



## 5G Wireless Technology

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### ABSTRACT

The 5G technology is growing worldwide and has a drastically changed our life. The 5G technology will decide upcoming future devices and Industry Automation. The 5G technology is one of the most powerful source for mobile data traffic and has led to development of different Technologies such as access technology, Wireless communication, Internet Technology. 5G technology will approaches to leverage the quality of experience of end users. Technology improvements such as low latency, flexibility in network, portability, usage of visualization and and fast computation technologies have been added to 5G technology.

### INTRODUCTION

In recent years, the worldwide growth in mobile data traffic has led to the event of recent technologies for future high capacity communication systems. Each year the amount of wireless devices such smartphones, laptops and tablets increases, thus multimedia content becomes the most a part of the general mobile data transferred. This fact ends up in an following generation of communication networks, which are expected to be deployed beyond 2020. Network design ers face several critical challenges, all of which require to be addressed, like optimal spectra allocation, high-capacity broadband links, power consumption, quality of services (QoS) and mobility. as an example, approximately one exabyte (EB) of information was transferred across the whole global internet in 2000 (0.083 EB/month). In contrast, 30 times more data was carried by the mobile networks per month in 2014, which corresponds to 2.5 EB/month). Moreover, the most recent projections from Cis co predict that the general mobile data traffic will reach approximately 24 EB/month by 2019, which is approxima tely one order of magnitude larger than 2014. This corresponds to a compound annual rate of growth (CAGR) of 57% for the 2014-2019 period. Following the projection Fig. 1 also shows the fit this data, which estimates that > 30 EB/month are transmitted beyond 2020. Most of this mobile data traffic (up to 69%) is anticipated to incorporates video and media by the top of 2018. Recent years, the worldwide growth in mobile data traffic has led to the event of latest technologies for future high capacity communication systems.

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Recent years, the worldwide growth in mobile data traffic has led to the development of new technologies for future high capacity communication systems. Every year the number of wireless devices such smartphones, laptops and tablets increases, thus multimedia content becomes the main part of the overall mobile data transferred. This fact results in an increasing throughput requirement from the next generation of communication networks (5G), which are expected to be deployed beyond 2020. Network designers face several critical challenges, all of which need to be addressed, such as optimal spectra allocation, high capacity broadband links, power consumption, quality of services (QoS) and mobility. For instance, approximately one exabyte (EB) of data was transferred across the entire global internet in 2000 (0.083 EB/month). In contrast, ~30 times more data was carried by the mobile networks per month in 2014, which corresponds to ~2.5 EB/month (refer to

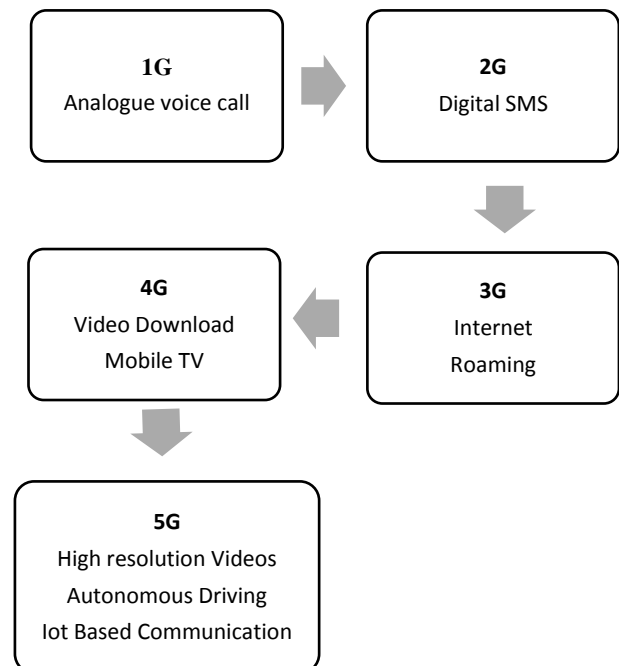


Fig. 1). Moreover, the latest projections from Cisco predict that the overall mobile data traffic will reach approximately 24 EB/month by 2019, which is approximately one order of magnitude larger than 2014. This corresponds to a compound annual growth rate (CAGR) of 57% for the 2014-2019 period. Following the projection Fig. 1 also shows the fit for this data, which estimates that > 30 EB/month will be transmitted beyond 2020. Most of this mobile data traffic (up to 69%) is expected to consist of video and media by the end of 2018.

|               | 4G   | 5G   |
|---------------|--|--|
| Bandwidth     | 200mbps  | >1gbs  |
| Latency       | 20-30 ms   | <10 ms   |
| Average Speed | 25 mbps  | 200-400 mbps   |
| Technology    | Wi-Max, LTE  | Developing   |
| Features      | Incredibly fast download speeds paved the way for HD Streaming | Ultra-fast internet, low-latency, and improved reliability |

## HOW 5G WORKS

As the other cellular network, 5G networks will consist of cells divided into sectors and send data through radio waves. Each cell is connected to a network backbone through a wired or wireless connection. 5G may transmit data over the unlicensed frequencies currently used for Wi-Fi. It promises a smarter, faster, and efficient network. The goal of 5G is to have far higher speeds available, at higher capacity per sector, and at far lower latency than 4G. so as to extend network efficiency, the cell is subdivided into micro and picocells. 5G will be a new mobile revolution as it is expected to provide gigabit-per-second data rates anytime, anywhere. during a 5G wireless network, every mobile will have an IPv6 address reckoning on the location and network being employed. 5G utilizes user-centric network concept World Wide Wireless Web (WWWW) rather than operator-centric as in 3G or service-centric as in 4G. WWW are going to be capable of supporting applications and services and interconnected the whole world. 5G includes the latest technologies such cognitive radio, Internet of things, nanotechnology, and cloud computing.

5G technology has the subsequent advanced features :

- Architecture will be device-centric, distributed, programmable, and cloud-based
- High data rates
- One to 10 Gbps connections to finish points One millisecond end-to-end trip delay. Low battery consumption
- Better connectivity regardless of location
- Larger number of supporting devices
- Lower cost of infrastructure development

### Key Enabling Technologies

The development of 5G will not be from scratch but will gradually depend upon 4G LTE. Major technologies enabling 5G include:

**D2D Communication:** Direct connectivity is achieved through device-to-device (D2D) technology. 5G cellular network will implement D2D mm wave communication technology to produce high speed data rate, improve coverage, and offer peer-to-peer services. Much research effort has been invested of characterizing D2D connections as a part of LTE .

**M2M Communication:** While D3D communication targets mobile radios, machine-to-machine (M2M) expands the scope and facilitates ubiquitous connectivity among mobile devices.

**MIMO:**

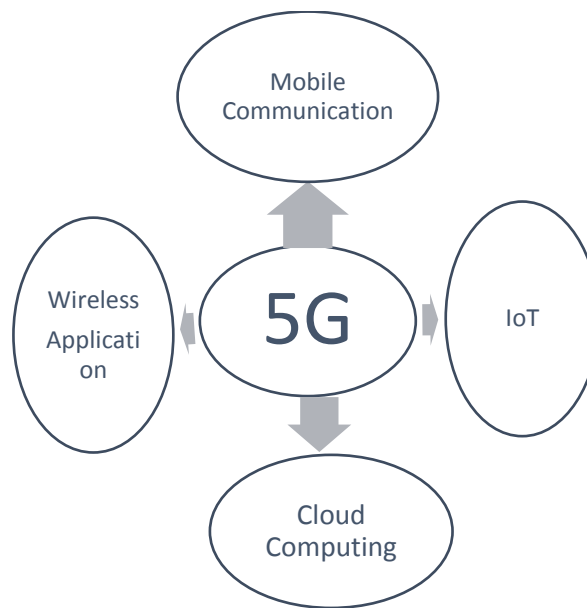
Multiple-input-multiple-output (MIMO) technology plays a vital role in 4G and is predicted to play an important function in 5G. Massive MIMO extracts the advantages of MIMO on a large scale by increasing the throughput and spectrum efficiency. Other enabling technologies of 5G include mmWave communication, ultra-dense network (UDN), all-spectrum access (ASA), OFDM (orthogonal frequency division multiplexing), and Internet of things.

### POTENTIAL APPLICATIONS:

Some of the significant applications of 5G wireless technologies include :

- Virtual reality/augmented reality/tactile Internet
- Autonomous driving/connected cars
- Wireless cloud-based office/multiple-person videoconferencing
- Unified global standard for all
- Network availability anywhere anytime
- Blockchain
- 3D and ultra HD videos
- Smart grid
- Smart surgery and remote checkup

In addition, 5G will allow one to pay all bills in a single payment with his/her mobile and vote from his/her mobile.



## 5G 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 satisfy increasing demands of the cellular communications market. It's a standard platform for all radio access technologies.

The AIPN uses packet switching and its continuous evolution provides optimized performance and price. In fifth generation specification carries with it a user terminal (which incorporates a crucial role within the new architecture) and variety of independent, autonomous radio access technologies (RAT). In 5G specification all IP based mobile applications and services like Mobile portals, Mobile commerce, Mobile health care, Mobile government, Mobile banking et al, are offered via Cloud Computing Resources (CCR). Cloud computing could be 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 most challenge for a RMTC is to cope with increasing different radio access technologies. The core could be a convergence of the nanotechnology, cloud computing and radio, and supported All IP Platform. Core changes its communication functions looking on status of the network and/or user demands. RMTC is connected to different radio access technologies starting from 2G/GERAN to 3G/UTRAN and 4G/EUTRAN additionally to 802.11x WLAN and 802.16xWMAN.

Other standards also are enabled like IS/95, EV-DO, CDMA2000 etc.

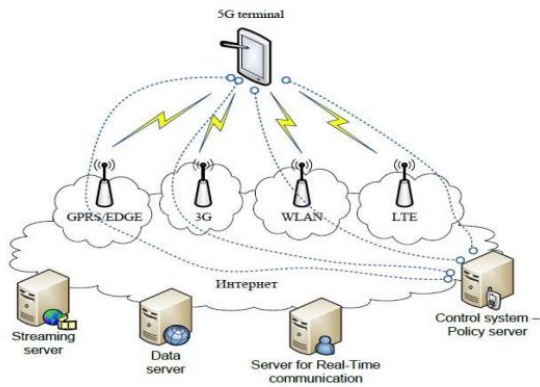


Fig: 5G Network Architecture

## BENEFITS

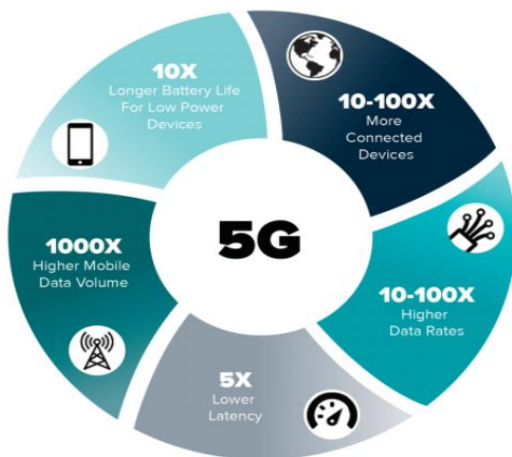
5G wireless technology is projected to bring twomain benefits:

- **Faster speed:** Data transfer speeds with 5G are projected to be about 10 times higher with 4G. That means significantly faster transmission of images and videos. **Shorter delays:** 5G should reduce latency (the time between cause and effect). This will make it possible, for example, to watch high-speed virtual reality video with no delays.

- **Increased connectivity:** 5G technology would will bring faster, more reliable connections for users than 4G/LTE. That means more people and devices will be able to communicate at the identical time. Besides these benefits, 5G has excellent capability to support both software and consultancy. It has high rate at the edge of the cell and better coverage area. it's low battery consumption. It is beneficial for the government, as it can make governance easier, and for the citizen, because it can provideInternet connectivity anytime anywhere.

## Challenges

The transition from 4G to 5G presents several transformational challenges which must be tackled to fully realize the 5G vision. There are challenges faced with the new technologies enabling 5G. There also are challenges with the integration of this technology to produce services in several Applications.



We also need to meet 5G system performance requirements such networkscalability, very long battery life, and green communications. It may be a challenge to satisfy these requirements and minimize costs at the same time.

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## CONCLUSION

The 5G wireless technology is a multipurpose wireless network for mobile, fixed and enterprise wireless applications. It incorporates all type of advanced features that makes it powerful and in huge demand in near future. Many tests and trials need to be conducted before implementing 5G. 5G technology remains in development stage. It incorporates a brightfuture and are a revolution within the mobile market. The development of the mobile and wireless networks goes towards higher data rates and all-IP principle. Mobile terminals are obtaining every year more processing power, more memory on board, and longer battery life for the identicalapplications. 5G include latest technologies like cognitive radio, SDR, nanotechnology, cloud computing and supported All IP Platform.

It's expected that the initial Internet philosophy of keeping the network simple as possible, and giving more functionalities to the top nodes, will become reality within the future generation of mobile networks, here observed as 5G.

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