

4G Technology and Its Application

An Overview

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Abstract: With the expanding requests in the field of versatile and information interchanges, the sole point is to associate clients as quick as could be expected under the circumstances. 4G gives high portability fast information rates furthermore underpins high limit IP-based administrations and applications while it too keeps up full in reverse similarity. It is additionally in light of remote correspondence that is IP construct and is slated in light of Advanced MIMO innovation. WiMAX, LTE, Advanced LTE Technologies, and so forth are part of 4G. In this paper, we depict what the 4G innovation really is counting its Technical perspectives, Key Features, Challenges, and so forth and how simple it is to execute 4G demonstrating its Cost viability. A few suggestions has been made with a specific end goal to comprehend the best possible focal points and difficulties of 4G System for powerful usage, for e.g.: 4G Network access requires expansive number of Transmitters and Collectors in the Device which bring about substantial utilization of battery. This paper underscores on such obliges and its evacuation. Further, use of multimode programming is clarified by which diverse systems can be kept up. Another proposition of Coding Strategies for 4G Wireless Networks if there should be an occurrence of Video is specified in the paper. At last, a depiction of Future Technologies, for example, 5G, 6G and 7G has been given which has monstrous degree for creative examination and improvement.

Keywords: 4G; LTE; LTE Advanced; MIMO; WiMAX ; 5G ; 6G ; 7G; Coding Strategies.

1. INTRODUCTION

4G is the Fourth Generation of mobile communication. A successor to 3G standards, it promises higher speed and better performance. ITU-Advanced specifications state that it should be able to provide 1Gbps speed for low mobility and at least 100Mbps for high mobility. With this feature, users will have access to different services, increased coverage, the convenience of a single device, one bill with reduced total access cost, and more reliable wireless access even with the failure or loss of one or more networks. 4G technology follows Multiple Input Multiple Output Technology that uses signal multiplexing between multiple transmitting antennas (space multiplex) and time or frequency. In Figure 1, the successive generations have been shown. The following sections in this paper attempt to focus on the features of 4G and also its challenges.

This new technology can be made to work on the existing platforms (towers and available antennae) quite proficiently, thus eliminating new hardware investment costs. But, with the onset of 4G, the problem of availability of network in remote places would become more than prominent as this technology is far more advanced than the previous standards. [16] Also, 4G network access requires substantial increase in the number of transmitters and receivers in the device, which means lowering of available battery backup which can be removed by efficient charger design for 4G device. The applications of 4G are many, amongst which multimode software, video coding strategies are the ones that are discussed in this paper. As it is widely known and accepted, that every new technology enhances scope for betterment and improvement, thus leading to innovation of a newer one. Following the same queue, valid ideas will be shared that leave room for creation of more advanced standards following 4G such as 5G, 6G and 7G.

2. KEY FEATURES OF 4G TECHNOLOGY

A. Network Detection and Network Selection — A mobile terminal that features multiple radio technologies or possibly uses software-defined radios if economical, allows participation in multiple networks simultaneously, thereby connecting to the best network with the most appropriate service parameters (cost, QoS and capacity among others) for the application.

B. Seamless Handover and Service Continuity — A “base station” that features intra- and inter-technology handovers, assuring service continuity with zero or minimal interruption, without a noticeable loss in service quality. Support for this function requires continuous transparent maintenance of active service instances and inclusion of various access technologies, from WiFi to OFDMA.[1]

WIMAX, LTE & MIMO as Next Generation Technologies:

The emergent 4G technologies such as WiMAX and LTE are stronger as compared to Wi-Fi. These technologies are having strong QOS and wider coverage. In some key aspect WiMAX and LTE resemble each other including operating in licensed spectrum bands, strong QOS support, wider coverage range. Based on point-to-multipoint connections, both WiMAX and LTE telecommunications technologies provide broadband wireless service. Through Base Station (BS), mobile subscribers (MS) such as smart phones/laptops get connected to internet, while BS controls the channel access of mobile subscribers. Frequency-division duplex (FDD) as well as time-division duplex (TDD) systems are being supported by both WiMAX and LTE. MU-MIMO (Multiple User MIMO) is a technology that deals in transmitting parallel & unique data streams in the same frequency-time to multiple users. (Spatial multiplexing) and also thereby improves sector/site capacity throughput.

3. CHALLENGES OF 4G

A. Security: The first step in analyzing cellular wireless security is to identify the security objectives. The goals that the security policy and corresponding technology should achieve are to ensure that information generated by or relating to a user is adequately protected against misuse or misappropriation. It is to be ensured that the level of protection afforded to users and providers of services is considered to be better than that provided in contemporary fixed and mobile networks. Further, it is to be seen that the implementation of security features and mechanisms can be extended and enhanced as required by new threats and services.[2]

B. Hand off Delay: Handoff delay poses another important QoS-related issue in 4G wireless networks. During the handoff process, the user may experience a significant drop in QoS that will affect the performance of both upper-layer protocols and applications. Deploying a priority-based algorithm and using location-aware adaptive applications can reduce both handoff delay and QoS variability. When there is a potential for considerable variation between senders' and receivers' device capabilities, deploying a receiver-specific filter in part of the network close to the source can effectively reduce the amount of traffic and processing, perhaps satisfying other users' QoS needs.[9]

C. 4G supportive devices showing less Battery Backup: In 4G supportive Devices due to presence of large number of Transmitters & Receivers, the battery of the device runs off quite quickly. With technological developments the devices are getting smaller in size due to Large Scale Integration and micro architecture. Hence in 4G devices if we want to enhance the battery life by designing a much powerful Li-on Battery ,then the backup would increase no doubt but also the size o the device would increase i.e. not highly recommended. Thus, we have discussed about solving this problem in the following section.

4. IMPLEMENTING 4G IN A COST EFFECTIVE MANNER

Embedding broadband in all types of consumer devices is a goal of 4G. To achieve the vision, of cost effective application of 4G ITU defines access layers of network such as Fixed (i.e.,DSL, cable, fiber) — fixed wireline networks, Personal (i.e., Bluetooth, UWB) —cars, cell phones ,Hot-spot (i.e., Wi-Fi/802.11) , Cellular (i.e.,UMTS, WiMAX) —highly-mobile users.These include higher speeds and more advanced network integration and enablement for service offerings. In terms of 4G Network cost and affordability, there are a number of issues to consider that reflect some degree of risk. Developing a successful 4G Network platform is a positive step towards the creation of a wireless and broadband

environment that possesses rapid transmission speeds, data integrity modules, and other related events that encourage users to take additional risks in promoting successful utilization of these 4G tools.

5. PROPOSED DESIGN OF EFFICIENT BATTERY CHARGER FOR 4G ENABLED DEVICE

5.1. LI-ion charging Information:

A Li-Ion battery is unique, as it is charged from a fixed voltage source that is current limited (this is usually referred to as constant voltage charging). We have designed an efficient single cell 150 mA charger which can be implemented in large scale thereby resulting in Li-on 4G device compatible charger that can charge a 1500-1800 mAh battery at ease and that too very fast. This can be done by changing the circuit parameters and also using 3cell Li-on. Figure 2 gives shows the proposed design or circuitry for the charger[12].

5.2. Constant Voltage Charging:

A constant voltage (C-V) charger sources current into the battery in an attempt to force the battery voltage up to a pre-set value (usually referred to as the set-point voltage or set voltage). If the voltage is too low, the cell will not be fully charged. The design presented next shows a simple solution for slow charging a single Li-Ion cell. An LP2951 regulator was selected because it has an output voltage that is very stable over temperature. The LP2951 is set for an output voltage of 4.20V using the resistors shown. The C1 capacitor is needed to prevent instability due to noise at the high impedance feedback node. Large resistor values are used in this design to keep the "OFF" current drain below 2mA. A blocking diode is used at the output of the LP2951 to prevent battery current from flowing back into the LP2951 output pin if the input power source is removed.

6. APPLICATIONS OF 4G

A. Multimode Software Application: 4G technology has an unique application of accessing several wireless networks. It is capable of high level of customization at the user-level end. This feature integrates the infrastructure of all available networks and steadily it will be easier for users to access services and applications regardless of the environment. One can easily access different mobile and wireless networks simultaneously. Multimode software is a software that allows the user device to adapt itself to various wireless interfaces networks in order to provide constant net access with high data (packet based) rate. how multiple networks are accessed through multimode operation. All the networks will be compatible once the switch is completed, eliminating roaming and areas where only one type of phone is supported. Once the voice and data networks are superposed there will suddenly be millions of new devices on the network cloud. This will require either reconstruction of the address space for the entire Internet or using different address spaces for the existing wireless networks. The multimode device architecture may improve call completion and expand effective coverage area.[2]

B. Video Network Coding for 4G Wireless networks: High Definition (HD) demand is increasing day by day more than that of the bandwidth support available. Network Coding allows to reduce the required number of packets to complete a transmission over noisy or unreliable networks compared non coded version, hence increasing throughput. Network coding offers exciting possibilities for the efficient transmission of video over wireless and bottleneck networks [1]. By sending combinations of packets and considering traffic as algebraic information not just bits, 4G network is ideally suited to Network Coding i.e. they are resources, need to serve a variety of different devices and femto cells connected to WIFI. However, it is also noted that the complexities that Network Coding can face in decoding nodes can accelerate the capabilities of embedded systems. This problem can be discarded by use of codes defined on small Galois Fields (GF). Thus, it is inferred that Network Coding could be doing peer to peer high definition video streaming and also thereby can be incorporated into more consumer-oriented devices. In the next section, the proposed strategy for Video Centric Network Coding has been briefly portrayed.[3]

6.1 Network Coding for 4G wireless Network: Proposed Strategy:

In this section, a novel proposal has been made that puts forward a variety of network coding approaches, and provides an efficient way to resolve the issues in Network Coding by encoding at the source, the core nodes as well as decoding at the edge. Mechanisms like progressive downloads have been designed to compensate for routing and decoding delays that

can cause betterment to the video experience. Video streaming on the Internet heavily rely on file transfer to provide the video end to end. The decoding delays associated with these codes can however be very “expensive” for video quality. In addition, source based solutions can burden a network along the packet route when only the edges requires added reliability. Here a Network Coding solution can recover packets efficiently since the “lost” packet is part of a linear combination of transmitted packets. In Figure 4, the network coding principle is illustrated[2].

7. CONCLUSION

The acknowledgment of 4G tears down the divider amongst remote and wireline administrations, a testing try. Sensibly, wide-scale accessibility of 4G is quite a while away, however administrators and measures bodies are gaining ground. 4G remote systems not just empower more proficient, adaptable, and dependable remote administrations additionally give more extensive assortment of administrations. These open doors accompany a requirement for reconsidering about the security, protection, planner and charging advancements that have been utilized for past eras. [2]We accept, in any case, that future exploration will defeat these difficulties and incorporate recently created administrations to 4G systems making them accessible to everybody and whenever. Further proceeding onward to further interchanges eras, it is normal that soon overall remote web will be far reaching over the globe furthermore information and voice correspondences may happen exclusively concerning satellite interaction.[4] We trust that this Paper advances more grounded connections between individuals working in various fields making future ideas of versatile correspondence, Internet administrations, and so forth. We infer that it is an incredible time to put resources into new businesses. These days versatile clients have much consciousness of the PDA (portable) innovation. The 5G, 6G &7G innovations incorporate all kind of cutting edge highlights which makes portable innovation most intense and in immense interest in not so distant future.

REFERENCES

- [1] 4G: The What, Why and When- The worldwide adoption and growth of wireless are the fastest technological achievements in history- Tellabs. www.tellabs.com/solutions/mobilebackhaul
- [2] Future and Challenges of 4G Wireless Technology by Nikita Rawat, December-2012
- [3] Video-centric Network Coding Strategies for 4G Wireless Networks: An Overview* by Marie-José Montpetit and Muriel Médard , MIT Research Laboratory for Electronics.
- [4] The 4G Technology V/S other G Technologies by Shipra Gupta, Supriya Shakya, Dept Of CSE, R.K.G.I.T.W,UP.
- [5] Analysis of SIP-based mobility management in 4G wireless networks by Nilanjan Banerjee*, Wei Wu, Kalyan Basu, Sajal K. Das, Center for Research in Wireless Mobility and Networking (CRWMan), Department of Computer Science and Engineering, The University of Texas at Arlington, Arlington, TX 76019-0015, USA
- [6] Generations of Mobile Wireless Technology: A Survey Mudit Ratana Bhalla, Dept. of Computer Science & Applications, Dr.H.S.Gour Central University, Sagar(M.P.)
- [7] Survey of Latest Wireless Cellular Technologies for Enhancement of Spectral Density at Reduced Cost, Prof. R. K. Jain¹, Sumit katiyar², Electronics Department, Singhania University, HIET Ghaziabad Jhunjhunu, Rajasthan 333515, India.
- [8] The Future of Mobile Wireless Communication Networks, Xichun Li,Abudulla Gani Department of Computer System and Technology Faculty of Computer Science and Information Technology, University of Malaya 50603 Kuala Lumpur, Malaysia.
- [9] Issues in Emerging 4G Wireless Networks, Upkar Varshney and Radhika Jain, Georgia State University
- [10] Generations of Mobile Wireless Technology:A Survey, Mudit Ratana Bhalla Dept. of Computer Science & Applications, Dr.H.S.Gour Central University, Sagar(M.P)
- [11] A Review on 5G Technology, Suvarna Patil, Vipin Patil, .Pallavi Bhat

- [12] Literature Number: SNVA557, Texas Instruments, Battery Charging
- [13] M. Allman, G. Glover and L. Sanchez, “Enhancing TCP over Satellite Channels using Standard Mechanisms.” RFC 2488, January 1999.
- [14] A. Eryilmaz, A. Ozdaglar and M. Médard, M., “On the Delay and Throughput Gains of Coding in Unreliable Networks”, IEEE Transactions on Information Theory, Volume 54, Issue 12, December 2008, pp:5511 - 5524.
- [15] Willie Lu, Fourth-generation mobile initiatives and technologies, IEEE Communications Magazine, Volume: 40 Issue: 3, Mar 2002.
- [16] Amy Cole, The Future of 4G Technologies: New Opportunities and Changing Business Models for the Emergence of LTE and WiMAX.