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Mobile Communication-5G Technology

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Abstract:
As a subscriber becomes more aware of the mobile phone technology. From generation 1G to 2.5G and from 3G to 5G this world of telecommunication has seen a number of improvements along with improved performance with every passing day. This fast revolution in mobile computing changes our day to day life that is way we work, interact, and learn etc. he search for new technology is always the main intention of the prime cell phone giants to out innovate their competitors. In addition, the main purpose of the fifth generation wireless networks (5G Wireless networks) is planned to design the best wireless world that is free from limitations and hindrance of the previous generations.5G technologies will change the way most high bandwidth users access their Mobile Radio Communication. The main features in 5G mobile network is that user can simultaneously connect to the multiple wireless technologies and can switch between them. This paper also focuses on all preceding generations of mobile communication along with fifth generation technology.

Keywords: *4G & 5G, 5G Architecture, Comparison of 3G, Evolution from 1G to 4G, Key concepts of 5G, Mix-Bandwidth Data Path, Wireless Grids*

1. Introduction

The present cell phones have it all. Today phones have everything ranging from the smallest size, largest phone memory, speed dialling, video player, audio player, and camera and so on. Recently with the development of Pico nets and Blue tooth technology data sharing has become a child's play. Earlier with the infrared feature you can share data within a line of sight that means the two devices has to be aligned properly to transfer data, but in case of blue tooth you can transfer data even when you have the cell phone in your pocket up to a range of 50 meters. The creation and entry of 5G technology into the mobile marketplace will launch a new revolution in the way international cellular plans are offered.

The global mobile phone is upon the cell phone market. Just around the corner, the newest 5G technologies will hit the mobile market with phones used in China being able to access and call locally phones in Germany. Truly innovative technology changing the way mobile phones will be used. With the emergence of cell phones, which are similar to a PDA, you can now have your whole office within the phone. Cell phones will give tough competitions to laptop manufacturers and normal computer designers. Even today there are phones with gigabytes of memory storage and the latest operating systems. Thus one can say that with the current trends, the industry has a real bright future if it can handle the best technologies and can produce affordable handsets for its customers. Thus you will get all your desires unleashed in the near future when these smart phones take over the market. 5G Network's router and switch technology delivers Last Yard Connectivity between the Internet access provider and building occupants. 5G's technology intelligently distributes Internet access to individual nodes within the building.

2. Evolution of Wireless Technologies

Mobile communication has become more popular in last few years due to fast revolution in mobile technology. This revolution is due to very high increase in telecoms customers. This revolution is

from 1G- the first generation, 2G- the second generation, 3G- the third generation, and then the 4G- the forth generation,5G-the fifth second generation.

A. First Generation (1G)

1G emerged in 1980s. It contains Analog System and popularly known as cell phones. It introduces mobile technologies such as Mobile Telephone System (MTS), Advanced Mobile Telephone System (AMTS), and Improved Mobile Telephone Service (IMTS), and Push to Talk (PTT). It uses analog radio signal which have frequency 150 MHz, voice call modulation is done using a technique called Frequency-Division Multiple Access (FDMA).It has low capacity, unreliable handoff, poor voice links, and no security at all since voice calls were played back in radio towers, making these calls susceptible to unwanted eavesdropping by third parties.

B. Second Generation (2G)

2G emerged in late 1980s. It uses digital signals for voice transmission and has speed of 64 kbps. It provides facility of SMS (Short Message Service) and use the bandwidth of 30 to 200 KHz. Next to 2G, 2.5G system uses packet switched and circuit switched domain and provide data rate up to 144 kbps. E.g. GPRS, CDMA and EDGE

C. Third Generation (3G)

It uses Wide Brand Wireless Network with which clarity is increased. The data are sent through the technology called Packet Switching. Voice calls are interpreted through Circuit Switching. Along with verbal communication it includes data services, access to television/video, new services like Global Roaming. It operates at a range of 2100MHz and has a bandwidth of 15-20MHz used for High-speed internet service, video chatting.3G uses Wide Band Voice Channel that is by this the world has been contracted to a little village because a person can contact with other person located in any part of the world and can even send messages too.

D. Fourth Generation (4G)

4G offers a downloading speed of 100Mbps.4G provides same feature as 3G and additional services like Multi-Media Newspapers, to watch T.V programs with more clarity and send Data much faster than previous generations. LTE (Long Term Evolution) is considered as 4G technology. 4G is being developed to accommodate the QoS and rate requirements set by forthcoming applications like wireless broadband access, Multimedia Messaging Service (MMS), video chat, mobile TV, HDTV content, Digital Video Broadcasting (DVB), minimal services like voice and data, and other services that utilize bandwidth.

3. Mix-Bandwidth Data Path Design

CDMA development group (CDG) has issued convergence architecture for 4G,Which combined pico cell, micro cell, macro cell and global area shown in Figure1? This architecture clearly shows that in pico-cell area, there are four wireless network covered, in micro cell area, there are three wireless network covered, in macro cell area, there are two wireless network covered at least. The problem is for any users at a certain place and time, it is one network supply wireless services for them, the others keep wireless network resources waste. 5G is real wireless world, it is completed wireless communication. We design mix-bandwidth data path for 5G so that all wireless network resource can be used efficiently.

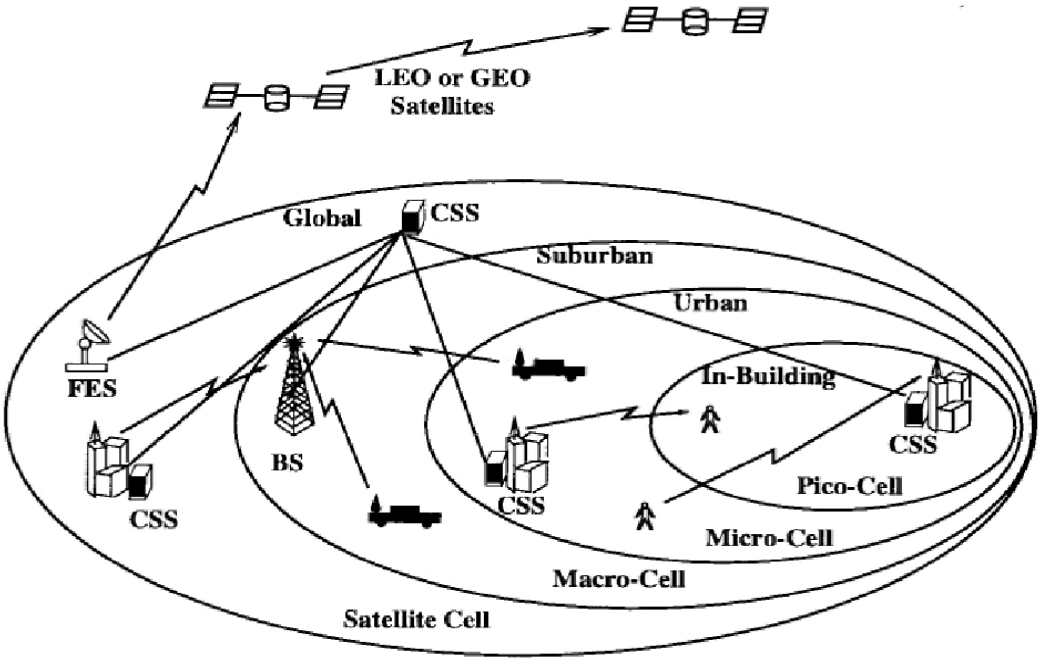

Fig1: 4G Convergence Architecture

4. Mix-Bandwidth Data Path Model Design

In order to design mix-bandwidth data path, we propose a new data model as shown in Figure2. This model based on any two networks overlay area. When a mobile node comes into the overlay area, both of the two networks can supply services for the mobile node simultaneously. Data request can be sent from any one network, and reply can be from any other network.

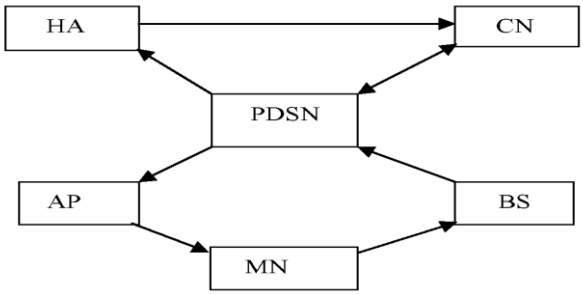

Fig2: Mix-bandwidth Data Path Model

In this model, the MN request can go through the first connection (MN → BS→PDSN → CN) and the resulting reply can come from the second connection (CN →PDSN → AP → MN). Thus, two networks supply services for the mobile node simultaneously. Following this model, we propose mix-bandwidth data path shown in Figure, which contains four components. They are bandwidth management, bandwidth selection, packet receiver and bandwidth monitor.

5. Mobile Wireless Grids

Mobile computing is an aspect that plays seminal role in the implementation of 4G Mobile Communication Systems since it primarily centres upon the requirement of providing access to various communications and services everywhere, any time and by any available means. Presently, the technical solutions for achieving mobile computing are hard to implement since they require the creation of communication infrastructures and the modification of operating systems, application programs and computer networks on account of limitations on the capability of a moving resource in contrast to a fixed one.

In the purview of Grid and Mobile Computing, Mobile Grid is a heir of Grid, that addresses mobility issues, with the added elements of supporting mobile users and resources in a seamless, transparent, secure and efficient way. It has the facility to organize underlying ad-hoc networks and offer a self-configuring Grid system of mobile resources (hosts and users) connected by wireless links and forming random and changeable topologies. The mobile Grid needs to be upgraded from general Grid concept to make full use of all the capabilities that will be available; these functionalities will involve end-to-end solutions with emphasis on Quality of Service (QoS) and security, as well as interoperability issues between the diverse technologies involved. Further, enhanced security policies and approaches to address large scale and heterogeneous environments will be needed. Additionally, the volatile, mobile and poor networked environments have to be addressed with adaptable QoS aspects which have to be contextualized with respect to users and their profiles.

6. Wireless Grids

Grid computing lets devices connected to the Internet, overlay peer-to-peer networks and the nascent wired computational grid dynamically share network connected resources in 4G kind of scenario. The wireless grid extends this sharing potential to mobile, nomadic, or fixed-location devices temporarily connected via ad hoc wireless networks. Following Metcalfe's law, grid-based resources become more valuable as the number of devices and users increases. The wireless grid makes it easier to extend grid computing to large numbers of devices that would otherwise be unable to participate and share resources. While grid computing attracts much research, resource sharing across small, ad hoc, mobile, and nomadic grids draws much less.

Wireless grids, a new type of resource-sharing network, connect sensors, mobile Phones and other edge devices with each other and with wired grids. Ad hoc distributed resource sharing allows these devices to offer new resources and locations of use for grid computing. In some ways, wireless grids resemble networks already found in connection with agricultural, military, transportation, air-quality, environmental, health, emergency, and security systems.

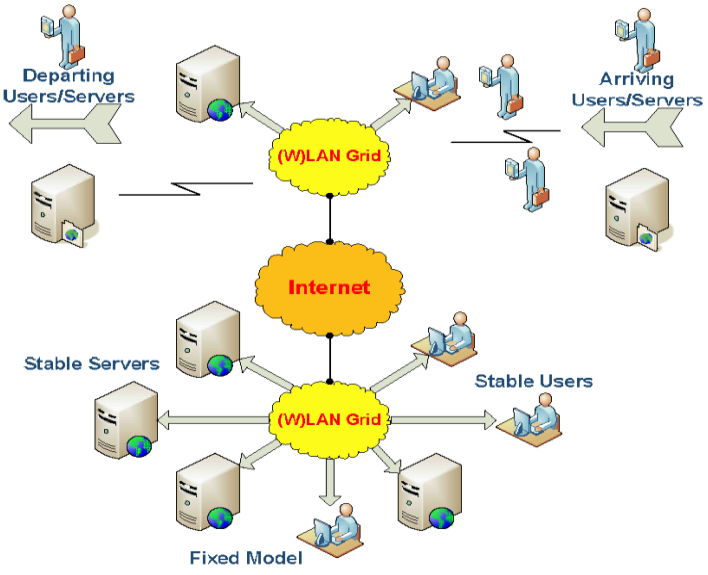

Fig3: Dynamic and fixed wireless grids.

7. 5G Network Architecture

Terminals and network components are dynamically upgraded (and adapted) to new situation. Network operators use the upgradeability to introduce value-added services more easily. Upgradeability is based on cognitive radio. Cognitive radio technologies include the ability of devices to determine their location and location's information (i.e. temperature, weather etc.), sense spectrum

used by neigh boring devices, change frequency, adjust output power and even alter transmission parameters and characteristics. A cognitive radio is a transceiver (beam) that is able to understand and respond to its operating environment. Thus cognitive radio concerns mobile devices and networks which are computationally intelligent about radio resources and related communications to explore user communication needs and provide wireless services, be appropriate to those needs. Hence, the radio is aware and cognitive about changes in its environment and responds to these changes by adapting operating characteristics in some way to improve its performance.

Table 1: Basic comparison among 3G, 4G and 5G Technology

Technology/ features	3G	4G	5G
Data Bandwidth	2Mbps	2Mbps to 1Gbps	1Gbps to Higher(as demand)
Frequency Band	1.8 - 2.5 GHz	2 - 8 GHz	3-300GHz
Standards	WCDMA CDMA-200 TD-SCDMA	All access convergence including:OFMDA,MC-CDMA Network-LMPS	CDMA & BDMA
Technology	Broad bandwidth CDMA,IP technology	Unified IP And seamless combination of broadband LAN/WAN/ PAN and WLAN	Unified IP and seamless combination of broadband, LAN/WAN/PAN/WLAN and technologies for 5G new deployment (could be OFDM)
Service	Integrated high quality audio, video and data	Dynamic information access, wear-able devices, HD streaming; global roaming;	Dynamic information access, wear-able devices, HD streaming; any demand of users; upcoming all technologies; global roaming smoothly
Multiple Access	CDMA	CDMA	CDMA & BDMA
Core Network	Packet Network	All IP Network	Flatter IP Network & 5G Network Interfacing(5G-NI)
Definition	Digital Broadband, packet data	Digital Broad band, Packet data, All IP	Digital Broadband, Packet data All IP, Very high throughput
Hand off	Horizontal	Horizontal & Vertical	Horizontal & Vertical
Start from	2001	2010	2015

8. Key Concepts of 5G

Suggested in research papers discussing 5G and beyond
4G wireless communications are:
(a) Real wireless world with no more limitation with access and zone issues.
(b) Wearable devices with AI capabilities.

(c) Internet protocol version 6 (IPv6), where a visiting care-of mobile IP address is Assigned according to location and connected network.
(d) One unified global standard.
(e) 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.
(f) 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.
(g) 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.

9. Features of 5g Networks Technology

Main features of 5G Network technology are as follows:
(a) 5G technology offer high resolution for crazy cell phone user and bi-directional large bandwidth shaping.
(b) The advanced billing interfaces of 5G technology makes it more attractive and effective.
(c) 5G technology also providing subscriber supervision tools for fast action.
(d) The high quality services of 5G technology based on Policy to avoid error.
(e) 5G technology is providing large broadcasting of data in Gigabit which supporting almost 65,000 connections.
(f) 5G technology offer transporter class gateway with unparalleled consistency.
(g) The traffic statistics by 5G technology makes it more accurate.
(h) Through remote management offered by 5G technology a user can get better and fast solution.
(j) The remote diagnostics also a great feature of 5G technology.
(k) The 5G technology is providing up to 25 Mbps connectivity speed.
(l) The 5G technology also support virtual private network.
(m) The new 5G technology will take all delivery service out of business prospect
(n) The uploading and downloading speed of 5G technology touching the peak.
(o) The 5G technology network offering enhanced and available connectivity just about the world

10. Conclusion

There are some other projects, which are undertaken ay 5G technologies. Here I want to mention that 3G mobiles are working these days, and 4G technologies are coming, but in future we are ready to face 5G technologies and some of its features I have presented in this paper.

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