile telecom field. This work will eventually increase the speed of the bandwidth providing UHD/BD, submerged apps and ultra response cloud as well. Radio interface clubbed up with novel network management functions and its

architecture will lay a pathway for 5G PPP, KPI and demolish the usage of novel tracking of address, the specific challenges that prevailed in mm-wave propagation. The main objective of this work is to strengthen up the European markets. Consortium binds up infrastructure vendor, European operations, top ranking research centers and university, measurement equipment vendor and one SME.

XHaul which was IMDEA Network project and also one among the European project 2020 5G PPP (Public Private Partnership) was better than fronthaul and backhaul and overcame its disadvantage too. [9] It provided a usable, sharable, cost affordable transport network. The greatest advantage of this was RAT and basic network mode. This team will be able to provide whole system optimization of Quality Of Service (QOS) as well as energy and network aware application development. It has about 21 firms and its partners includes many telecommunication companies, IT sectors, small and medium sized enterprise and academic institution as well.

The next project was the flex 5G ware organized by European 5G research by July 2015. This team integrated both networking and device together with the increase in capacity, energy consumption and modifies the present 4G network to 5G as well by using reconfigured hardware (HW) platform combined with HW-agnostic software (SW). This project will be ready to meet the requirements in mobile data traffic and large diversity of applications as well. In the same year SUPERFLUIDITY work was started which was also a part of 2020 5G PPP headed by CNIT which was an Italian inter-university consortium. In general physical term, super fluidity refuses to the state in which the substance melts down into fluid and moves with zero viscosity. In the same way network is trying to run the services anywhere and shift to location. This team is able to solve the drawbacks of update networking system. Long provisioning times, reliance a rigid and cost ineffective hardware devices daunting complexity emerging from three forms of heterogeneity. Heterogeneous traffic and source, heterogeneous service and needs, and heterogeneous access technologies with multi vendor networking. This project would bring a revolution in business sectors and reduce the setup and maintenance cost.

Around January 29, 2016 Google bought forth the project of 5G in the name of Sky Bender and planned to disturb the connection through sun-powered drones. By middle of the year at March UK government wanted to become the leading among all

the 5G producers. Even though the project does not support much it planned for a big focus update. The advance research that brings out the latest 5G module are as follows:

- Massive mimo.
- Proactive content caching at edge.
- Interface and mobility management.
- Internet of things.
- Mm wave frequency.
- Passive networks.
- Multiple-hop networks.
- Wireless network virtualization.
- Cognitive radio.
- Dynamic Adhoc wireless network.
- Vendor monde subspace frequency division multiplexing.
- IPV6.
- Wearable device with AI capability.
- Standardization.
- Wireless modulus without any restriction in access and zonal issues.
- User centric.
- Li-Fi is a possible MIMO visual
- Worldwide Wireless Web(WWW)

All these research features are to be bought together to form the next latest generation of while networking layer the base for machine thinking and man-machine interactivity.[7] The drawbacks of existing generation have been solved and the present enhancement has been made with the latest research results. This project would be a success if it overcomes all its drawbacks and provide the estimated speed and latency rate. This will make a new revolution in the field of networking.

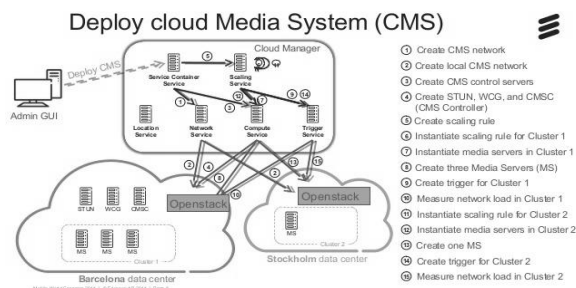


Figure 2 Deploy cloud media system

### 3. ANTIQUE HISTORY OF 5G NETWORKING

April 2008, NASA in hand with Geoff brown and M2MI(Machine-to-Machine Intelligence)Corporation was the start of 5G technology.[3][6]“5G mobile communication system based on beam-division

multiple access and relays with group cooperation” was also standard in same year.NYU wireless project of August 2012 to being out 5G wireless.

University of surveyfunded 35M and accompanied with British government, UKRPIF (UK Research Partnership Investment Fund) providing testing phase for all the 5G networks. It was partnered by Hawaii Samsung, Telefonica, Fujitsu lab, Rohed& Schwarz and Aircom international.Mobile and wireless communication enables for the twenty-twenty information society metes project of November 2012 will play a major role on standardization and stakeholder ship.I join EU aimed on “small cell” technologies with the advantages of certain resources such as radio wore spectrum in November 2012 paved the next step of 5G evolution. ITU-R works in February 2013 bought the results on the study on the IMT 2020 and study on future of IMT terrestrial system.Samsung in the year 2013 may had a speed of 1056 gigabits within 2km with the help of MIMO technique.NTT (Nippon Telegraph and Telephone)was the first to outbreak 5G in JAPAN around October 2013.

Start testing of 5G on 8<sup>th</sup> May 2k14 by NTT DoCoMo hand in hand with alcatel lucent, Ericsson, Fujitsu, NEC, Nokia and Samsung.[2]CROWD a project of EU during June 2014 made a list of demonstration at EUCUL European Conference on Network and Communication headed by EC during the same year.TIGER-CM (Integrated technologies for management and question of 5G networks) whose goal was to formulate next generation mobile networking on the bases of SON (System defined networking) which was headed by IMDEA.Megafon and Hawaii powering on the research of 5G networking at the Russia would show its trail version at the end of 2051.

In about 19 November 2014, Hawaii and sister triggered up with the agreement of mouth to breakout 54 networking. Greek government has given a statement that it would provide license to 5G access would bring a preferable earning of about 350 million Euros by solving the update.Testing phase of 5G would begin at US in 2k16.In around 8<sup>th</sup> September 2k15 Verizon announced this testing phase would be conducted in field trials in US.Orange picked up innovative idea in the development of 5G in January 2016 in Belfort at France.Ericsson tied up with felia source bought its networking skill together to form a 5G network to provide this technology to TeliaSoneracustomers.NTT DoCoMo and Ericsson has a positive result in providing a speed of 5G outdoor trait at 22<sup>nd</sup> February 2016.Around 22<sup>nd</sup>

February 2016 Samsung and version joined hands to form trails for 5G. All these researches in a minute level progression bought a great revolution in field of networking in the name of 5G. This technology traces its basic and complete policies from the above researches in a successful manner.

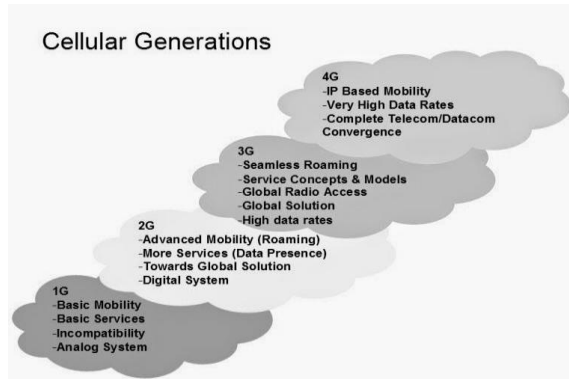


Figure 3. Cellular Generations

#### 4. WHY 5G?

Three major and very distinct 5G network versions that had emerged by 2014 has led to the importance of 5G and gives a clear answer for the question why the next generation has come “5G”. [8]

They are:

- a) A super-efficient mobile network.
- b) A super fast mobile network.
- c) A converged fiber-wireless network

**4.1 A super-efficient mobile network** It is the most advanced mobile network that has the better performance than the other networking technology available in a cost efficient manner. [4] On a scalar compression of cost in accordance with the data transfer rate, it is nearly the direct reaction to that of the amount of data transferred. This technology would move ahead with the IET DAN (Diamond Attentive Network) technique.

**4.2 A super fast mobile network** This technology is superfast when compared to other networking as its latency is very less almost 0. It was a concept of small cells in which it has a very high density clustered beam of network to provide continuous coverage with any interception in between in a whole of the urban area. This technology is the true “wide area mobility” technique. To do this it requires spectrum under 4 GHz through the dynamic spectrum access

**4.3 A converged fiber-wireless network** In this technology, for the first time internet Wi-Fi is used within mm-wave bands. This is capable to send

wide band radio channels at a speed rate 10 gigabit/s. It generally requires only a short Wi-Fi link at the end of the fiber optic cable. This would provide a high nomadic service rather than the normal mobile service.

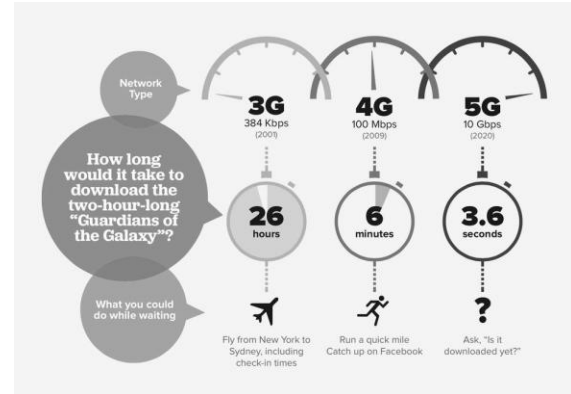


Figure 4 Variations in Network speed

Horizon 2020 5GPPP, a project of European Union suggested that this technology is at the most significant for the sectors such as automotive, transportation, healthcare, energy, manifesting, media and entertainment. It expects a latency less than 5ms and connectivity for about 100 devices in a square meter. It also expects a proper coverage. To solve quite a lot of requirements and also overcome the drawback of pre existing generation the 5G was introduced. Thus it clearly explains why 5G is an essential update.

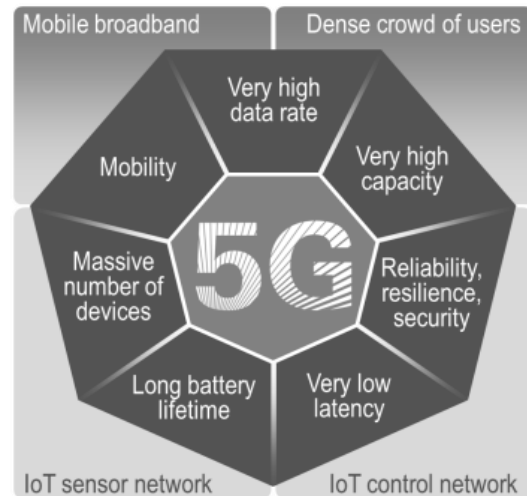
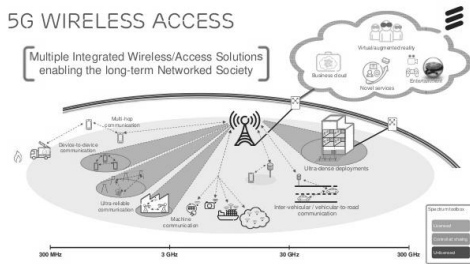


Figure 5 Merits of 5G network

#### 5. CONCLUSION

This paper has totally discussed about the upcoming generation technology that would increase the speed of internet access in a rapid way. This technology upgraded would have a vast expectation in market and provide benefit to all

sectors at some cost. The cost efficiency and speed is expected to be unimaginable.



**Figure 6 5G Wireless Access**

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