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A Review Hsdpa Mobile High Data Rate Various Wireless Access OFDM Transmission in 4G Systems

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ABSTRACT: Future 4G systems require transmission of richer multimedia services which inevitably implies an Increase in data rate. Combination of (OFDM) orthogonal frequency division multiplexing technique HSDPA design and specification now being finished, the HSDPA will be ready for deployment in the very near future. While theoretical HSDPA performance has thoroughly been investigated, one of the major tasks of WCDMA network operators, the embedding of the HSDPA into their Release 99 network planning and optimization workflow, has rarely been treated so far. Consequently this paper a process and a toolset to find an optimal performance balance between Release 99 services and the HSDPA. Especially the availability of necessary input values for this process was noted in the process design, since, for example, traffic maps are usually not reliably available in the planning phase.

Keywords: *HSDPA, WCDMA, CDMA, 4th generation,*

I. INTRODUCTION

4 generation systems will support multimedia services like high-speed internet access & broadcast services from information sites. Data traffic in the downlink is expected to be much more than that in the uplink because number of substation at downlink frequency is more than the

Uplink frequency [11]. Therefore, high data rates are especially necessary for 4G in the downlink. The Main purpose of the 4th generation (4G) mobile Communication is provide high rate data serves 100Mbps, especially in the downlink over wide Coverage. Various wireless access schemes have the satellite transponder can be accessed by many earth stations from different locations on the earth at same time instant called as multiple access technique. FDMA is a first generation (1G) used 30 KHz for each user. TDMA is a (2G) used same 30 KHz channels, but with three users sharing them (3 slots). WCDMA is a 3G wireless network 1st lunch by NTT DOCOMO, Japan. It provide multimedia services with data rate of 2Mb/s with band width of 5MHz.HSDPA has been introduced in the WCDMA System by using advanced techniques, [14] such as adaptive modulation and coding and hybrid automatic repeat request (ARQ), and the data rate can be increased to 14 Mb/s. Data rate requirement increases dramatically due to demand for high-speed multimedia services. Future 4G mobile communication systems are designed to fill this big gap. A new wireless access technique using 50–100 MHz bandwidth is needed been proposed for the broadband downlink transmission in 4G systems. Single carrier CDMA is not suitable over a broadband channel, due to too much multi path interference (MPI) on the other hand, although [2] orthogonal frequency division multiplexing (OFDM) is robust to MPI, it does not have coherent frequency diversity. Moreover, in mobile cellular systems, OFDM suffers from adjacent [7] cell interference unless the same sub carriers are not used among adjacent cells. Thus, Orthogonal frequency code division multiplexing (OFCDM) system has been design for the high Speed data transmission in down link in future 4G Networks for wireless transmission in the downlink of 4G systems. Various wireless access schemes have been proposed for the broadband downlink transmission in 4G systems. OFDM is attractive for high-speed wireless communication; it does not have coherent frequency diversity. Moreover, in mobile cellular systems, OFDM suffers from adjacent cell interference unless the same sub carriers are not used among adjacent cells. OFCDM system has been proposed for the Downlink transmission in future 4G networks. Modulation is a mapping of the information a change in the carrier phase, frequency or amplitude or combination.

Multiplexing is a method of sharing a bandwidth with other, independent data channels. OFDM is a combination of modulation and multiplexing. In OFDM independent signal are a subset of one main signal put on sub channel after serial to parallel conversion of bit of stream.

In OFDM the signal is first split into independent channel, modulated by data and the multiplexed to create the OFDM carrier. OFDM is a special case of frequency division multiplexing (FDM).As an analogy ,a FDM channel is like water flow out of faucet, in contrast the OFDM signal is like shower .In a faucet all water come in one big stream and cannot be sub-divided. OFDM shower is made of lot of little streams the OFDM spectrum consist of different sub channel carry different symbols. Another way to see this, one hire a big truck or four smaller trucks, both methods carry the exact same amount of data .But in case of accident, one ¼ of data on the of OFDM trucking will suffer. These 4 smaller trucks when seen as signal are called as sub carrier in an OFDM system and they must be orthogonal for this idea to work. The independent sub channel can be multiplexed by frequency division multiplexing [4]. The idea is key to understanding OFDM .The orthogonality allows simultaneous transmission on a lot of sub carriers in tight frequency space without interference from each other. An OFDM signal offers an advantage in a channel that has a frequency selective fading response. When we lay an OFDM signal spectrum against the frequency selective response of the channel, only few sub carriers are affected

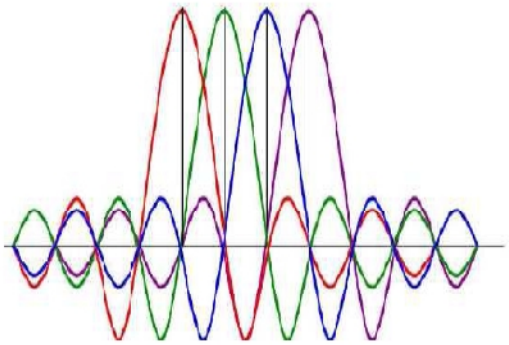

Fig. 1. OFDM spectrum.

Long Term Evolution (LTE) and Worldwide Interoperability for Microwave Access (WiMAX)—the leading technologies for next-generation mobile broadband. The information presented here will help readers understand how the two technologies differ, why Verizon Wireless chose LTE, [14] and what advantages LTE offers customers. Driving the evolution of wireless broadband technology is customers' increasing expectations for speed, bandwidth, and global access. Customers want more information, such as business and consumer applications, and entertainment available through their mobile devices, but with greater speeds. For wireless carriers to achieve greater speeds and pervasive connectedness, their networks need to start behaving more like landline IP-based networks. This line of thinking represents a fundamental shift in perspective from mobile services to broadband connections for customers and service providers alike. Enter the fourth-generation (4G) wireless network. Unlike earlier wireless standards, 4G technology is based on TCP/IP, the core protocol of the Internet. TCP/IP enables wireless networks to deliver higher-level services, such as video and multimedia, while supporting the devices and applications of the future. Verizon Wireless chose LTE over WiMAX as the technological foundation for its 4G wireless broadband network. The company believes that LTE offers a number of significant technological and business advantages over WiMAX that make it a superior networking standard. Verizon Wireless customers want to be truly untethered with advanced communication devices that provide a similar immersive experience as found in today's wired networks whether it's downloading or uploading large files, video, gaming, downloading music, or social networking. They want to be able to communicate in new and innovative ways whenever and wherever they choose around the globe. For these reasons, Verizon Wireless believes LTE is the best technology with the global scale needed to deliver such experiences.

II. THE BENEFITS OF LTE

Provides a global ecosystem with inherent mobility Offers easier access and use with greater security and privacy Dramatically improves speed and latency Delivers enhanced real-time video and multimedia for a better overall experience Enables high-performance mobile computing Supports real-time applications due to its low latency Creates a platform upon which to build and deploy the products and services of today and those of tomorrow Reduces cost per bit through improved spectral efficiency Within the Verizon Wireless network, LTE will operate in the 700 MHz spectrum, giving it vast potential for greater

Wireless carriers are keenly interested in choosing the best technology for their customers—for both today and tomorrow. For Verizon Wireless, selecting the right technology is imperative. As a leader in the wireless industry, Verizon Wireless is committed to the potential technology advances offered by LTE.

Verizon Wireless is currently conducting laboratory and field tests using LTE technology and plans to launch its 4G mobile network in 2010. This deployment will help the company realize its goal of delivering improved wireless Internet connectivity and mobility to its customers. For the mobile user, connectivity means an untethered experience and true mobility. Users can work and communicate almost whenever and wherever they want. LTE's improved speeds will allow wireless carriers to offer a number of business-specific applications and services, such as video conferencing, direct connectivity, and mobile applications that bring the desktop experience to mobile devices. Wireless technologies enable one or more devices to communicate without an actual wired connection. Radio frequency is used to transmit the data. Such technologies are rapidly evolving to meet a variety of communications needs, from simple to complex. Wireless communications needs can all be classified in one of three ways, based on the distance they are meant to cover. These include: wireless personal area networks (WPAN), wireless local area networks (WLAN), and wireless wide area networks (WWAN).

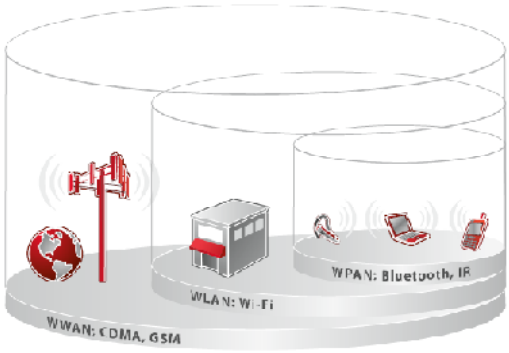

Fig. 2. Wireless network technologies.

Wireless networks form the transport mechanism between devices and traditional wired networks. WPANs are limited to distances under about 10 meters and include technologies such as infrared (IR), Bluetooth® technology, and ultra-wideband (UWB). WLANs cover a local area with distances of individual access points reaching to about 100 meters, and include technologies such as Wi-Fi (802.11a/b/g/n). WWANs cover even larger areas, using cellular data networks. This section discusses some of the most popular and widely used wireless technologies to provide readers with a point of reference for the use of 3G technology.

A. WPAN

WPANs typically provide ad hoc network connections designed to dynamically connect devices to other devices within close range of each other. These connections are termed ad hoc because they do not generally need to connect to any network infrastructure to operate. They can simply connect to each other and perform necessary communications without the need of any access network devices, such as access points or base stations.

B. Bluetooth

Bluetooth has emerged as the most widely used WPAN network standard. The Bluetooth standard is an industry specification that describes how mobile phones, headsets, computers, handhelds, peripherals, and other computing devices should interconnect with each other. Bluetooth network applications include wireless headsets, hands-free operation, wireless synchronization, wireless printing, advanced stereo audio, dial-up networking, file transfer, and image exchange, to name a few.

C. WLAN

WLANs provide connections designed to connect devices to wired networks. Unlike a wired LAN, a WLAN does not require cabling to connect the device to a switch or router. Devices connect wirelessly to nearby wireless access points that are attached to the local network using an Ethernet connection. A single access point communicates with nearby WLAN devices in a coverage area of about 100 meters. This coverage area allows users to move freely within range of an access point with their notebook computers, handhelds, or other network devices. Multiple access points can be coordinated together by a network WLAN switch to allow users to hand off between access points.

D. Wi-Fi

Wi-Fi (or IEEE 802.11) is the set of standards established to define wireless LANs. A number of different protocols are defined in the 802.11 family of standards, [4] addressing various operating frequencies and maximum throughputs. The 802.11g standard is currently the predominant protocol deployed in WLAN implementations.

E. WWAN

WWANs provide broadband data networks with a far greater range, using cellular technologies such as GPRS, HSPA, UMTS, 1xRTT, 1xEV-DO, and LTE. Wireless data devices connect to a wireless broadband network through a commercial carrier's data network, [5] allowing broadband performance without the need for a cabled connection to a network infrastructure (much like a WLAN), while providing end users with far greater mobility. These WWANs typically incorporate sophisticated user identification techniques to ensure [6] that only authorized users are accessing the network.

Multiple base stations are coordinated by base station controllers to allow users to hand off between base stations (cell sites).

F. 1xEV-DO Rev. A

1xEV-DO is the broadband wireless network standard developed by the Third-Generation Partnership Project 2 (3GPP2) as part of the CDMA2000 family of standards. EV-DO networks were first launched based on release 0 of the standard. The standard is currently in revision A, which has been deployed nationally by Verizon [3] Wireless, and provides average download speeds of 600 Kbps to 1.4 Mbps, and average upload speeds of 500 to 800 Kbps, with low latency, typically between 150 and 250 milliseconds.

WWAN Evolution: A Choice of Upgrade Paths. As the use and number of wireless devices increased, more and more demands were placed on the underlying technologies to deliver [1] enhanced capabilities and services. This section discusses the evolution of WWAN technologies and their capabilities.

Fig. 3. The Verizon wireless upgrade path to LTE.

G. WWAN Evolution: CDMA to LTE 1G First-generation (1G) radio networks were analog-based and limited to voice services and capabilities only. 1G technology was vastly inferior to today's technology. 1G devices were easily susceptible to cloning and one channel supported only one device at a time. Today's technology allows multiple devices to be supported by a single channel at the same time.

H. cdmaOne

Second-generation [7] (2G) CDMA-based wireless networks, known as cdmaOne, proved their eff ectiveness in delivering high-quality voice traffi c to subscribers. 2G networks made the transition from analog signals to all-digital signals, expanding network capabilities to include both voice and data services. With cdmaOne technology, services such as email and text messaging became possible.

I. CDMA2000

In response to subscriber growth and demand for data services that require high-speed access, 3G wireless network technology, known as CDMA2000, was implemented. CDMA2000 off ered users increased voice and data services and supported a multitude of enhanced broadband data applications, such as broadband Internet access and multimedia downloads. This technology also doubled user capacity over cdmaOne, and with the[8] advent of 1xRTT, packet data was available for the fi rst time. In addition, CDMA2000 networks supported higher numbers of voice and data customers at higher data rates and at a lower cost, compared to 2G-based networks.

J. CDMA2000 1xEV-DO

CDMA2000 1xEV-DO introduced high-speed, packet-switched techniques designed for high-speed data transmissions, enabling peak data rates beyond 2 Mbps. 1xEV-DO expanded [10] the types of services and applications available to end users, enabling carriers to broadcast more media-rich content, while users could enjoy near-wireline speeds on mobile devices. CDMA2000 1xEV-DO was initially released as release 0 (Rel. 0) and has undergone one upgrade, known as 1xEV-DO Revision A (Rev. A).

K. CDMA2000 1xEV-DO Rel. 0

Rel. 0 provides peak speeds of up to 2.4 Mbps with an average user throughput of between 400 and 700 Kbps. The average uplink data rate is between 60 and 80 Kbps. Rel. 0 makes use of existing Internet protocols, enabling it to support [11]. IP-based connectivity and software applications. In addition, Rel. 0 allows users to expand their mobile experience by enjoying broadband Internet access, music and video downloads, gaming, and television broadcasts.

L. CDMA2000 1xEV-DO Rev. A

Rev. A supports the framework for future quality of service (QoS) applications, reduces latency, and features peak speeds of 3.1 Mbps for downloads, and 1.8 Mbps for uploads. Rev. A technology's increased bandwidth capabilities further improve a user's ability to send large files, email attachments, pictures, and video from mobile devices. [9] Average speeds of Rev. A are 600 to 1,400 Kbps for downloads and 500 to 800 Kbps for uploads.

M. LTE

As mentioned previously in this paper, LTE is a 4G wireless technology that Verizon Wireless and numerous leading wireless carriers have chosen as their upgrade path beyond 3G technologies. Verizon Wireless will operate LTE in the 700 MHz spectrum, which translates to unprecedented performance and data access.

N. WWAN Evolution: GSM to LTE 1G

WWAN Evolution: CDMA to LTE, for a description of 1G WWAN technology.

O. GSM

Global System for Mobile Communications (GSM) is 2G technology that offers both voice and data capabilities.

GSM differs from 1G by using digital cellular technology and time division multiple access (TDMA) [12] transmission methods, rather than CDMA. GSM offers data transmission rates of up to 9.6 Kbps, while enabling such services as short messaging service (SMS) or text messaging, as it is more commonly known, and international roaming.

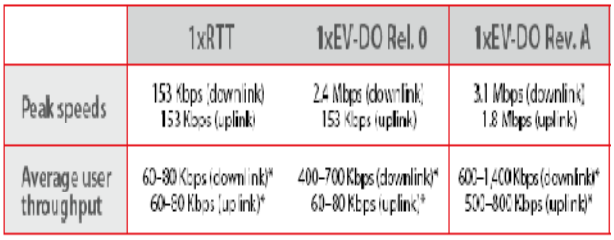

Fig. 4. The evolution of CDMa to Lte.

P. W-CDMA

Wideband Code Division Multiple Access (W-CDMA) brings GSM into 3G. W-CDMA is a type of 3G cellular network and is a high-speed transmission protocol used in Universal Mobile Telecommunications [13] System (UMTS). UMTS offers packet-based transmission for text, digitized voice, video, and multimedia content.

Q. HSPA

High-Speed Packet Access (HSPA) is a mobile telephony protocol that helps improve the performance of UMTS. HSPA uses improved modulation schemes, while refining the protocols that mobile devices and base stations use to communicate. These processes improve radio bandwidth utilization provided by UMTS.

R. HSDPA

High-Speed Downlink Packet Access (HSDPA) is a 3G mobile telecommunications protocol from the HSPA mobile protocol family. HSDPA enables higher data transfer speeds and capacity in UMTS-based networks. The standard currently supports peak downlink speeds of up to 14.4 Mbps in 5 MHz bandwidth.

R. HSUPA

High-Speed Uplink Packet Access (HSUPA) is also a 3G mobile telecommunications protocol from the HSPA mobile protocol family. The HSUPA protocol enables peak uplink speeds of up to 5.76 Mbps.

S. HSPA+

Evolved HSPA (HSPA+) is a wireless broadband standard that provides peak speeds of up to 42 Mbps on the downlink and 22 Mbps on the uplink, using multiple-input multiple-output (MIMO) technology and higher order modulation.

T. LTE

WWAN Evolution: CDMA to LTE, for a description of LTE. W-CDMAHSPAHSPA +3GPP LTE Peak speeds2 Mbps (downlink)*1.8 Mbps–14.4 Mbps (downlink)384 Kbps–2 Mbps (uplink)42 Mbps (downlink)22 Mbps (uplink)100 Mbps (downlink)50 Mbps (uplink)Average user throughput100 Kbps–320 Kbps (downlink)*Less than 100 Kbps (uplink)*Up to 2 Mbps (downlink only)*Uplink speeds vary by device5 Mbps (downlink)*3 Mbps (uplink)*5–12 Mbps (downlink)**2–5 Mbps (uplink)** the evolution of GSM to Lte.4G Mobile Broadband Technologies4G mobile broadband technologies will allow wireless carriers to take advantage of greater download and upload speeds to increase the amount and types of content made available through mobile devices.

U. Defining 4G Mobile Broadband Technology

4G networks are comprehensive IP solutions that deliver voice, data, and multimedia content to mobile users anytime and almost anywhere. 4G technology standards offer greatly improved data rates over previous generations of wireless technology [14]. Faster wireless broadband connections enable wireless carriers to support higher-level data services, including business applications, streamed audio and video, video messaging, video telephony, mobile TV, and gaming.

III. CONCLUSION

LTE is the future of the Verizon Wireless wireless broadband network. This technology will allow Verizon Wireless to offer users more of what they want, which is untethered mobility. Plus, LTE will support more of the products and services in use today, because of its backward compatibility to 3GPP networks. Verizon Wireless is fully committed to LTE mobile technology and improving its wireless network. To that end, the company actively participates in the development of technology standards to ensure that future standards will greatly benefit its customers. Verizon Wireless believes in the viability of the LTE standard and its future potential, having spent countless hours researching and testing 4G technologies to determine the best fit for its network. For these reasons, Verizon Wireless chose LTE as the technology to deliver the next generation of mobile services and applications to its customers.

REFERENCES

[1] E. Gustafsson, and A. Jonsson, "Always best connected," *IEEE Wireless Communications*, vol. **10**, no. 1, pp. 49-55, Feb. 2003.

[2] H. Atarashi, N. Maeda, S. Abeta, M. Sawahashi, 'Broadband Wireless Access based on VSF-OFCDM and MC/DSCDMA,' *Proc. of IEEE PIMRC 2002*, vol. **3**, pp. 992-997, Sept. 2002.

[3] The IST MATRICE project. Available: http://www.ist-matrice.org.

[4]. The IST 4MORE project. Available: http://www.ist-4more.org.

[5]. S. M. Alamouti. A simple transmit diversity technique for wireless communications. *IEEE Journal on Selected Areas in Communications*, **16**(8):1451-1458, Oct. 1998.

[6]. 3GPP2 TR 25.996, 2003-05, "Network spatial channel model for multiple input multiple output simulations (release 6)," 3GPP spatial channel AHG, sCM-134, Apr. 2003.

[7]. J. Rodriguez et. al, "D2.1: Definition of framework for joint layer design and optimization", 4MORE WP2, Sept. 2004. http://www.ist- 4more.org.

[8]. Ericsson, "Effective SNR mapping for modelling frame error rates in multiple-state channels," 3GPP2-C30-20030429-010.

[9]. France Telecom R&D, "WCDMA-HSDPA system level simulator calibration", Montreal, Canada, Tech. Rep. 3GPP R1-04-0499, May 2004.

[10]. A. Jayanthiladevi, H. Premlatha, and G. Nawaz, "Analysis study of Seamless Integration and Intelligent Solution in any situation by the Future Advanced Mobile Universal Systems 4G-(FAMOUS 4G)", IEEE International Conference on Emerging Trends in VLSI, *Embedded Systems, Nano Electronics and Telecommunication Systems*, pp.1-5, Tiruvannamalai, Jan 2013.

[11]. Mobile Radio Telephone, Wikipedia(access on 10 November 2013) http://en.wikipedia.org/wiki/Mobile_radio_telephone

[12] S. Gupta, S. Shakya and H. Tyagi, "The 4G Technology V/S other G Technologies", *International Journal of Advanced Research in Computer Science and Software Engineering*, vol. **3**, pp. 737-740, 2013.

[13]. MK. Iqbal, MB Iqbal, I. Rasheed and A. Sandhu, "4G Evolution and Multiplexing.