

A Novel Approach in 4G Mobile Technology

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ABSTRACT

Due to the growth of user demands and the limitation of third generation (3G) mobile communication system, the need of fourth generation (4G) is expected. Due to the lot of features in 4G, it is better than 3G networks, some features of 4G like high speed internet, fastest data transfer, user can access internet anytime from anywhere. It does basically include the terminal ability that is different types of wireless services at anytime and anywhere. The fourth generation (4G) network will be a heterogeneous network. Here we also work on obtaining the best handoff which includes vertical handoff and horizontal handoff.

1. INTRODUCTION

Wireless mobile communication systems are introduced in the early 1980's. First generation (1G) systems were marked by analog frequency modulation and user primarily for voice communication. Second generation (2G) wireless communication system which made their appearance in the late 1980's were also used mainly for voice transmission and reception, where by 2G communication is global system for mobile, two & half G is usually identified as being fuelled by general packet radio service along with GSM. In 3G system making their appearance in late 2002 and 2003 are designed for voice and paging services as well as interactive media use such as teleconferencing internet access and other services, even before 3G networks fully launched and utilized various study groups are considering the shape of the next generation of cellular technology so called the fourth generation (4G).

Short History of Mobile Technology

Technology	1G	2G	3G	4G
Design Began	1970	1980	1990	2000
Implementation	1981	1991	2001	2010
Services	Analog Voice	Digital Voice short message	Higher Capacity data rates up to 2 Mbps	Higher capacity completely IP-oriented multimedia, data to hundreds of megabits
Standards	AMPS, TACS, NMT, etc	TDMA, CDMA, GSM	WCDMA, CDMA2000	Single standard
Data Rate	NA	14.4 kbps	2 Mbps	> 200 Mbps
Multiplexing	FDMA	TDMA, CDMA	CDM	OFDM
Core Network	PSTN	PSTN	Packet Network	Internet

Legend: AMPS – Advance mobile phone service, CDMA-Code division multiple access, FDMA-Frequency division multiple access, GSM-Global system for mobile communication, NMT-Nordic mobile telephone, OFDM-Orthogonal frequency division multiplexing, PSTN-Public switched telephone network, TACS-Total access communications, TDMA-Time division multiple, WCDMA-Wideband CDMA

2. LIMITATION OF 3G/NEED FOR 4G

1. 3G can support multimedia internet type services at high data rates up to 384 kb/s for moving up to 2 Mbps in limited coverage area.
2. The 4G technology would offer high bandwidth services with the transmission speed of more than 20 Mbps within the reach of LAN “Hotspots” which are installed everywhere home, malls and airport lounges.
3. In 3G, extension to higher data rates is difficult with CDMA due to excessive interference between the service and users.
4. To ensure connection ubiquity together with high bandwidth and mobility, the network architecture must be heterogeneous rather than homogenous.
5. The 3G mobile network is based on primarily a wide area concept. In 4G system, utilizing both wireless LAN, and cellular design the user will be connected to a high speed network anywhere, any time.
6. The 4G mobile network will be cheaper than 3G.

3. FEATURES OF 4G

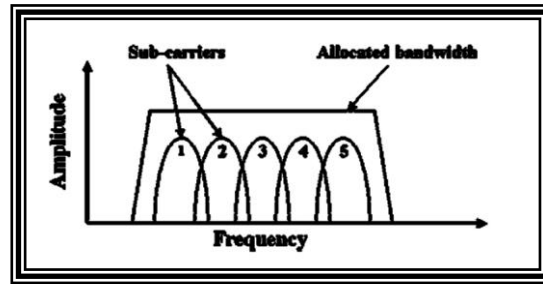
1. User friendliness and user personalization: The combination of user friendliness and user personalization appears to be the winning concept when you try to encourage people to move towards a new technology. If user friendliness the interaction between the application and user can be minimized and simplifies.
2. Terminal Heterogeneity and Network Heterogeneity:- 4G Provides not only higher data rates but also a clear and valuable advantage in people everyday life with the combination of terminal heterogeneity and network heterogeneity. Terminal heterogeneity refers to the different type terminals in terms of display size energy consumption etc. Network heterogeneity is related to the increasing heterogeneity of wireless network.
3. Important features of 4G system are: High Speed, high capacity, low cost per bit, better scheduling and call admission control techniques. Enabling person to person, person to machine and machine to machine communication, IP based core network etc.

There is also some important features like global roaming and inter working between different access technologies both horizontal (intra system) and vertical (inter system) handoff.

4. TECHNOLOGIES IN 4G

4G mobile technologies are originally originated from 3G and they are evaluations of WCDMA and CDMA2000. Some techniques are:

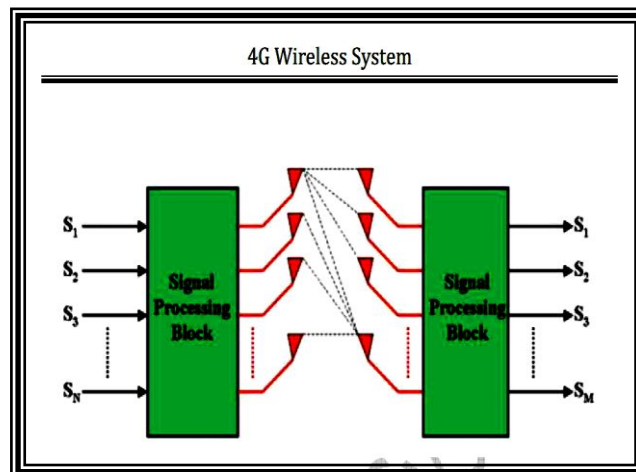
1. Orthogonal Frequency Division Multiplexing (OFDM): OFDM is a type of multi carrier modulation and they work by dividing the data stream for transmission at a bandwidth B into an N multiple and parallel bit stream, spaced B/N apart.



An OFDM transmitter accepts data from an IP network, converted and encoded the data prior to modulation. The inverse fast fourier transform (IFFT) transform the OFDM signal into an IF analog signal, which is sent to the RF transceiver. The receiver circuit reconcept the data by reversing this process OFDM actually provide better link and communication quality.

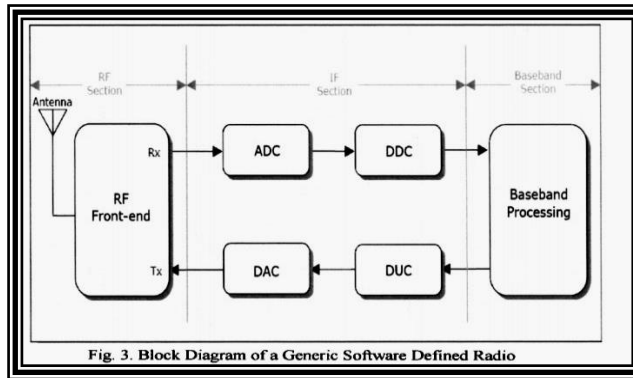
- Multiple Input Multiple Output (MIMO): Smart/Multiple antennas basically increase the capacity of systems and have intelligent functions such as audio tracking, digital beam forming and suppression of interference signals.

Actually antennas there are both a receiver and transmitter by using a limiting factor and they are supporting to increase data rates. Basically the concept behind MIMO is that the signals and transmit and receiver antennas are combined. Thus the quality and the data rate can be improved.



Thus the result in high spectral efficiencies and rich scattering environment.

- Software Defined Radio(SDR): Software defined radio major functional block as shown in figure, namely front end (RF section), the IF section and the base band section. The RF section is also called RF front end. The RF section is responsible for transmitting and receiving the radio frequency (RF) signal from the antenna. The conversion from analog to digital (on receiving path) and from digital to analog (on the transmitting path) is performed by using the ADC/DAC at the IF section.



4.1 Advantages of SDR are:

4. Flexibility and reconfigurability
5. Interoperability
6. Connectivity

4.2 Drawbacks in SDR:

1. ADC's are not enough
2. It is impossible to have just one antenna and one low noise amplifier to serve the wide range of frequency band.

5. CHALLENGES

Terminal mobility:- For getting different types of wireless services at any time and any where is known as terminal mobility. Terminal mobility is very important in 4G infrastructure because a 4G network will be a heterogeneous network. In terminal mobility, there are two main issues location management and handoff management.

When the mobile terminal is tracked located by the system for possible connection is called location management. When it is maintained on going communication is called handoff management.

In 4G network system it is more difficult to solve the handoff problem because type of handoff involved.

- 1-Horizontal handoff
- 2- Vertical handoff and we try to solve the problem.

6. NEW CHALLENGES

For obtaining the best handoff solution we have to mainly focus on the two main streams of handoff.

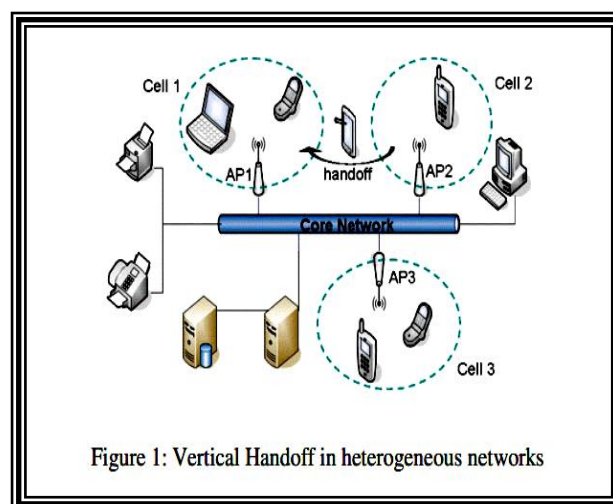
1. Horizontal handoff
2. Vertical handoff

Horizontal handoff (HH): In horizontal handoff, handoff between two base stations (BSs) of the same system is called horizontal handoff. HH involve the terminal device to change cells with in device to change cells within the same type of network to maintained service continuity. [1]

Horizontal handoff between two BS under same foreign agent (FA) is known as link layer handoff. Handoff occurs between two BSs that belong to different FAs and both FAs belong to same system is called intrasystem handoff.

Vertical handoff (VH): The vertical handoff mechanism allows a terminal device to change network between different type of network example - 3G and 4G network. In a way that is completely transparent to end user applications. The vertical handoff process involves three main phases [2] [3] namely system discovery, vertical of decision and VHO execution.

In VHO choice stage the versatile terminal decides measure the association should keep utilizing the present system or to be changed to another system. Amid the execution, the association in the portable terminal are re-steered from the current system to the new system is a consistent way.



We propose the requirement for vertical handoff decision modal for heterogeneous 4G networks.

7. CONCLUSION

In this paper the overall vision of the 4G mobile communication system was presented. It is a future mobile network it provides the very high data rates. And here we also discuss about the fourth generation 4G network. Features like user friendliness and user personalization, terminal heterogeneity and network heterogeneity. Here we basically focus on the vertical handoff in homogeneous network to solve the issue of vertical handoff.

8. FUTURE WORK

For more efficient handoff mechanism we have work on its bandwidth, handoff latency, power consumption, network cost, user preferences, network throughput, network load balancing, network security, velocity, Received signal strength.

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