

Future Wireless Technology

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Abstract- The development of wireless technologies in recent years started an era of highly-efficient information society. It is expected that the wireless technologies will become wider and deeper in the coming years. Understanding the greater importance of wireless communication in the future for both academics and industries around the world have initiated the study of the next generation, namely 5G, of wireless communication systems. The 5G technology (fifth generation) also know as 2021 wireless network technology is the foremost phase of wireless communication standards ahead of current 4G/IMT standard. The coming 5G technology and Information & Communication technology (ICT) networks signify evolution of the globally connected digital society. The main contribution of this paper is definition of 5G i.e. Fifth Generation mobile network concept which is seen as user-centric concept instead of operator-centric as we have in 3G or service-centric concept as seen for 4G. In the proposed concept the mobile user is on the top of all.

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

I. INTRODUCTION

The world has seen and exponential growth in the telecommunication industry in last few years. We have different types of mobiles keypad to Smartphone there has been a great development in wireless field from 1G to 2/2.5G and 3G to 5G. These generations can be differentiated from each other on the following aspects,

Radio access, data rates, bandwidth and switching schemes.

The developed world is already utilizing 4G and it is beyond imagination that what will be engulfed in 5G as everything is already embedded such as smallest mobile phones, speed dialling, largest memory, audio and video player, Microsoft office, etc. Pico net and Bluetooth technology has made data sharing a child's play.

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II. 5G NETWORK

The 5G wireless communication system will be a converged system with multiple radio access technologies integrated together. It can support a wide range of applications and services to comprehensively satisfy the requirements of the information society by the year 2020 and beyond.

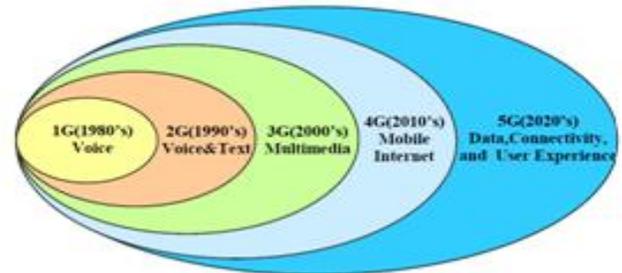


Fig.1 Development from 1G to 5G

5G networks use the flat IP concept to make it easy for different RAN to upgrade into a single Nano Core network. 5G uses Nanotechnology as a defensive tool for security concern that arises due to the flat IP. Surely the Flat IP network is the key to make 5G acceptable for all kind of technologies. To meet 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 a way to identify devices using symbolic names, unlike the hierarchical architecture such as that used in "normal" IP addresses. The key benefits of flat IP architectures are

- lower costs
- reduced system latency
- decoupled radio access and core network evolution

This is of more interest to mobile broadband network operator's .With the shift to flat IP architectures, mobile operators can:

- Reduce the number of network elements in the data path to lower operations costs and capital expenditure.
- Partially decouple the cost of delivering service from the volume of data transmitted to align infrastructure capabilities with emerging application requirements.
- Minimize system latency and enable applications with a lower tolerance for delay; upcoming latency 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 in the past, creating greater flexibility in network planning and deployment.

- Develop a flexible core network that can serve as the basis for service innovation across both mobile and generic IP access networks
- Create a platform that will enable mobile broadband operators to be competitive, from a price/performance perspective, with wired network

Flat network architecture removes that voice-centric hierarchy from the network. Instead of overlaying a packet data core on the voice network, separate and much-simplified data architecture can be implemented that removes the multiple elements from the network chain.

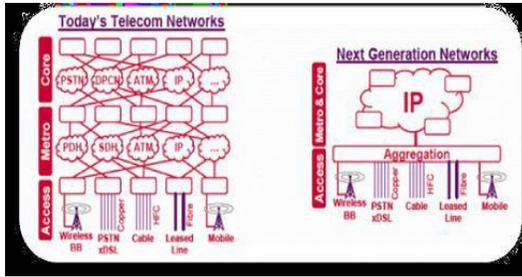


Fig.2 5G Network

The model that proposes design for a network architecture for 5G mobile systems, which is all-IP based model for wireless and mobile networks interoperability. The system consists of a user terminal (which has a crucial role in the new architecture) and a number of independent, autonomous radio access technologies. Within each of the terminals, each of the radio access technologies is seen as the IP link to the outside Internet world. However, there should be different radio interface for each Radio Access Technology (RAT) in the mobile terminal

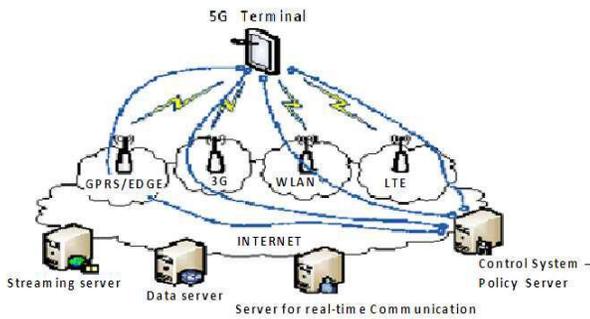


Fig.3 Design of 5G network

III. 5G ARCHITECTURE

The 5G Nanocore is a convergence of below mentioned technologies. These technologies have their own impact on existing wireless network which makes them in to 5G.

- Nanotechnology.
- Cloud Computing.
- All IP Platform.

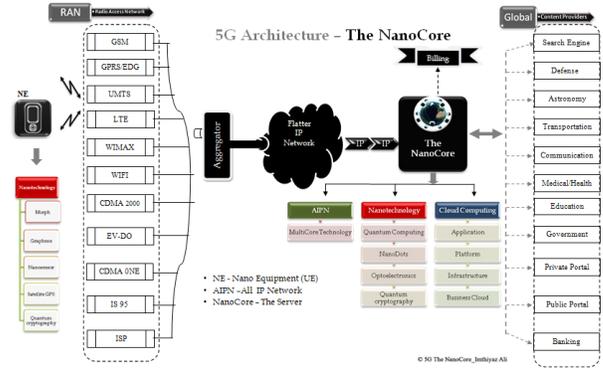


Fig.4 5G Architecture

IV. NANOTECHNOLOGY

This is the application of nano science to make the control process to a nano meter scale which will be in between 0.1 and 100nm. This particular field is known as Molecular Nano Technology (MNT). Atom by atom and molecule by molecule based control of the structure of matter. The telecommunication industry will radically get changed into the latest Nanotechnology in little year time. Putting the impact in both mobile as well as core network is the mode of operation of the nanotechnology. Perfection in security and the better impact on the sensor makes the nanotechnology the most significant in its row. The most common and general identity of a human being nowadays is the mobile device. The nano equipment in the 5G nano core is the mobile phone itself as they are geared up with the nanotechnology. Wireless industry mainly aims at the implementation of the intelligence which will ensure that the computation and communication are available as desired. The introduction of intelligence in the mobile devices will help in embedding the devices in the human environments that can create a new platform which will enable the ubiquitous sensing, computing and communication. The nano equipments will be loaded with some of the core features like self cleaning, self powered, sensible to the environment with which it is been interacting, flexible and also transparent.

Cell phones enhanced with the carbon nanotube will be introduced soon which comes under the nanotechnology. In 5G Nanocore these mobile are referred as NanoEquipment 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 Nano Equipments 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

V. CLOUD COMPUTING

Technology used for maintaining data and applications that uses the internet and central remote server is known as Cloud Computing. In 5G, the central remote server will be the main provider of content. Clouding will introduce a layer in which the consumers can use the applications without installation and also personal files can be accessed with the use of internet access. In Nanocore the same concept will be used in which the user tries to access his private account from a global content provider in the form of cloud. 5G will add on the real time applications through the Nanocore clouding.

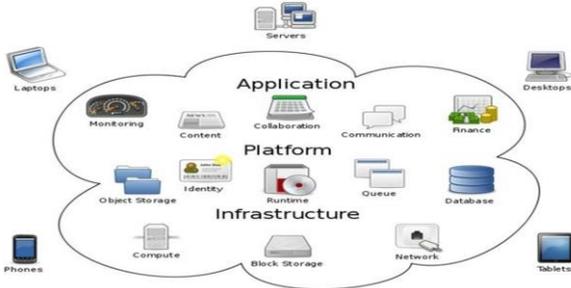


Fig.5 Segment of cloud computing

The Cloud computing has three segments as follows:

- Applications
- Platform
- Infrastructure

Applications means, software services on demand. The products which are used to deploy internet is generally referred to as the platform segment of cloud computing. The infrastructure and is the backbone of the entire concept. The infrastructure vendors will allow the user to build applications in this platform. Satisfying the customer demand is attained in 5G by the mutual integration of all the three segments. The CAPEX (Capital Expenditure) of 5g has been reduced by the cloud computing deployment.

VI. ALL IP NETWORK

A common platform is required to interact for the convergence of different technologies to form a single 5G Nanocore. The essential part of the 5G network will be the Flat IP architecture. So as to meet the increasing requirement of the mobile telecommunication market, All IP Network (AIPN) has been introduced by the 3GPP system. Migrating into AIPN will meet the requirements of the customer for the real time data applications delivered over the mobile broadband networks. Provision of the complete edge performance in terms of both performance and costs is the primary focus of the enhanced packet switched technology. The touched benefits of the IP architectures are reduction of the system latency, improved user experience, globally seamless access, core network evolution, and decoupled radio access, cost effectiveness and much more. Placement of the stringent performance demands on IP based equipments and devices, which leads to the growing demand of the multicore technology. Strong demands have been seen in the

Next Generation Network (NGN) infrastructures both in wired and wireless layers.

Another important challenge in the telecommunication field is that the network should be in such a way that it should be flexible and improved to provide larger number of connections to multiple users without losing the quality within the limited frequency spectrum available with the increased system capacity. Communication made possible within limited spectrum and time is the biggest challenge to be tackled properly without any loop holes. Meeting this target is achieved by the implementation of multiple access techniques like OFDMA, FDMA, TDMA, CDMA, etc. OFDMA (Orthogonal Frequency Division Multiple Access) technique divides and allocates the available frequency resources to maximize the resource utility efficiency. In OFDMA, the multiuser capability is achieved by assigning each user a subset of OFDM (Orthogonal Frequency Division Multiplexing) subcarriers. OFDM is a digital transmission technique that uses a large number of carriers spaced apart at slightly different frequencies. In FDMA the corresponding frequency division and allocation will take place and in CDMA and TDMA, code and time division multiplexing will happen accordingly. FDMA (Frequency Division Multiple Access) is a technology by which the total bandwidth available to the system is divided into frequencies. Unlike FDMA, CDMA (Code Division Multiple Access) separates calls by code. Every bit of a conversation is been tagged with a specific and unique code. The system gets a call, it allocates a unique code to that particular conversation, and now the data is split into small parts and is tagged with the unique code given to the conversation of which they are part of. In TDMA (Time Division Multiple Access) the division of calls happens on time basis. The system first digitizes the calls, and then combines those conversations into a unified digital stream on a single radio channel. Now it divides each cellular channel into three time slots that means three calls get put on a single frequency and then, a time slot is assigned to each call during the conversation, a regular space in a digital stream.

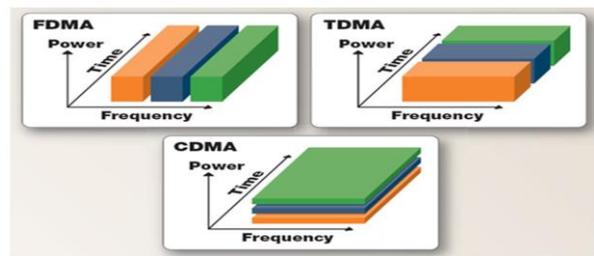


Fig. 6 FDMA, TDMA, CDMA

The users transmit in rapid succession, one after the other, each using its own time slot. This allows multiple stations to share the same transmission medium (e.g. radio frequency channel) while using only a part of its channel capacity. In near future it is expected that the capacity required in a mobile communication network will keep on climbing as the number of mobile stations are increased and apparently the data required in respective mobile stations is increased.

VII. BDMA (BEAM DIVISION MULTIPLE ACCESS)

BDMA is the latest allocation technique in which an orthogonal beam is allocated to each mobile station. In this technique, an antenna beam will get divided and allocated into the locations of the mobile stations to provide multiple accesses and thereby increasing the capacity of the system. Since mobile stations and the base stations are in Line of Sight state, they can transmit beams which directed to each other's position for proper communication, without making any kind of interference with cell edge mobile stations. When the mobile stations are positioned at different angles compared to the base station, the base station will transmit the beams in such a way that different angles will be covered and at the same time multiple mobile stations will be taken care. The working is like one mobile station does not use one beam exclusively, but the mobile stations positioned at similar angles will keep on sharing the one beam to communicate with the base station. Mobile stations that are sharing the same beam will divide the same frequency or time resources and will use the orthogonal

According to the mobile communication environment, a base station can change the direction, number and respective widths of the beams adaptively with the almost easiness. Three dimensional mode of division will happen in the case of beams and hence a spatial reuse of frequency or time resources can be maximized. The first slot of communication is the base station and the mobile station does not know each other's position. The mobile station will detect their positions and the moving speeds and will transmit the entire information to the base station. The second stage is taken care by the base station. The base station will calculate the direction along with the width of a downlink beam which is based on the position and moving speed information received from the mobile station. After the calculation part is over, the base station will transmit the downlink beam to the mobile station with all the calculations regarding the direction and width.

VIII. CONCLUSION

While the future is becoming more difficult to predict with each passing year, we should expect an accelerating pace of technological change. 5G is not a term officially used for any particular specification or in any official document yet made public by telecommunication companies or standardization bodies such as 3GPP, WiMAX Forum, or ITU-R. We conclude that nanotechnology, Cloud computing, All IP are the next great technology wave. We hope that this Paper helps to promote stronger links between people working in different fields creating future concepts of mobile communication, Internet services, Cloud computing, All IP network, and Nanotechnologies. We conclude that it is a great time to invest in startups. Nowadays mobile users have much awareness of the cell phone (mobile) technology.

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