



SURVEY OF 5G NETWORK: THE NEXT GENERATION OF MOBILE COMMUNICATION

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Abstract— In the near future, i.e., beyond 4G, some of the prime objectives or demands that need to be addressed are increased capacity, improved data rate, decreased latency, and better quality of service. To meet these demands, drastic improvements need to be made in cellular network architecture. This paper presents the results of a detailed survey on the fifth generation (5G) cellular network architecture and some of the key emerging technologies that are helpful in improving the architecture and meeting the demands of users. In this detailed survey, the prime focus is on the 5G cellular network architecture, massive multiple input multiple output technology, and device-to-device communication (D2D). Along with this, some of the emerging technologies that are addressed in this paper include interference management, spectrum sharing with cognitive radio, ultra-dense networks, multi-radio access technology association, full duplex radios, millimeter wave solutions for 5G cellular networks, and cloud technologies for 5G radio access networks and software defined networks. In this paper, a general probable 5G cellular network architecture is proposed, which shows that D2D, small cell access points, network cloud, and the Internet of Things can be a part of 5G cellular network architecture. A detailed survey is included regarding current research projects being conducted in different countries by research groups and institutions that are working on

5G technologies

Introduction:

Today and in the recent future, to fulfill the presumptions and challenges of the near future, the wireless based networks of today will have to advance in various ways. Recent technology constituent like high-speed packet access (HSPA) and long-term evolution (LTE) will be launched as a segment of the advancement of current wireless based technologies. Nevertheless, auxiliary components may also constitute future new wireless based technologies, which may adjunct the evolved technologies. Specimen of these new technology components are different ways of accessing spectrum and considerably higher frequency ranges, the instigation of massive antenna configurations, direct device-to-device communication, and

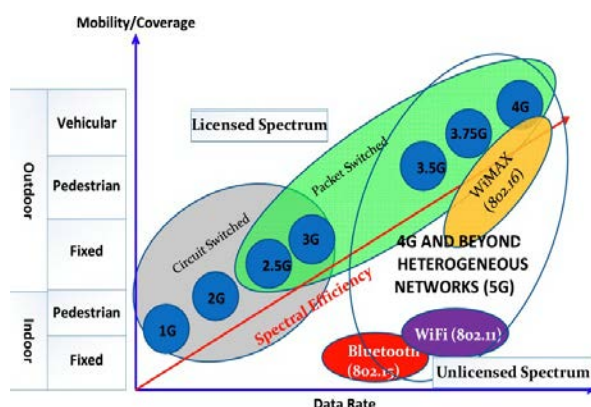
ultra-dense deployments. The imagination of our future is a networked society with unbounded access to information and sharing of data which is accessible everywhere and every time for everyone and everything. To realize this imagination, new technology components need to be examined for the evolution of existing wireless based technologies. Present wireless based technologies, like the 3rd Generation Partnership Project (3GPP) LTE technology, HSPA and Wi-Fi, will be incorporating new technology components that will be helping to meet the needs of the future. Nevertheless, there may be certain scenarios that cannot be adequately addressed along with the evolution of ongoing existing technologies. The instigation of

completely new wireless based technologies will complement the current technologies which are needed for the long term realization of the networked society

Evolution of Wireless Technologies:

G. Marconi, an Italian inventor, unlocks the path of recent day wireless communications by communicating the letter 'S' along a distance of 3Km in the form of three dot Morse code with the help of electromagnetic waves. After this inception, wireless communications have become an important part of present day society. Since satellite communication, television and radio transmission has advanced to pervasive mobile telephone, wireless communications has transformed the style in which society runs. The evolution of wireless begins and is shown in Fig.

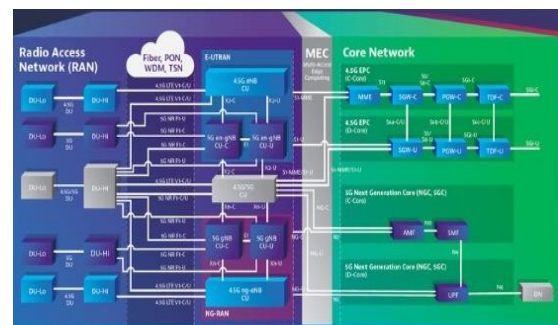
1. It shows the evolving generations of wireless technologies in terms of data rate, mobility, coverage and spectral efficiency. As the wireless technologies are growing, the data rate, mobility, coverage and spectral efficiency increases. It also shows that the 1G and 2G technologies use circuit switching while 2.5G and 3G uses both circuit and packet switching and the next generations from 3.5G to now i.e. 5G are using packet switching. Along with these factors, it also differentiate between licensed spectrum and unlicensed spectrum. All the evolving generations use the licensed spectrum while the WiFi, Bluetooth and WiMAX are using the unlicensed spectrum. An overview about the evolving wireless technologies is below:



5G Cellular Network Architecture:

To contemplate 5G network in the market now, it is evident that the multiple access techniques in the network are almost at a still and requires sudden improvement. Current technologies like

OFDMA will work at least for next 50 years. Moreover, there is no need to have a change in the wireless setup which had come about from 1G to 4G. Alternatively, there could be only the addition of an application or amelioration done at the fundamental network to please user requirements. This will provoke the package providers to drift for a 5G network as early as 4G is commercially set up. To meet the demands of the user and to overcome the challenges that has been put forward in the 5G system, a drastic change in the strategy of designing the 5G wireless cellular architecture is needed. A general observation of the researchers has that most of the wireless users stay inside for approximately 80 percent of time and outside for approximately 20 percent of the time. In present wireless cellular architecture, for a mobile user to communicate whether inside or outside, an outside base station present in the middle of a cell helps in communication. So for inside users to communicate with the outside base station, the signals will have to travel through the walls of the indoors, and this will result in very high penetration loss, which correspondingly costs with reduced spectral efficiency, data rate, and energy efficiency of wireless communications. To overcome this challenge, a new idea or designing technique that has come in to existence for scheming the 5G cellular architecture is to distinct outside and inside



setups With this designing technique, the penetration loss through the walls of the building will be slightly reduced. This idea will be supported with the help of massive MIMO technology in which geographically dispersed array of antenna's are deployed which have tens or hundreds of antenna units. Since present MIMO systems are using either two or four antennas, but the idea of massive MIMO systems has come up with the idea of utilizing the

advantages of large array antenna elements in terms of huge capacity gains.

Emerging Technologies for 5G Wireless Networks:

It is expected that mobile and wireless traffic volume will increase a thousand-fold over the next decade which will be driven by the expected 50 billion connected devices connected to the cloud by 2020 and all need to access and share data, anywhere and anytime. With a rapid increase in the number of connected devices, some challenges appear which will be responded by increasing capacity and by improving energy efficiency, cost and spectrum utilization as well as providing better scalability for handling the increasing number of the connected devices.

- 1000 times increased data volume per area
- 10 to 100 times increased number of connected devices
- 10 to 100 times increased typical user data rate
- 10 times extended battery life for low power Massive Machine Communication (MMC) devices
- 5 times reduced End-to-End (E2E) latency

Conclusion:

In this paper, a detailed survey has been done on the performance requirements of 5G wireless cellular communication systems that have been defined in terms of capacity, data rate, spectral efficiency, latency, energy efficiency, and Quality of service. A 5G wireless network architecture has been explained in this paper with massive MIMO technology, network function virtualization (NFV) cloud and device to device communication. Certain short range communication technologies, like WiFi, Small cell, Visible light communication, and millimeter wave communication technologies, has been explained, which provides a promising future in terms of better quality and increased data rate for inside users and at the equivalent time reduces the pressure from the outside base stations. Some key emerging technologies have also been discussed that can be used in 5G wireless systems to fulfill the probable performance desires, like massive MIMO and Device to Device communication in particular and interference management, spectrum sharing with cognitive radio, ultra dense networks, multi

radio access technology, full duplex radios, millimeter wave communication and Cloud Technologies in general with radio access networks and software defined networks. This paper may be giving a good platform to motivate the researchers for better outcome of different types of problems in next generation networks

The Advantages and Disadvantages of a 5G Network:

- Advantage: Increased Bandwidth for All Users.
- Advantage: More Bandwidth Means Faster Speed
- Disadvantage: An Increased Bandwidth will mean Less Coverage.

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