



# Analysis of Emerging Technology of 5G Network in 3D

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**Abstract**—5G technology is such an enormously wide variation in the requirements: superfast downloads to small data requirements than any one system will not be able to meet these needs. The gigantic array of innovative technology being built into new cell phones is stunning. Now we are implementing and adding the concept of 3D internet with a speed of 5G. It is a powerful new way to reach consumers, online medical diagnosis, business customers, co-workers, partners, and students. It combines the immediacy of television, the versatile content of the Web, and the relationship-building of social networking sites like Face book. The 3D Internet is inherently interactive and engaging. Virtual worlds provide immersive 3D experiences that replicate (and in some cases exceed) real life.

**Keywords:** 5G wireless network, 3D

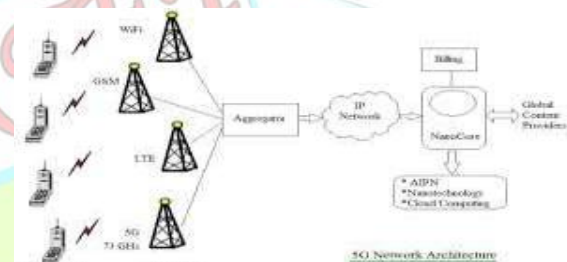
## I. INTRODUCTION

Mobile and Wireless Communication systems will allow 5G support for the expected increase in data volumes and broadening in the range of application domains. 5G systems are built upon the evolution of existing technologies complemented by new radio concepts that are designed to meet the new and challenging requirements. Essential services such as e-banking, e-learning and e-health will continue to proliferate and become handier for pocket devices. Evolutionary research has been carried out on the development of interactive television (iTV), Video on Demand (VoD) and broad wireless internet contents, which will progressively be delivered over mobile and wireless systems. These developments will lead to an avalanche of mobile and wireless traffic volume, projected to increase a thousand-fold over the next decade. Furthermore, some applications will impose additional and very diverse requirements on mobile and wireless communication systems that 5G will have to support.

## II 5G PRELIMINARY INFORMATION ABOUT THE WIRELESS TECHNOLOGY

### A. 5G OVERVIEW AND DIFFERENCES

5G is a new technology which provides significant gains over previous systems and an adequate business case for mobile operators to invest in new system. Facilities that might be seen with 5G technology include far better levels of connectivity and coverage. The term World Wide Wireless Web, or WWW is being coined for this for 5G technology to be able to achieve this, new methods of connecting will be required as one of the main drawbacks with previous generations is lack of coverage, dropped calls and low performance at cell edges. 5G technology will need to address this.



### B. Features

- 5G technology offer high resolution for crazy cell phone user and bi- directional large bandwidth shaping.
- The advanced billing interfaces of 5G technology makes it more attractive and effective.
- 5G technology also providing subscriber supervision tools for fast action.
- The high quality services of 5G technology based on Policy to avoid error.
- 5G technology is providing large broadcasting of data in Gigabit which supporting almost 65,000 connections.
- 5G technology offer transporter class gateway with unparalleled consistency.
- The traffic statistics by 5G technology makes it more accurate.



- Through remote management offered by 5G technology a user can get better and fast solution.
- The remote diagnostics also a great feature of 5G technology.
- The 5G technology is providing up to 25 Mbps connectivity speed.
- The 5G technology also support virtual 3D private network.
- The new 5G technology will take all delivery service out of business prospect
- The uploading and downloading speed of 5G technology touching the peak.

### C. Table Structure Of Generations

GENERATION	REQUIREMENTS	COMMENTS
1G	No official Requirements. Analog Technology	Deployed in 1980s
2G	No official requirements. Digital Technology. First digital Systems.	Deployed on 1990s. New services such as SMS and low rate data
3G	ITU's IMT-2000 required 144 kbps mobile, 384 kbps pedestrian, 2 Mbps	WiMAX now an official 3G technology
4G	Advanced requirements include ability to operate in up to 40MHz radio channels and with very high spectral efficiency.	IEEE 802.16m and LTE-Advanced being designed to meet requirements
5G	heterogeneous wireless devices added to IP architecture of 4G communication system 10Gbps peak data rates with 8~10bps/Hz/cell.	New system concepts to boost for this wireless network and implementing 3D concept

### D. 5G specifications

Although the standards bodies have not yet defined the parameters needed to meet a 5G performance level yet, other organizations have set their own aims that may eventually influence the final specifications

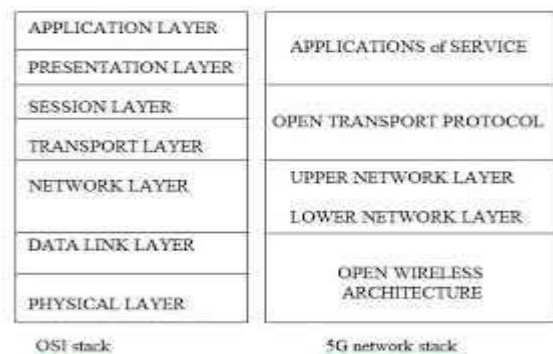
Typical parameters for a 5G standard may include:

Suggested 5G Wireless Performance	
Parameter	Suggested Performance
Network capacity	10 000 times capacity of current network
Peak data rate	10 Gbps
Cell edge data rate	100 Mbps
Latency	< 1 ms

### 5G Network Architecture | 5G protocol stack

This page of 5G tutorial covers 5G network architecture and 5G protocol stack. The 5G network architecture consists of all RANs, aggregator, IP network, Nanocore etc. The 5G protocol stack consists of Open Wireless Architecture, lower and upper network layer, open transport protocol and application layer. These have been explained below with the figures.

Figure-1 depicts 5G network architecture. As shown 5G network uses flat IP concept so that different RANs (Radio Access Networks) can use the same single



Nanocore for communication. RANs supported by 5G architecture are GSM, GPRS/EDGE, UMTS, LTE, LTE-advanced, WiMAX, WiFi, CDMA2000, EV-DO, CDMA One, IS-95

### E. 5G Protocol Stack

Figure-2 below depicts 5G protocol stack mentioning 5G protocollayers mapped with OSI.

**OWA Layer:** OWA layer is the short form of Open Wireless Architecture layer. It functions as physical layer and data link layer of OSI stack.

**Network Layer:** It is used to route data from source IP device to the destination IP device/system. It is divided into lower and upper network layers.

**Open Transport Layer:** It combines functionality of both transport layer and session layer.

**Application Layer:** It marks the data as per proper format required. It also does encryption and decryption of the



data. It selects the best wireless connection for given service.

### III 5G Requirements For The Next Generation Mobile Wireless System

#### A. 5G Technology Requirements

In recent years there have been several views about the ultimate form that 5G wireless technology should take. There have been two views of what 5G wireless technology should be:

- **Hyper Connected View-** This view of the requirements for 5G wireless systems aims to take the existing technologies including 2G, 3G, 4G, Wi-Fi and other relevant wireless systems to provide higher coverage and availability, along with more dense networks. Apart from having requirements to provide traditional services, a key differentiator would be to enable new services like Machine to Machine, M2M applications along with additional Internet of Things, IoT applications. This set of 5G requirements could require a new radio technology to enable low power, low throughput field devices with long battery lifetimes of ten years or more.
- **Next Generation Radio-Access Technology-** This view of the 5G requirements takes the more technology driven view and sets specifications for data rates, latency and other key parameters. These requirements for 5G would enable a clear demarcation to be made between 4G Sim or other services and the new 5G wireless system.

#### B. Network Synchronization in 5G Ultra-Dense Networks Joint 3D Positioning Using UKF and EKF

It is commonly expected that future fifth generation (5G) networks will be deployed with a high spatial density of access nodes (ANs) in order to meet the envisioned capacity requirements of the upcoming wireless networks. Densification is beneficial not only for communications but it also creates a convenient infrastructure for highly accurate user node (UN) positioning. Despite the fact that positioning will play an important role in future networks, thus enabling a huge amount of location-based applications and services, this great opportunity has not been widely explored in the existing literature. Therefore, this paper proposes an unscented Kalman filter (UKF)-based method for estimating directions of arrival (DoAs) and times of arrival (ToA) at ANs as well as performing joint 3D positioning and network synchronization in a network-centric manner. In addition to the proposed UKF-based solution, the existing 2D extended Kalman filter (EKF)-based solution is extended to cover also realistic 3D positioning scenarios. Building on the premises of 5G

ultra-dense networks (UDNs), the performance of both methods is evaluated and analyzed in terms of DoA and ToA estimation as well as positioning and clock offset estimation accuracy, using the METIS map-based ray-tracing channel model and 3D trajectories for vehicles and unmanned aerial vehicles (UAVs) through the Madrid grid. Based on the comprehensive numerical evaluations, both proposed methods can provide the envisioned one meter 3D positioning accuracy even in the case of unsynchronized 5G network while simultaneously tracking the clock offsets of network elements with a nanosecond-scale accuracy.

### IV. Current Research

The technology can be upgraded by combining two major current trends according to the Radio access technology. The powerful network of 5G and virtual reality of 3D combining to form effective way and interaction between the user and system or Mobile.

#### Basic Process of 5G in 3D

- Internal process
- External 3D virtual reality

##### A. Internal process

There are several key areas that are being investigated by research organizations. These include:

- **Millimeter-Wave technologies**

Using frequencies much higher in the frequency spectrum opens up more spectrums and also provides the possibility of having much wide channel bandwidth - possibly 1 - 2 GHz. However this poses new challenges for handset development where maximum frequencies of around 2 GHz and bandwidths of 10 - 20 MHz are currently in use. For 5G, frequencies of above 50GHz are being considered and this will present some real challenges in terms of the circuit design, the technology, and also the way the system is used as these frequencies do not travel as far and are absorbed almost completely by obstacles.

- **Future PHY / MAC:** The new physical layer and MAC presents many new interesting possibilities in a number of areas:

- **Waveforms:** One key area of interest is that of the new waveforms that may be seen. OFDM has been used very successfully in 4G LTE as well as a number of other high data rate systems, but it does have some limitations in some circumstances. Formats being proposed include: GFDM, Generalized Frequency Division Multiplexing, as well as FBMC, Filter Bank Multi-Carrier, UFMC, Universal Filtered



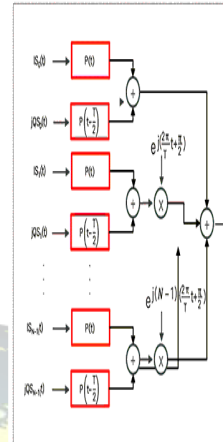
Multicarrier. Each has its own advantages and limitations and it is possible that adaptive schemes may be employed, utilizing different waveforms adaptively for the 5G mobile systems as the requirements dictate. This provides considerably more flexibility for 5G mobile communications.

- **Multiple Access Schemes:** Again a variety of new access schemes are being investigated for 5G technology. Techniques including OFDMA, SCMA, NOMA, PDMA, MUSA and IDMA have all been mentioned.
- **Modulation:** Whilst PSK and QAM have provided excellent performance in terms of spectral efficiency, resilience and capacity, the major drawback is that of a high peak to average power ratio. Modulation schemes like APSK could provide advantages in some circumstances.
- **Duplex methods:** There are several candidate forms of duplex that are being considered. Currently systems use either frequency division duplex, FDD or time division duplex, TDD. New possibilities are opening up for 5G including flexible duplex, where the time or frequencies allocated are variable according to the load in either direction or a new scheme called division free duplex or single channel full duplex. This scheme for 5G would enable simultaneous transmission and reception on the same channel.

### Solutions

Filter Bank Multi-Carrier (FBMC), Generalized Frequency Division Multiplexing (GFDM), Universal Filtered Multi-Carrier (UFMC), Filtered Orthogonal Frequency-Division Multiplexing (F-OFDM), And Many More. F-OFDM And FBMC Are Widely Considered By Multiple Researchers.

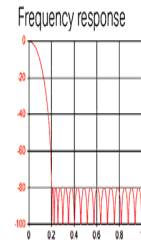
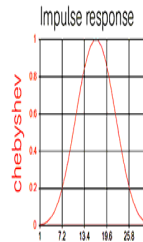
Block diagram of OQAM/FBMC



Transmit signal equation for filtered OFDM

$$X(t) = \sum_n \sum_k S_k(n) P_k(t-nT) e^{j2\pi k(t-nT)/T}$$

$$P_k(t) = \text{rect}\left(\frac{t-T/2}{T}\right) * h(t)$$



Transmit signal equation for FBMC

$$X(t) = \sum_n \sum_k S_k(n) P_k(t-nT/2)$$

$$P_k(t) = p(t) e^{j(k+n)\pi/2} e^{j\pi k t/T}$$

Like F-OFDM, FBMC is a well-known multicarrier technique in which data symbols are simultaneously transmitted over multiple frequency subcarriers. The main difference between the two is the choice of symbol time and prototype filters. In an FBMC system,

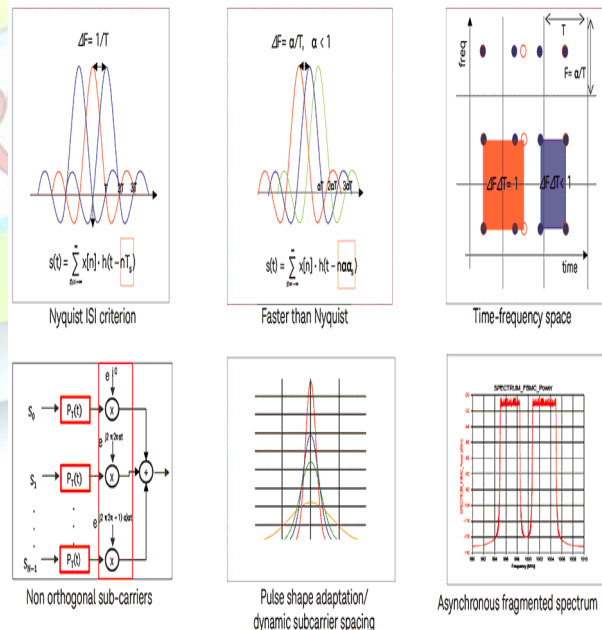


Figure 2. This diagram provides a closer look inside some of the new 5G waveform technologies.

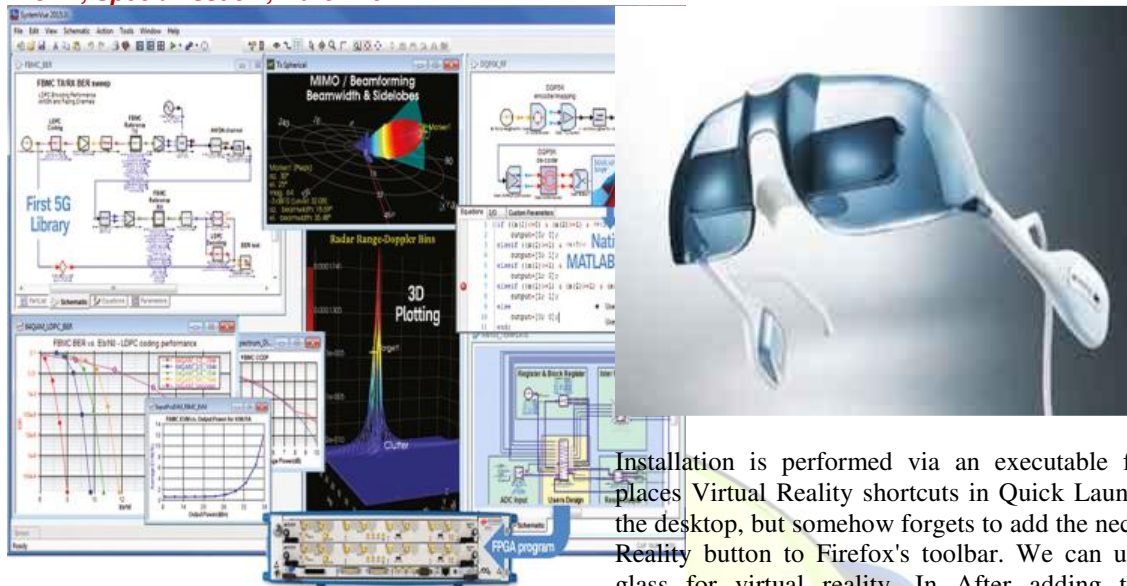


Figure 3. As a dedicated platform for ESL design and signal processing realization, System replaces general-purpose digital, analog, and math environments.

It enables system architects and algorithm developers to innovate the PHY of wireless and aerospace/defense communications FPGA/ASIC implementers.

Adding the 5G Baseband Exploration Library to the mix provides ready-to-use advanced digital signal processing blocks for 5G candidate waveform technologies, end-to-end physical layer transmit and receive simulation models, and signaling schemes for MIMO channels (Figure 4). It also enables reference waveform generation to verify RF circuit designs.

#### B. External process 3D virtual reality

The success of 3D communities and mapping applications, combined with the falling costs of producing 3D environments, are leading some analysts to predict that a dramatic shift is taking place in the way people see and navigate the Internet and also will be immersed in a three dimensional "stereo-vision" virtual reality called 3dLife with a speed of 5G.

Installation is performed via an executable file which places Virtual Reality shortcuts in Quick Launch and on the desktop, but somehow forgets to add the necessary 3D Reality button to Firefox's toolbar. We can use the 3D glass for virtual reality. In After adding the button manually and repeatedly being told our current version was out of date, we were ready to 3D-ify some websites and see just how much of reality we could leave in two-dimensional dust. Mobile phones we can create 3D mode and use it as when necessary.



Virtual Reality is designed to offer different kinds of 3D environments that center around spacious rooms that users can explore and customize, but it can also turn some sites like Flickr into virtual museums, hanging photos on virtual walls and halls. Strangely, it's treating Ars Technical as an image gallery and presenting it as a malformed 3D gallery through the internet in the speed of 5G technology. We will see the excited result and its interactive virtual reality.

#### 3D Mouse

A 3D mouse lets you move effortlessly in all dimensions. Move the 3D mouse controller cap to zoom, pan and rotate simultaneously. The 3D mouse is a virtual



extension of your body - and the ideal way to navigate virtual worlds like Second Life.



## Conclusion

Shopping is the most effective way to shop online. 3DInternet dedicated years of research and development and has developed the worlds' first fully 3D functional, interactive and collaborative shopping mall where online users can use our 3DInternet's Hyper-Reality technology to navigate and immerse themselves in a Virtual Shopping Environment. Unlike real life, you won't get tired running around a mall looking for that perfect gift; you won't have to worry about your kids getting lost in

the crowd; and you can finally say goodbye to waiting in long lines to check out.

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