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5G WIRELESS TECHNOLOGY

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ABSTRACT:

5G mobile telecommunication standards stand for fifth-generation advancements made in the mobile communications field. These comprise packet switched wireless systems using orthogonal frequency division multiplexing (OFDM) with wide area coverage, high throughput at millimeter waves (10 mm to 1 mm) covering a frequency range of 30 GHz to 300 GHz, and enabling a 20 Mbps data rate to distances up to 2 km. The millimeter-wave band is the most effective solution to the recent surge in wireless Internet usage. These specifications are capable of providing 'wireless world wide web' (WWWW) applications. The WWWW allows a highly flexible network (flexible channel bandwidth between 5 and 20 MHz, optimally up to 40 MHz), and dynamic ad-hoc wireless network (DAWN). This technique employs intelligent antennae (e.g., switched beam antennae and adaptive array antennae) and the flexible modulation method, which helps in obtaining bidirectional high bandwidth, i.e., transfer of a large volume of broadcasting data in giga bytes, sustaining more than 60,000 connections and providing 25 Mbps connectivity. Users of 5G technology can download an entire film to their tablets or laptops, including 3D movies; they can download games and avail of remote medical services.

5G WIRELESS TECHNOLOGY:

5G (**5th generation mobile networks** or **5th generation wireless systems**) denotes the next major phase of mobile telecommunications standards beyond the current 4G/IMT-Advanced standards. 5G is also referred to as beyond 2020 mobile communications technologies. 5G does not describe any particular specification in any official document published by any telecommunication standardization body.

Although updated standards that define capabilities beyond those defined in the current 4G standards are under consideration, those new capabilities are still being grouped under the current ITU-T 4G standards.

EVOLUTION OF MOBILE GENERATION (1G-5G):

1G: These are the *analog* systems such as AMPS that grew rapidly in the 1980s and are still available today. Many metropolitan areas have a mix of 1G and 2G systems, as well as emerging 3G systems. The systems use frequency division multiplexing to divide the bandwidth into specific frequencies that are assigned to individual calls.

2G: These second-generation systems are *digital*, and use either TDMA (Time Division Multiple Access) or CDMA (Code Division Multiple Access) access methods. The European GSM (Global System for Mobile communications) is a 2G digital system with its own TDMA access methods. The 2G digital services began appearing in the late 1980s, providing expanded capacity and unique services such as caller ID, call forwarding, and short messaging. A critical feature was seamless roaming, which lets subscribers move across provider boundaries.

3G systems 3G has become an umbrella term to describe cellular data communications with a target data rate of 2 Mbits/sec. The ITU originally attempted to define 3G in its IMT-2000 (International Mobile Communications-2000) specification, which specified global wireless frequency ranges, data rates, and availability dates. However, a global standard was difficult to implement due to different frequency allocations around the world and conflicting input. So, three operating modes were specified. According to Nokia, a 3G device will be a personal, mobile, multimedia communications device that supports speech, color pictures, and video, and various kinds of information content. Nokia's Web site (http://www.Nokia.com) provides interesting information about 3G systems. There is some doubt that 3G systems will ever be able to deliver the bandwidth to support these features because bandwidth is shared. However, 3G systems will certainly support more phone calls per cell.

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Generation (1G,2G,3G,4G,5G)	Definition	Throughput/ Speed	Technology	Time period	Features
1G	Analog	14.4 Kbps	AMPS,NMT,TACS	1970 – 1980	Used for ***voice only***.
2G	Digital Narrow band circuit data	9.6/14.4 Kbps	TDMA,CDMA	1990 to 2000	Used for ***data also along with voice***.
2.5G	Packet Data	171.2 Kbps(peak) 20-40 Kbps	GPRS	2001-2004	***Internet*** becomes ***Phones start supporting web browsing***
3G	Digital Broadband Packet Data	3.1 Mbps (peak) 500-700 Kbps	CDMA 2000 (1xRTT, EVDO) UMTS, EDGE	2004-2005	3G has ***Multimedia services support***.
3.5G	Packet Data	14.4 Mbps (peak) 1-3 Mbps	HSPA	2006 – 2010	Supports ***higher throughput and speeds*** .
4G	Digital Broadband Packet All IP Very high throughput	100-300 Mbps (peak) 3-5 Mbps 100 Mbps (Wi-Fi)	WiMax LTE Wi-Fi	Now (Read more on Transitioning to 4G)	***Speeds*** for 4G are further increased ***High definition streaming*** is now supported in 4G In 4G,***Portability*** is increased further.
5G	Not Yet	1Gpbs	Not Yet	Soon (probably 2020)	When this becomes available it will provide very high speeds to the consumers.

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4G Systems On the horizon are 4G systems that may become available even before 3G matures (3G is a confusing mix of standards). While 3G is important in boosting the number of wireless calls, 4G will offer true high-speed data services. 4G data rates will be in the 2-Mbit/sec to 156-Mbit/sec range, and possibly higher. 4G will also fully support IP. High data rates are due to advances in signal processors, new modulation techniques, and smart antennas that can focus signals directly at users. OFDM (orthogonal frequency division multiplexing) is one scheme that can provide very high wireless data rates. OFDM is described under its own heading.

5G HARDWARE & SOFTWARE:

Hardware:

Hardware of 5g architecture uses Ultra Wide Band (UWB) network with higher Bandwidth even at low energy levels. Bandwidth is of 400 times faster than today's wireless network. It uses Code Division Multiple Access (CDMA) with smart antennas.

Software:

5g will be single unified standard of different wireless networks, including LAN technologies, LAN/WAN, WWWW (Wireless World Wide Web), unified IP & seamless combination of broadband. This software defined with radio, encryption, flexibility and anti-virus.

KEY CONCEPTS OF 5G:

The key concepts discussing 5G and beyond 4G wireless communications are:

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 according to location and connected network.

4) One unified global standard.

5) Pervasive networks providing ubiquitous computing:

The user can simultaneously be connected to several wireless access technologies and seamlessly move between them. These access technologies can be a 2.5G, 3G, 4G or 5G mobile networks, Wi-Fi, WPAN or any other future access technology. In 5G, the concept may be further developed into multiple concurrent data transfer paths.

6) Cognitive radio technology, also known as smart-radio: allowing different radio technologies to share the same 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 in a distributed fashion, and relies on software defined radio.

7) High altitude stratospheric platform station (HAPS) systems. The radio interface of 5G communication systems is suggested in a Korean research and development program to be based on beam division multiple access (BDMA) and group cooperative relay techniques.

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Fig: 1 5G Mobile concept

ARCHITECTURE:

5G wireless technology defines by OSI layer1and layer2, for these two layers the 5G mobile network is likely to be based on Open Wireless Architecture (OWA). OWA is the combination Physical layer and Data link layer.

All mobile networks will use mobile IP. Each mobile terminal will be a Foreign Agent (FA).A mobile can be attached to several mobiles or wireless networked the fixed time. The fixed IPv6 will be implement in mobile phones. Network layer separated into lower network layer (for each interface) and upper network layer (for each mobile terminal).

5G mobile terminals have transport layer that is possible to be downloaded and installed is an Open Transport protocol (OTP). This Open Transport protocol is the combination of Transport layer and Session layer.

Application layer provides intelligent Qos (Quality of Service) management over variety of networks and possibility for service quality testing & storage of measurement information in information database in the mobile terminal. QoS has the parameter such as delay, losses, Bandwidth, reliability. Application provides with the help of both Presentation layer and Application layer.

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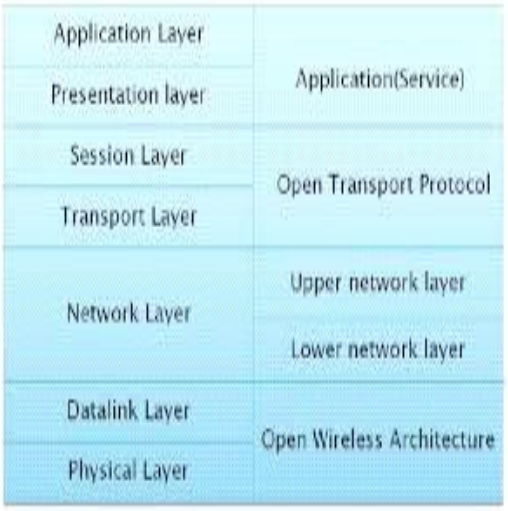

RESEARCH AND DEVELOPMENT PROJECTS:

In 2008, the South Korean IT R&D program of "5G mobile communication systems based on beam-division multiple access and relays with group cooperation" was formed.
In 2012 the UK Government announced the setting up of a 5G Innovation Centre at the University of Surrey – the world's first research centre set up specifically for 5G mobile research.
In 2012, NYU WIRELESS was established as a multi-disciplinary research center, with a focus on 5G wireless research as well as in the medical and computer science fields. The center is funded by the National Science Foundation and a board of 10 major wireless companies (as of July 2014) who serve on the Industrial Affiliates board of the center (www.nyuwireless.com). NYU WIRELESS has conducted and published some of the world's first channel measurements that show that millimeter wave frequencies will be viable for multi-Gigabit per second data rates for future 5G networks, and shares its extensive propagation database with the industrial affiliate sponsors of its research center. NYU WIRELESS hosted the first Brooklyn 5G Summit (B5GS) held on its Brooklyn, NY campus on April 24-25, 2014, where global leaders working on 5G provided thoughts and early results. The B5GS is an annual event that will be held in April, to bring together the research and technology leaders who are working on 5G.

In Europe, Neelie Kroes, the European Commissioner, committed in 2013 50 million euros for research to deliver 5G mobile technology by 2020. In particular, The METIS 2020 Project is driven by a car manufacturer and several telecommunications companies, and aims at reaching world-wide consensus on the future global mobile and wireless communications system. The METIS overall technical goal is to provide a system concept that supports 1000 times higher mobile system spectral efficiency as compared with current LTE deployments. In addition, in 2013 another project has started, called 5GrEEn, linked to project METIS and focusing on the design of Green 5G Mobile networks. Here the goal is to develop guidelines for the definition of new generation network with particular care of energy efficiency, sustainability and affordability aspects.

FEATURES:

- Very High speed, high capacity, and low cost per bit.
- It supports interactive multimedia, voice, video, Internet, and other broadband services, more effective and more attractive, and have Bi-directional, accurate traffic statistics.
- 5G technology offers Global access and service portability.
- It offers the high quality services due to high error tolerance.
- It is providing large broadcasting capacity up to Gigabit which supporting almost 65,000 connections at a time.
- More applications combined with artificial intelligent (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones.
- 5G technology use remote management that user can get better and fast solution.
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- The uploading and downloading speed of 5G technology is very high.
- 5G technology offer high resolution for crazy cell phone user and bi-directional large bandwidth shaping.
- 5G technology offer transporter class gateway with unparalleled consistency.

ADVANTAGES:

- Data bandwidth of 1 Giga bits per second and higher.
- Globally accessible.
- Dynamic information access.
- Available at low cost.
- Supports WWWW, etc.,

APPILICATION:

- Wearable devices with AI (Artificial Intelligence) capabilities.
- Pervasive (Global) network.
- Media independent handover.
- Radio resource management.
- VoIP (Voice over IP) enabled devices.
- With 6th sense technology.

CONCLUSION:

The development of the mobile and wireless networks is going towards higher data rates and all-IP principle. Mobile terminals are obtaining each year more processing power, more memory on board, and longer battery life for the same applications. 5g include latest technologies such as cognitive radio, SDR, nanotechnology, cloud computing and based on
All IP Platform. It is expected that the initial Internet
Philosophy of keeping the network simple as possible, and giving more functionalities to the end nodes, will become reality in the future generation of mobile networks, here referred to as 5G.

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