5G Technology

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Abstract: The term "5G" refers to the fifth generation of mobile technology. Beyond the upcoming 4G standards, 5G is a term used in some research papers and projects to refer to the next major phase of mobile telecommunications standards. Currently, 5G is not an official word for any specific specification or document published by telecommunication corporations or standardisation bodies such as 3GPP, WiMAX Forum, or ITU-R. Standardization groups are working on new standards beyond 4G, but they are not yet considered new mobile generations because 4G implementation and distribution is still underway; the aim of a 5G-based telecommunications network would ideally address the issues that a 4G model would offer once it has become widely used.

Index Terms— **Flat IP Network, BDMA, 5G Architecture-Nanotechnology, Cloud Computing.**

I. INTRODUCTION

In the field of communication, the world has changed dramatically. We no longer utilise landlines. Everyone has a phone that works 24 hours a day, seven days a week. Our phones not only keep us linked to the rest of the world, but they also act as entertainment devices. This realm of telecommunications has seen several advancements from 1G to 2.5G and 3G to 5G. Most of the customers' access to their cell phones is about to change thanks to 5G technology. With 5G pushed over a VOIP-enabled device, users will experience a level of call volume and data transmission. Customers' understanding of emerging technology, inexpensive bundles, and attractiveness is growing. It is critical that mobile phone manufacturers provide a comprehensive bundle to maintain client loyalty. To compete with innovative market giants, the most significant and primary motive of top mobile phone makers is the development of top and latest technologies. We have seen incredible cell phones one after the other, each with its own set of features. Apple has continued to shake the electronic world by releasing the iPhone 4G, which has taken the market by storm. Huge features are contained in such a small electrical element. There are not many phones left that don't have an mp3 player or a camera. People are concentrating on acquiring whatever they want without spending any additional money. Economic mobile phones with maximal functionality are introduced keeping the user's pocket in mind. You can use 5G technology to connect your smartphone to your laptop for high-speed internet access. The features of today's mobile phone, particularly the video player, camera, mp3 recorder, messengers, photo editing, and games, have turned it into a handheld computer.

Everything is already embedded in 5G, such as the tiniest mobile phones, fast dialling, largest memory, audio and video player, Microsoft office, and so on. Data exchange has become a child's play thanks to Piconet and Bluetooth technology. We can still recall the inconvenience and annoyance caused by data transfer, but the introduction of Bluetooth changed the course of history. It allowed us to transfer data between two devices at 50 metres. With the rapidity of data sharing, cell phone manufacturers have concentrated on mobile broadband, which has the potential to open a new window of communication and navigation in the telecommunications sector.

5G technology will revolutionize the way cellular plans are sold around the world. A new revolution is on its way. The world's first worldwide cell phone is just around the corner. With this new technology, locals will be able to call and access China's local phone from Germany's local phone. The way people communicate will be completely transformed. With better and more accessible connectivity around the world, the use of this device will undoubtedly advance. With this cell phone, your office will shrink into your smartphone, resembling a twenty-first-century PDA (personal digital assistant).

II. 5G MOBILE NETWORK

5G networks make use of this flat IP concept to make it easier for various RAN to upgrade in to at least one Nanocore network. Our 5G network uses Nanotechnology as defensive tool for security concern that arises thanks to flat IP. Certainly, Flat IP network is that the key concept to form 5G acceptable for all quite technologies. to satisfy customer demand for real-time data applications delivered over mobile broadband networks, wireless operators are turning to flat IP network architectures. Flat IP architecture provides the thanks to spot devices using symbolic names, unlike the hierarchical architecture like that utilized in "normal" IP addresses. this is often of more interest to mobile broadband network operators.

With the shift to flat IP architectures, mobile operators can:

- Reduce the amount of network elements within the data path to lower operations costs and cost.
- Partially decouple the value of delivering service from the quantity of knowledge transmitted to align infrastructure capabilities with emerging application requirements.
- Minimize system latency and enable applications with a lower tolerance for delay upcoming enhancements on the radio link can also be fully realized.

- Evolve radio access and packet core networks independently of each other to a greater extent than within the past, creating greater flexibility in network planning and deployment.
- Develop a versatile core network which will function the idea for service innovation across both mobile and generic IP access networks.
- Create a platform which will enable mobile broadband operators to be competitive, from a price /performance perspective, with wired networks.

Flat specification removes that voice-centric hierarchy from the network. rather than overlaying a packet data core on the voice network, separate and much-simplified data architecture are often implemented that removes the multiple elements from the network chain.

III. 5G ARCHITECHTURE –THE NANOCORE

The 5G Nanocore is a convergence of below mention technologies. These technologies have their own impact on exiting wireless network which makes them in to 5G.
- Nanotechnology.
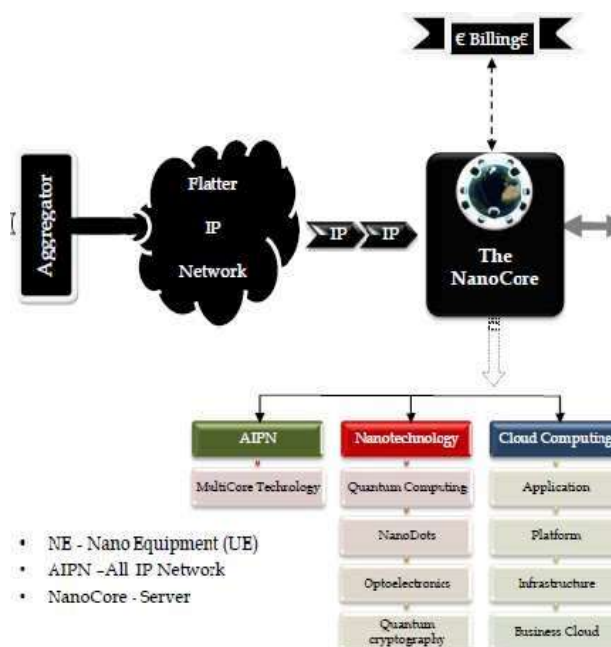- Cloud Computing.
- All IP Platform.

Fig.1. 5G Architechture-The Nanocore

A. Nanotechnology:

Nanotechnology is the application of nanoscience to control process on nanometer scale. i.e., between 0.1 and 100nm.The field is also known as molecular nanotechnology (MNT). MNT deals with control of the structure of matter based on atom-by-atom and molecule by molecule engineering. The term nanotechnology was introduced by Nori Taniguchi in 1974 at the Tokyo international conference on production engineering. Nanotechnology is the next industrial revolution, and the telecommunications industry will be

radically transformed by it in a few years. Nanotechnology has shown its impact on both mobile as well as the core network. Apart from this it has its own impact on sensor as well as security. This is considered as a most significant in telecommunication. We will be discussing the same in our further slides.

B. Nano Equipment (NE):

Mobile phone has become more than a communication device in modern world it has turned into an identity of an individual. In 5G Nanocore these mobiles are referred as Nano Equipment as they are geared up with nanotechnology. One of the central visions of the wireless industry aims at ambient intelligence: computation and communication always available and ready to serve the user in an intelligent way. This requires that the devices are mobile. Mobile devices together with the intelligence that will be embedded in human environments – home, office, public places – will create a new platform that enables ubiquitous sensing, computing, and communication Specs of NanoEquipments given as follow:
• Self Cleaning – the phone cleans by itself
• Self powered – the phone derives its energy/power from the sun, water, or air.
• Sense the environment – the phone will tell you the weather, the amount of air pollution present, etc.
• Flexible – bend but not break
• Transparent – "see through" phones

C. Cloud Computing:

Cloud computing is a emerging technology that uses the central remote server and web to take care of applications and data. In 5G network this central remote server are going to be our content provide. With internet access, Cloud computing allows their consumers and business owners to use applications without any installation and allows to access their personal files from any computer, from anywhere. In Nanocore, the same concept is going to be used, where the user can try to access his private account in form of cloud, form a global content provider through Nanocore. Tremendous opportunities are provided by development of cloud computing. As we know cloud computing relies on the networks, it shows the importance of networks and also promotes development in networks. The cloud computing requires a secure and good reliable service providers, who can handle capabilities that that can operate and have deep expertise. Operators can start in to the market of cloud computing and make new value-added services and experiences by integrating industry content and applications within the digital supermarket model. This could make our user to get far more real-time application to utilize his 5G network efficiently. Secure and reliable service are often given the assistance of quantum cryptography. Cloud computing customer avoids cost for the Nanocore thereby also reducing the value of buying physical infrastructure by renting the usage from a 3rd party Provider(Content Provider). The Nanocore requires the resources and pay for its usuage. The Segments of Cloud Computing: Mainly the Cloud computing has three segments like :

1. Applications – it's supported , on demand software services. On demand software services come in different varieties. They change in pricing scheme and how the software should be delivered in the hands of end users. Previously, the end-user would have to purchase a server that can be accessed by them through internet.
2. Platform - The platform segment of cloud computing refers to products that are wont to deploy internet. Amazon, Microsoft, and Google have now developed platform, which will allow users to access applications from centralized servers. Google, amazon.com and sales force are actively working now.
3. Infrastructure –The backbone of the entire concept is Infrastructure. Infrastructure's environments providers like Google and Amazon allows user for application building. Amazon's S3 the cloud storage, is now considered to be a part of the infrastructure segment.

5G Nanocore will use all this segments to satisfy demands of customer. Cloud computing will decrease the 5G network deployment's CAPEX. In turn through Nanocore decrase billing to the end user for all kinds of services that he utilizes.

D. All IP Network:

Last but not the smallest amount. As already discussed for converging different technologies to make one 5G Nanocore. We require a common platform to interact. Flat IP architecture act as an important a part of 5G network. The All-IP Network (AIPN) is an evolution of the 3GPP system to satisfy the increasing demands of the mobile telecommunications market. To meets demands of customer for real-time data applications delivered over mobile broadband networks, wireless operators are going to be flat IP network architectures. Primarily focused upon enhancements of packet switched technology, AIPN provides a continued evolution and optimization of the system concept so as to supply a competitive edge up terms of both performance and cost. The key benefits of flat IP architectures are:

- lower costs
- universal seamless access
- improved user experience
- reduced system latency
- decoupled radio access and core network evolution.

The drive to all or any IP-based services is placing stringent performance demands on IP-based equipment and devices, which successively is growing demand for multicore technology. There is strong growing demand for advanced telecommunications services on wired and wireless Next Generation Network (NGN) infrastructures, and fast growing demand for an equivalent within the enterprise too. Within a couple of years, quite 10 billion fixed and mobile devices are going to be connected via the web to feature to the quite one billion already connected. All these services are getting to be deployed over full IP-based architecture.

IV. Beam-division multiple-access (BDMA)

This scheme has been proposed by Korean engineers to extend capacity of wireless communication system and also to handle an outsized number of mobile users in 5th Generation (5G) systems.

The number of mobile users is growing exponentially and is expected to grow ten times by the end of the year 2021. As a result, Korean engineers have proposed BDMA technique as a radio interface for 5G systems because it is frequency independent and time resources. This technique solves both the problem that is issue of bandwidth capacity and efficiency and also it eliminates signal deterioration at cell edges.

In BDMA technology, the base station allocates separate antenna beams to each and every mobile phone or mobile station. This could be done after evaluating position of the mobile stations also as their moving speeds, then deciding widths and directions of beams for mobile stations with respect to the base station. All the mobile stations communicate with base station when these are in its line-of-sight (LoS) and every one the beams are distinct for every individual station. So simultaneous data transmission is feasible to different mobile stations at different angles.
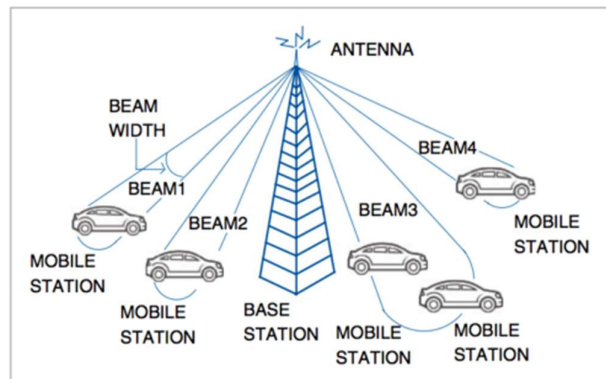

Fig2. Beam-division multiple-access

The beam should be divided in order to support more and more number of users and also Mobile stations located at similar angles can share one beam to communicate with the base station using TDMA.

This BDMA technique significant in reducing the overhead of channel estimation, also as, to processing complexity at transceivers.

V. CHALLENGES OF 5G

A. Frequency bands

Though 4G LTE already operates on established frequency bands below 6GHz, 5G requires frequencies, all the way up to 300GHz. Some are better known as mm Wave. Those bands can carry much more capacity and deliver ultra-fast speeds that deliver a 20-fold increase over LTE's fastest theoretical throughput.

Wireless carriers still need to bid for the higher spectrum bands as they build and roll out their respective 5G networks. In Canada, for instance, the federal held a spectrum auction for 600MHz in 2019, with 3500MHz ongoing for 2020 and 1GHz currently planned for 2021. More are likely to follow that. In the US, millimetre wave spectrum auctions netted $4.47 billion (US) — the largest single total in the country's history — as of the spring in 2020.

B. Deployment and coverage
Though 5G offers a significant increase in speed and bandwidth, its more limited range will require further infrastructure. Higher frequencies enable highly directional radio waves, meaning they can be targeted or aimed — a practice called beamforming. The challenge is that 5G antennas, although able to handle more users and data, can only beam out over shorter distances.
This means that antennas and base stations will likely be smaller in the 5G era, but more of them would have to be installed on buildings or homes to compensate for their shorter range. Cities will need to install extra repeaters to spread out the waves and extend range, while also maintaining consistent speeds in more densely populated areas. For this reason, it is likely that carriers will continue to use lower-frequency bands to cover wider areas until the 5G network matures.

C. Cost to build, cost to buy.
Building a network is expensive, and carriers will raise the money to do it by increasing customer revenue. Much like LTE plans incurred a higher initial cost, 5G will probably follow a similar path. And it is not just building a layer on top of an existing network — it's laying the groundwork for something new altogether.
According to Heavy Reading's Mobile Operator 5G Capex, total global spending on 5G is set to reach $88 billion by 2023. Once it becomes truly viable, certain device segments will be connected in entirely new ways, particularly vehicles, appliances, robots, and city infrastructure.
Now that 5G-enabled smartphones and other devices are trickling into the market, networks are evolving in various countries across the globe. Autonomous vehicle technology is already in the market in limited forms, but fully autonomous vehicles are years away, and would otherwise drive blind without a super-fast network like 5G to communicate.
The concept behind the Internet of Things (IoT) is predicated on a fast network that can tie devices and services together. That is one of the promises analysts have forecasted for 5G's potential, but people will first want to see how much the additional speed will enrich their lives.
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connected in entirely new ways, particularly vehicles, appliances, robots, and city infrastructure.

D. Device support
There is plenty of buzz already generating around 5G-enabled smartphones and other devices. However, their availability will hinge on how expensive they are for manufacturers to make, as well as how quickly the network rolls out. Some carriers in the U.S., South Korea and Japan have already launched 5G pilots in select cities, and manufacturers have confirmed compatible mobile devices are coming in 2019.
Similarly, autonomous vehicle technology is already in the market in limited forms, but fully autonomous vehicles are still years away. They are waiting on 5G deployment, as they would be driving blind without the super-fast network to communicate with.
The concept behind the Internet of Things (IoT) is too predicated on a fast network that can tie devices and services together. That is one of the promises analysts have forecast for 5G's potential, but people will first want to see how much the additional speed will enrich their lives.

E. Security and privacy
Like any data-driven technology, 5G rollout will have to contend with both standard and sophisticated cybersecurity threats. Though 5G falls under the Authentication and Key Agreement (AKA), a system designed to establish trust between networks, it would currently be possible to track people nearby using their phones or even eavesdrop on live phone calls.
Much like it is now, the onus will be on the carriers and network consortiums to provide a digital safety net for customers.
With data speeds expected to be magnitudes faster than current levels, so too will connectivity increase. It will force cloud-based and data virtualization services to be as airtight as possible to protect user data and privacy. In the same vein, their users will have to be more careful and vigilant, as stewards of their data.
The rollout of a technology as life changing as 5G won't be an easy one, and challenges are already starting to come to light as we step into this new era of connectivity. Even so, the benefits far outweigh the issues, as the rollout of 5G also signals the dawn of autonomous vehicles, next-level smart cities and homes, and more. By building out infrastructure, updating policy, and rethinking the role we play in privacy, we all can do our part to prepare for the 5G era.

VI. Conclusion:
While the future is becoming harder to predict with each passing year, we should always expect an accelerating pace of technological change. 5G isn't a term officially used for any particular specification or in any legal document yet made public by telecommunication companies or standardization bodies like 3GPP, WiMAX Forum, or ITU-R. We conclude that nanotechnology, Cloud computing, All IP are succeeding great technology wave. We conclude that

it's an excellent time to take a position in startups. In this day and age mobile users have much awareness of the (mobile) technology. There is no doubt to say that the 5G technologies include all sort of advanced features which makes 5G mobile technology most powerful and in huge demand in near future.

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