DESIGN AND ANALYSIS OF ENHANCED DOVELOPMENTS IN WIRELESS MOBILE NETWORKS

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Abstract

The latest mobile technology must have new features. With the advent of the Internet, the most-wanted feature is better, faster access to information. Cellular subscribers pay extra on top of their basic bills for such features as instant messaging, stock quotes, and even Internet access right on their phones. To support such a powerful system, we need pervasive, high-speed wireless connectivity. A number of technologies currently exist to provide users with high-speed digital wireless connectivity; Bluetooth and 802.11 are examples. The introduction of 4G has widened the scope of mobile communication. Now mobile is not only a device used for talking but it's more or less a portable computer that can serve different purposes. 4G offers higher data rates with seamless roaming. The mobile user can communicate without any disturbance while switching his coverage network. 4G is still passing through research and therefore there are some problems that need to be fixed in order to benefit the users from it fully. In this report we discuss various challenges 4G is facing and solutions to those problems are discussed. We propose our own way of improving QoS in 4G by using combination of mobility protocol SMIP and SIP. We propose that by using such scheme we can achieve better QoS during the process of handover.

Key Words:

4G resp 3G: 4th (resp. 3rd) Generation

CDMA: Code Division Multiple Access

MIMO: Multiple Input Multiple Output

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QoS: Quality of Service

OFDMA: Orthogonal Frequency Division Multiple Access.

MANET: Mobile Ad-Hoc Network

This paper is organized in the following way: Section 1 introduces the different types of wireless mobile generations. Section 2 presents Applications of the 4G design. Section 3 details how 4G technology might influence networks. Section 4 highlights security issues of 4G, section 5 describes the Quality of Service in 4G. Finally, Section 6 concludes and describes future work.

1. Introduction

Mobile communication means communicating while on move. Mobile communication itself has seen various developmental stages such as first generation (1G), second generation (2G), third generation (3G) and fourth generation (4G). The Brief description of the generations of mobile communication is given in the bellow.

1G First generation of network came into use for the first time in July 1978 in USA.1G consists of distributed transceivers that helped in communicating with mobile phone. The structure of the mobile phone was analogue and it could only be used for voice traffic.

2G The first 2G system was introduced in Finland in 1991, by Radiolinja (now part of Elisa Oyj). In 2G the shift was made to fully digital encrypted communication rather than analogue in 1G. 2G also introduced the additional data transfer through mobile rather than only voice data as in 1G. For example SMS text messages. As an example of successful 2G system we can study GSM, it was developed in 1980s and is currently under control of ETSI.

3G

Figure 1 3G applications

3G can provide higher data rates both in mobile and in fixed environments. It gives up to 2Mbps in stationary and about 384 Kbps in mobile environments. 3G has encouraged the video streaming and IP telephony and provide cost effective services to mobile users. 3G is the ITU standard to represent third generation mobile telephone system under the scope international mobile telecommunication program (IMT2000). 3G can implement various network technologies such as UMTS, GSM, CDMA, WCDMA, CDMA200, TDMA and EDGE.

4G Fourth generation (4G) also called Next Generation Network (NGN) offers one platform for different wireless networks. These networks are connected through one IP core. 4G integrates the existing heterogeneous wireless technologies avoiding the need of new uniform standard for different wireless systems like World Wide Interoperability for Microwave Access (WiMAX), Universal Mobile Telecommunications System (UMTS), wireless local area network (WLAN) and General Packet Radio Service (GPRS). 4G networks will increase the data rates incredibly, by providing 100Mbps to 1Gbps respectively.

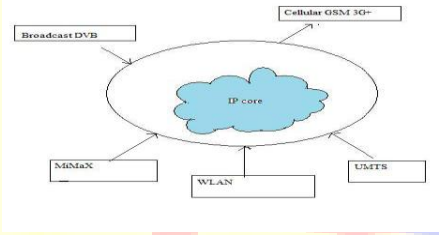

Figure 2 4G network

Present technology especially in areas of memory, bandwidth, and power, as well as new technological solution that should be available in near future are investigated in this paper. This paper should be able to present a picture of the physical constraints of MANET at present. Hopefully this will allow other researchers to set reasonable constraints and physical boundaries for future research, tests, and simulations in MANETs.New wireless communication technologies are expected to significantly influence the design and implementation of MANETs in the military environment. it is critical to understand the meaning of 4G and its Potential in influencing wireless networks, particularly MANET.

2. Applications of 4G

With the increase in the data rates, the mobile phones are made to perform higher performance applications. One such application in 4G is context awareness. For example if the mobile user is passing by an office where he/she is having an appointment to meet someone and they have forgotten the appointment. If the office location, address and geographical location matches the one user has already stored in the phone, he/she will receive information about the appointment and will be reminded that you need to perform this activity.

2.1 LTE

Long Term Evolution is an emerging technology for higher data rates. It is also referred as 3.9 G or super 3G technology. LTE is developed as an improvement to Universal Mobile Telecommunication System by 3G Generation Partnership Project (3GPP). LTE uses Orthogonal Frequency Division Multiple Access (OFDMA). The download rate in LTE is 150 Mbps and it utilizes the available spectrum in a very sophisticated way. The mobile TV broadcast is facilitated by LTE over LTE network.

3. Networks with 4G

Although there are different ideas leading towards 4G, network components frequently come up as a supporting and significant solutions that help achieve progress towards 4G. In this section we are going to investigate and explain technological innovations such as MIMO (Multiple-Input Multiple-Output), OFDMA (Orthogonal Frequency Division Multiple Access) that could significantly increase security, mobility and throughput of 4G.

3.1 MIMO

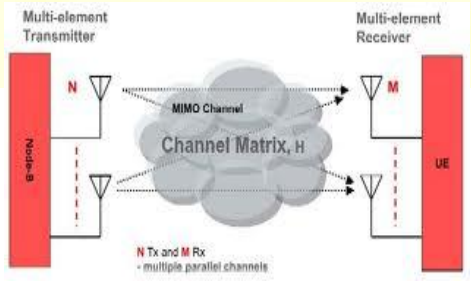

Figure 3 MIMO works

Imagine that you can hear better what you want to listen, and don't hear what bothers you, just by pointing out where message and noises are coming from. Beam forming that is the significant concept of MIMO (Multiple-Input Multiple-Output) allows you do just that using smart antennas system. Increasing speed and range, MIMO is already accepted by researchers as one of the main components of projects such as WiBro, WiMAX, WLAN, 802.11n, UMTS R8 LTE, and UMB.

3.2 OFDMA Evolution

Data comm. Research Company proposed the simplest way to implement MIMO is by sharing frequency using OFDM, that together significantly can increase performance by extending range, boosting speed and improving reliability. OFDM is the modulation scheme which divides allocated frequency channel into many narrow bands guaranteeing mutual independency between subcarriers such that there is no interference between them; signals are orthogonal.

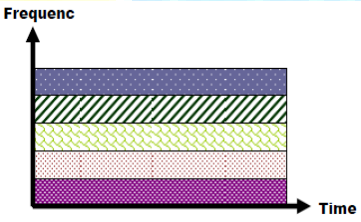

Figure 4 **FDMA**

Before OFDM become popular, three other solutions were presented to share radio spectrum between multiple users. Used by 1G, FDMA :partition the channel by users.TDMA it was proposed that allocate each user access to the whole bandwidth for short period of time.

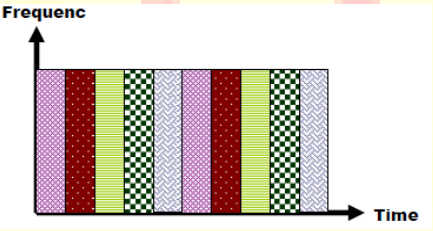

Figure 5 **TDMA**

Because TDMA in 2G caused interference problem, CDMA was proposed as a new form of multiplexing where each user was allowed to use the whole channel capacity.

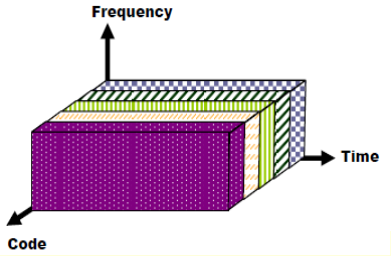

Figure 6 CDMA

The better data throughput become possible, when using orthogonal frequency division multiplexing, the radio bandwidth could be subdivided into narrow bands.

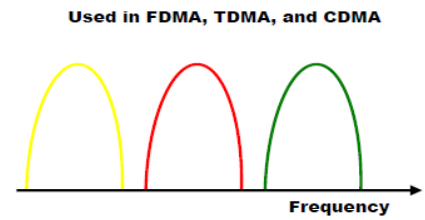

Figure 7 Sharing frequency in FDMA, TDMA, and CDMA

4. SECURITY

Security in digital world means to protect the digital systems from criminal and unauthorized usage. In terms of computers and mobile communications the need for security has increased overwhelmingly with the improvement in technology. Some decades ago when first generation of mobile networks were in use the concept of security was not so much in practice or we can say that awareness was not that much highlighted. But as technology kept on improving and new advents were introduced the need of security kept on creeping. These days no one likes to be insecure digitally. Because of the heavy dependence on digital media for the use of private, sensitive, financial and important communication. There can be many attacks on digital data some of them are eavesdropping, man in the middle attack, denial of service (DOS) attack, spoofing and lot more.

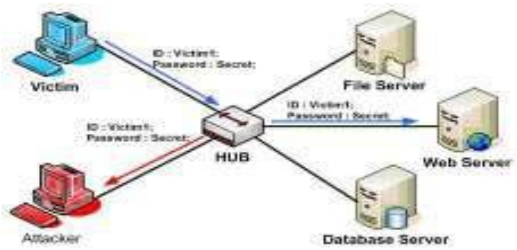

Figure 8 Eavesdropping

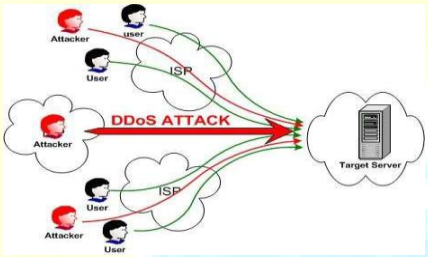

Figure 9 Denial of Service

Traditionally network security is considered to secure network edges from external attacks. Unfortunately this is not sufficient as attackers look for breaches in network protocols, operating systems and applications. Therefore we need a comprehensive security mechanism that can protect the whole network. We can design security architecture on the basis of following objectives:

Availability: keeping the network and its components secure from malicious attacks so that there is no break during service flow.

Interoperability: using security solutions that are applicable to most of the 4G applications. They should avoid interoperability issues.

Usability: end user shall use the security mechanism easily.

QoS: security solutions should follow QoS metrics. Cryptographic algorithms used for voice and multimedia shall meet QoS constraints.

Cost effectiveness: security mechanism should cost as less as possible.

5. Quality of Service in 4G:

In telecommunication the term QoS (Quality of Service) stands for the resource reservation control mechanism, instead of the translation of term as achieved service quality. Communication occurs when the data flows from source to destination and QoS guarantees a

specified level of bit rate, jitter, and delay and packet drop probability to the flow. QoS assurance is important for real time traffics like Voice over IP (VoIP), online gaming, IP TV and video streaming etc. QoS enables network administrators to avoid network congestion and manage the network resources efficiently.

The goal of the 4G is to provide the users the facility of Always Best Connected (ABC concept). To provide QoS in 4G is not simple and easy job as one has to deal with different parameters in different technologies. Like if a user is moving and changing his coverage network, so to provide service under QoS framework is challenging. While a mobile user is moving from one network to another network his communication session needs to be maintained seamlessly irrelevant of the coverage network

There are some protocols designed to maintain the seamless communication of the users while moving or in other words to minimize the latency and packet loss of the ongoing communication session. The mobility protocols are Mobile IPv6, Hierarchical MIPv6, Fast MIPv6.These protocols can help in improving the mobility management of mobile users. In order to provide QoS to the mobile users we propose a combination of mobility protocol Seamless Mobile IPv6 (SMIPv6) and Session Imitation Protocol (SIP). Session Initiation Protocol (SIP) is used to manage mobility of different entities such as session, terminal, service and personal mobility. It facilitates mobility and maintains the real time multimedia sessions. SIP is an application layer protocol therefore it can work both in IPv4 and IPv6.

6. Conclusion:

In this paper we are describing about the various wireless mobile technologies, and various applications of 4G mobile communication as well as the LTE (Long Term Evolution). And also we describe about various networks we are used in 4G, such as MIMO and OFDMA Evolution, in that we discus about FDMA, CDMA, as well as TDMA. And also describes the Security, Quality of Service in 4G. We present the challenges that 4G faces and their up-to-date solutions. To improve the QoS in 4G we propose our own scheme of combining mobility protocol SMIP and application layer protocol SIP. We can make sure the resource allocation during the handover process by combining the two protocols and mobility management can be optimized.

Future work:

In future work we suggest that SIP could be combined with other mobility protocols to facilitate the mobility management and improve QoS in 4G networks.

References:

1. http://www.mobile-phone-directory.org.Visited 09, February 2010.

2. http://en.wikipedia.org/wiki/2.5G. Visited 10 February 2010

3.http://www.mobileinfo.com/3G/3G_Wireless.htm. Visited10, February 2010

4. ttp://en.wikipedia.org/wiki/3G. Visited11 February 2010

5. http://techcrunchies.com/3g-subscription-penetration-worldwide/. Visited 11, February 2010

6. 4G wireless technology: when will it happen? What will it offer? Krenik, B.; Solid-State Circuits Conference, 2008. A-SSCC '08. IEEE Asian Digital Object Identifier:10.1109/ ASSCC.2008.4708715Publication Year: 2008 , Page(s): 141 – 144

7. Research on coexistence of WiMAX and WCDMA systems, ZhengRuiming; Zhang Xin; Li Xi; Pan Qun; Fang Yinglong; Yang Dacheng; Vehicular TechnologyConference Fall (VTC 2009-Fall), 2009 IEEE 70th Digital Object Identifier:10.1109/VETECF.2009. 5378806 Publication Year: 2009.

8.http://www.ericsson.com/thecompany/press /releases/2010/01/1372929 visited 25, February 2010.

9. A Survey of Security Threats on 4G Networks, Yongsuk Park; Taejoon Park; 2007 IEEEDigital Object identifier:10.1109/GLOCOMW.2007.4437813Publication Year: 2007 , Page(s): 1 - 6

10. Integrating fast mobile IPv6 and SIP in 4G network for real-time mobility, Nursimloo, D.S.; Chan, H.A.; Networks, 2005. Jointly held with the 2005 IEEE 7th Malaysia International Conference on Communication. 2005 13th IEEE International Conference on Volume: 2 Digital Object Identifier: 10.1109/ICON.2005.1635641Publication Year: 2005

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