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DEVELOPMENT OF 5G NETWORK TECHNOLOGY

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ABSTRACT

The 5G technology is expected to provide new bands along with the wider spectral bandwidth per frequency channel. As we know previous generation mobile technologies have indicated a substantial increase in peak bit rate. 5G is different from the previous one. 5G is not only the increase in bit rate from the 4G, it also Larger data volume per unit area. High capacity to allow more devices connectivity concurrently and instantaneously is the main feature of the 5G. Lower battery consumption, Better connectivity regardless of the geographical area, a larger number of supporting devices Lower cost of infrastructural development and better reliability of the communications are key features of the 5G network.

Keywords: 1G, 2G, 3G, 4G, 5G, MIMO, MEC, NOMA.

A. INTRODUCTION:

Radio technologies have indicated a rapid and multidirectional evolution of the analogue cellular systems in 1980s. Thereafter, digital wireless communication systems are consistently on a mission to satisfy the growing need of citizenry (1G, 2G ...4G or now 5G). So, this paper describes the 5G technology highlighting on its significant features, technological design (architecture), advantages and challenges.

B. Network:

A network, in computing, could also be a gaggle of two or more devices which will communicate. The computers on a network could even be linked through cables, telephone lines, radio waves, satellites, or infrared beams.

C. Object of the study :

- A. To review the network generation development
- B. To study the 5G network generation development

D. Data sources : This study is predicated on secondary data sources

E. The history of the network :

The 1G cell phones were within the 1970s and 80's.

they're big and heavy. it had been analog like traditional home landline phone. The 1990's saw 2G cell phones make a call can send smiling faces and messages. it had been digital. within the 2000's 3G cell phones accompany internet browsers. The technology behind 3G is HSPA plus 3G used MIMO multiple inputs multiple output method for multiplying the capacity of the link . In data transmission, packet switching is employed . within the 2010s 4G come and nowadays everyone are using 4G network, Behind 4G LTE (Long-Term Evaluation) or WiMax. 4G uses IP and packet switching. 2020 are going to be 5G. 5G are going to be 100 times faster than the present 4G.

F. 4G Network :

4G is defined because the fourth generation of mobile technology which follows the 2G and 3G networks. it's also referred to as 4G LTE. Nowadays it's the foremost advanced technology that's employed by the bulk of mobile network service providers. Standard 4G offers download speeds of around 14 Mbps, which is nearly five times faster than the 3G network. 4G networks can reach speeds as high as 150 Mbps, allowing users to

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download gigabytes of data in minutes or even seconds, instead of hours like with 3G networks. Uploading data is far faster. Standard 4G upload speeds are around 8 Mbps, with theoretical speeds reaching as high as 50 Mbps.

G. what's 5G?

5G may be a software defined network. It means while it's won't replace cable entirely It could replace the necessity for them by largely operating on the cloud instead. this suggests it'll have 100 times better capacity that 4 G which can dramatically improve internet speed, for instance , to download two hours film on 3G would take about 26 hours, 4G takes 6 minutes and on 5G you'll be able to watch your film in only over three and half seconds. The 5G technologies include all kinds of advanced features that make 5G technology the foremost powerful and in huge demand within the near future.

H. LITERATURE REVIEW ON 5G:

1. Farris said that, the web of Things (IoT) ecosystem is evolving towards the deployment of integrated environments, wherein heterogeneous devices pool their capacities together to match wide-ranging user and repair requirements. As a consequence, solutions for efficient and synergistic cooperation among objects acquire great relevance. Along this line, this paper focuses on the adoption of the promising MIFaaS (Mobile-IoT-Federation-asa-Service) paradigm to support delay-sensitive applications for high-end IoT devices in next-to come fifth generation (5G) environments. MIFaaS fosters the provisioning of IoT services and applications with low-latency requirements by leveraging cooperation among private/public clouds of IoT objects at the sting of the network. A performance assessment of the MIFaaS paradigm during a cellular 5G environment supported both future Evolution (LTE) and therefore the recent Narrowband IoT (NB-IoT) is presented. Obtained results demonstrate that the proposed solution outperforms classic approaches, highlighting significant benefits derived from the joint use of LTE and NB-IoT bandwidths in terms of increased number of successfully delivered.

2. Bego Blanco discusses current standardization situation of 5G and therefore the role network softwarization plays so as to deal with the challenges the

new generation of mobile networks must face. This paper surveys recent documentation from the most stakeholders to select out the utilization cases, scenarios and emerging vertical sectors which will be enabled by 5G technologies, and to spot future high-level service requirements. Driven by those service requirements 5G systems will support diverse radio access technology scenarios, meet end-to- user experienced requirements and supply capability of flexible network deployment and efficient operations.

3. Rupendra NathMitra discussed, all new 5G expected to be operational by 2020. This time, it's therefore crucial to understand the direction of research and developments enabling 5G technology. This paper provides an inclusive and comprehensive analysis of recent developmental endeavors toward 5G. It highlights salient features, i.e., flexibility, accessibility, and cloud based service offerings; those are getting to make sure the futuristic mobile communication technology because the dominant protocol for global communication.

4. Erik Dahlman analyzed details of the new 5G radio-access technology to be developed by 3GPP. It begins with a discussion of some key design principles that must be followed so as to make sure a high performance, flexible, and future proof air interface. It then goes more into the small print on the key 5G technology components including but not limited to duplex arrangement, 5G waveform, massive MIMO, multi-site connectivity, flexible system plane, and access/backhaul integration.

While the longer term is becoming harder to predict with each passing year, we should always expect an accelerating pace of technological change. We conclude that nanotechnology, Cloud computing, All IP are subsequent great technology. the event of the mobile and wireless networks goes towards higher data rates and all-IP principle.

I. APPLICATIONS OF 5G TECHNOLOGIES

- 1) Real wireless world with no more limitation with access and zone issues.
- 2) Wearable devices with AI capabilities.
- 3) Internet protocol version 6(IPv6), where a visiting care-of mobile IP address is assigned consistent

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with location and connected network.

- 4) One unified global standard.
- 5) Pervasive networks providing ubiquitous computing: The user can simultaneously be connected to many wireless access technologies and seamlessly move between them these access technologies are often a 2.5G,3G, 4G or 5G mobile networks, Wi-Fi, WPAN or the other future access technology. In 5G, the concept could also be further developed into multiple concurrent data transfer paths.
- 6) Cognitive radio technology, also referred to as smart radio: allowing different radio technologies to share an equivalent spectrum efficiently by adaptively finding unused spectrum and adapting the transmission scheme to the requirements of the technologies currently sharing the spectrum. This dynamic radio resource management is achieved during a distributed fashion, and relies on software defined radio.
- High altitude stratospheric platform station (HAPS) Systems. The radio interface of 5G communication systems is usually recommended during a Korean research and development

program to be supported beam division multiple access (BDMA) and group cooperative relay techniques.

J. Response Time :

Response Time will much faster than 4G network. It will take around one millisecond, 400 times faster than the blink of the eye. Smart phone users will enjoy a more streamlined experience but for a world that is increasingly dependent on the internet just to function a reduction in time delay is critical. For example, selfdriving cars require a continuous stream of data the quicker that information is delivered to autonomously vehicles the better and safer they can run. 5G provides much more personalized web experiences using a technique called network slicing- It is a way of creating a separate wireless network on the cloud.

K. Features of 5G :

1. 5G will be new radio called millimeter wave, The radio frequency spectrum from One gigahertz be very crowded many technologies uses this range such as GPS, Wi-Fi, 4G, 3G LBand satellite, Sband and Cband. The spectrum range from 30 GHz to 300 GHz knows as millimeter-wave is utilized thus the range from 24 GHz to 100 GHz proposed for 5G.



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The millimeter-wave has at least three advantages

- 1. It is a new and less used bandwidth
- 2. Higher frequency wave carries much more data than lowered frequency wave.
- 3. Millimeter-wave makes it possible to have massive MIMO antenna

2. Massive MIMO : The relationship between the wave frequency and antenna size is inversely promotional which means lower frequency needs a bigger antenna to transmit and receive while higher frequency signals can work well with smaller size antenna. The higher frequency wave we can use the smaller antenna we can get thus millimeter-wave makes it

possible to have a lot of transmitters and receivers installed on a small size cell or panels.

3. Small cell : Millimeter-wave has advantages but it has some disadvantages too, for example, higher frequency signals will have more collisions with obstacles in the air and thus they tend to lose energy more quickly there for millimeter-wave signals cover a shorter distance. They are also blocked by buildings and trees to solve these problems small cells are needed to fill in coverage gaps between a base station and users. Each cell station covers a small area the number of small cell stations, and the distance between them depends on the population and that location.



Source: https://www.researchgate.net/figure/A-multi-tier-architecture-for-5G-networks-with-small-cell-base-stations-SBS-mobile_fig1_334382834

In the highly populous district, for instance, the space between small cells could vary from 10 to 100 meters. Within the future, you would possibly see such small cells everywhere in your neighborhood.

4. **Beam forming :** In 4G the wireless signals, if not unidirectional are spreading over an outsized area as they travel. Thus signals tend to lose energy more quickly to

form things worse, different users might interfere with one another if they're standing on the brink of one another. Beam forming makes the transmission between users and base or cell station more directional. It is often visualized because the last beam between them in order that signals appear to be traveling along an invisible cable. The upper density of beam forming results in less

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interference and less energy consumption and thus, the

faster rate are often achieved.



Source: https://www.youtube.com/watch?v=hQvHNVRv ms&feature=youtu.be

5. NOMA : (Non-Orthogonal Multiple Access) In previous generation 1G through 3G, multiple access methods are supported frequency, time and code. In 4G orthogonal multiple access is employed the key idea of

NOMA is to use the facility level of the user devices to access the bottom station. The new multiple access method would allow different signals to share an equivalent channel simultaneously. But NOMA provides a better sum rate than the orthogonal method.



Source: https://www.youtube.com/watch?v=hQvHNVRv_ms&feature=youtu.be

6. Mobile Edge Computing (MEC) : Utilizes cloud computing but brings cloud computing on the brink of users. During a normal cloud computing environment, there are several drawbacks.

1. Cloud services are distant from users' physical

distance always makes a difference. Longer distance would easily create latency.

2. Many data and applications need downloading to users' devices. It might be an excessive amount of to burdens users' devices especially for the devices with limited processing power and memory.

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Source: https://www.youtube.com/watch?v=hQvHNVRv_ms&feature=youtu.be

Mobile edge computing brings cloud computing and services to the sting which is closer to the user they're physically local to users Intensive and latency-sensitive applications like video conference are often hosted at the sting of the network. An application splitting is another benefit. This is able to enable the application to be split into small tasks with some performed at the device and a few at the cloud.

Sr. No.	Specifications	4G (IV Generation)	5G (V Generation)
1	Bandwidth	Up to 100 Mbps	Greater than 1Gbps
2	Frequency Band	2GHz to 8GHz	3GHz to 300GHz
3	Technologies	Unified IP, seamless integration	4G, advanced technologies
		of broadband	based on OFDM
		LAN/WAN/PAN and	modulation and IPV6
		WLAN	
4	Services	Global roaming, Dynamic	Wearable Devices, Dynamic
		Information	information access, HD
		Access, HD streaming, Wearab	streaming,
			Devices with AI capabilities
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L COMPARISON BETWEEN 4G AND 5G MOBILE TECHNOLOGIES

5	Standards	IP based on LAN/WAN/PAN IP	IP based on LAN/WAN/PAN
			and w w w w
6	Multiple Access	CDMA	CDMA, BDMA, FBMC
7	Core Network	All IP Networks	5G Network Interfacing,
			Flatter IP Network
8	Initiation year	2010	2015
0	Antonno tuno	Sub Wayalangth Antonna	Arrow Antonno
9	Antenna type	Sub wavelength Antenna	Array Antenna
10	Radiation Pattern	Omni-directional	Fan-beam Directional
11	Diversity and	Present	Present
	MIMO		
12	Danlaymont	2010	Px 2020
12	Deployment		By 2020.
	Vear		
	Ical		

M. ADVANTAGES:

- 1. 5G has high resolution and bi-directional large bandwidth shaping.
- 2. 5G uses technology with which all networks are often gathered on one platform.
- 3. It's simpler and efficient. Ø Technology to facilitate subscriber supervision tools for the fast action.
- 5G provides an enormous broadcasting data (in Gigabit), which can support quite 60,000 connections.
- 5. It's easily manageable with the previous generations.

N. Conclusion :

5G will set the foundational infrastructure for building smart cities. It supports hypermedia, voice, video Internet and other broadband services, greater effective and more attractive, and has Bi-directional, accurate traffic statistics. 5g include the newest 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 a reality within the future generation of mobile networks 5G should be more intelligent technology that interconnects the whole world without limits.

References :

- 1. Jitendra Kumar Sao1, Veena Thaiwait2, Kavita Mahilane3, Suraj Kumar4.
- 2. "A BRIEF CASE STUDY ON 5G CELLULAR TECHNOLOGIES".
- 3. Miss. Diksha Dileep Neve. "An Overview on fifth generation (5G) mobile wireless Technology".

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---------------------	--------------------

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- 4. Farris Federated IoT services leveraging 5G technologies at the edge- January 2018.
- 5. Bego Blanco, Technology architecture of future pillars in the 5G mobile networks: NFV, MEC and SDN–November 2017.
- 6. Rupendra Nath Mitra, 5G mobile technology: A survey-December 2015.
- Erik Dahlman New 5G Radio-Access Technology-2016.
- Rakesh Kumar Singh1, Deepika Bisht2 and R.C. Prasad3"Development of 5 Mobile Network Technology and Its Architecture".
- 9. Kelechi G. Eze, Matthew N. O. Sadiku, Sarhan M. Musa "5G Wireless Technology: A Primer"
- 10. http://tec.gov.in/pdf/Studypaper/5G%20Study %20Paperapproved%20by%20Sr%20DDG.pdf
- 11. https://www.tutorialspoint.com/5g

