International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 7
July 2017

Connectivity based Handoff Scheme for WiMAX

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ABSTRACT

Now days, Wireless communication technologies are migrating towards heterogeneous overlay networks. WiMAX stands for Worldwide Interoperability for Microwave access, is one of the latest broadband access technology that cover large area. The WiMAX has been seen as a most promising approach towards fourth generation (4G).

Recently, mobile users increases day by day, for handling those users mobile WiMAX technology become more popular. In existing system long handover delay occurs when stations are out of range of all APs and BSs. Therefore no communication for the specific stations that contributes to the overall end-to-end communication delay. This paper presents overcome scheme to the handover delay when out of reach condition occurs through Wireless ad-hoc network technology application. The projected system can keep the users constantly best connected to provide services.

1. INTRODUCTION

The most promising wireless technology that provides broadband access over large geographical area with higher bandwidth and data rate is WiMAX. It is based on IEEE 802.16 specification and it is expected to deliver high quality broadband services. IEEE 802.16 is a unit of the IEEE 802 LAN/MAN Standards Committee. The fourth generation (4G) wireless technology i.e. WiMAX replace the third generation (3G) wireless technology i.e. Wi-Fi. WiMAX provides end-to-end IP services with high speed internet access, scalable bandwidth and very high peak data rate support, robust security using Advanced Encryption Standard (AES), support mobility and quality of service.

WiMAX provides two forms of wireless service, Non-line-of-sight and Line-of-sight. Non-line-of-sight is a Wi-Fi sort service that uses a lower frequency range 2GHz to 11GHz and Line-of-sight connection is stronger and more stable with higher frequencies reaching a possible 66GHz.

WiMAX offer broadband access to anywhere anytime. It supports both fixed and mobile AP wireless technology using IEEE 802.16 based base stations are used and it supports mobile internet which transfers data, voice, and video. The IEEE 802.16 standards have divided the WiMAX system into two groups [1]. Fixed WiMAX (IEEE 802.16d-2004), Mobile WiMAX (IEEE 802.16e-2005). In our proposed work we research on a cost-based adaptive handover scheme that can realize the handover parameter optimization for self-optimization on the network handoff.

A mobile Ad Hoc Network (MANET) is also known as wireless ad hoc network [2] or ad hoc wireless network, is a continuously self-configuring, infrastructure-less network of mobile devices connected wirelessly[3]. It a collection of two or more devices which have wireless communications and networking capability to communicate with each other in decentralized manner. MANETs are a kind of wireless ad hoc network (WANET) that usually has a routable networking environment on top of a Link Layer ad hoc network. MANETs consist of a peer-to-peer, self-forming, self-healing network. MANETs circa 2000-2015 typically communicate at radio frequencies (30 MHz - 5 GHz).

Smart Phone Ad Hoc or Smart Phone Ad Hoc Networks (SPANs) evolve from the concept behind a wireless ad-hoc network the main feature of SPANs is, Capability of going off-grid and enabling peer-to-peer communications without relying on cellular carrier networks, wireless access points, or traditional network infrastructure.

2. RELATED WORK

N. Nasser et al. [6] performed the work on efficient handoff schemes to improve the quality of service and provide flawless mobility. A.V. Garmonov et al. [7] performed the work on quality of service oriented intersystem handover for WiMAX and WLAN networks. In which he worked on a novel seamless and proactive VHOM scheme and the considered QoS factors are data rate, data block delay and bit error rate. C. Guo et al. [8] performed the work on an end-to-end mobility management system for seamless and proactive wandering across heterogeneous wireless networks. In this paper author proposed a heterogeneous wireless network which is competent of reacting to roaming events proactively and precisely and maintaining the connection's continuity with small handoff delay. A.B. Pontes et al. [9] performed the work on the most recent research efforts in the area of handover management in integrated WLAN and wireless metropolitan area networks (WMANs). In which the handover decision algorithm is based on MIH framework but it does not consider the packet delay and bandwidth while handoff is occurring. Lekha D. Shah, Shraddha S. Dalve et al. [10] gives fundamental qualities of Mobile Ad-hoc network. G.Nathiya et al. [11] gives potential application of ad hoc network and also describe its intrinsic flexibility, lack of infrastructure, ease of deployment, auto-configuration, and low cost.

3. LITERATURE REVIEW

Since the WiMAX standard has been deployed with many objectives in mind like wide coverage, mobility, flexible architecture, low cost, high security, QoS, Quick deployment etc. There are two versions of IEEE 802.16 forum used for fixed and mobile WiMAX.

- 802.16d WiMAX or 802.16-2004
- 802.16e WiMAX or 802.16-2005

WiMAX offers both standards 802.16d and 802.16e, which supports different applications. These two versions of WiMAX technology are used for fixed and mobile applications but they are based on the same standard i.e. IEEE 802.16, the implementation of each has been optimized to suit its particular application.

3.1 802.16d – The 802.16-2004 standards, more commonly known as 802.16d, was published in 2004 and this standard supports fixed and nomadic applications, limited portability services. This is the first industry-wide standard that can be used for fixed wireless access with substantially higher bandwidth than most cellular networks [12]. The basic application provided by this version is data connectivity and VoIP. 802.16d version provides a wireless equivalent of DSL broadband data. The 802.16d is able to provide data rates of up to 75 Mbps and as a result it is ideal for fixed, DSL replacement applications. Many of the 802.16d deployments are expected to follow a FDD (frequency division duplexing) frequency plan driven by the 802.16d WiMAX profiles. It may also be used for backhaul where the final data may be distributed further to individual users. 802.16d supports both Orthogonal Frequency Division Multiplexing (OFDM) with 256 FFT (Fast Fourier Transform) and Orthogonal Frequency Division Multiple Access (OFDMA) with 2048 FFT.

3.2 802.16e – The 802.16e standard is an amendment to the 802.16d standard and was ratified at the end of 2005 and published as 802.16-2005. The 802.16e as the "mobile standard" in actually, it supports fixed, nomadic, portable and mobile solution. the initial products in early 2007, the gap between product introductions has closed and time to market advantages for 802.16d have diminished. As a result, operators must weigh the merits of the two standards and their long-term role in the industry when making investment decisions.

3.3 Comparison between 802.16d and 812.16e.

The following table provides comparisons of the both standards:

International Journal of Engineering Technology Science and Research
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www.ijetsr.com
ISSN 2394 – 3386
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Table 1.Comaparision Table of 802.16d and 802.16e

Standard	802.16d WiMAX	802.16e WiMAX
Release	June 2005	December 2005
Service Supported	Fixed	Mobile
Application	Data connectivity, VoIP	Data connectivity, Fixed and mobile VoIP
Service providers	DSL and cable modem	Mobile operators
Multiple access method	OFDM/OFDMA [4]	S-OFDMA
Bandwidth Supported(MHz)	1.75/3/3.5/5.5/7 (OFDM)[4] 1.25/3.5/7/14/28 (OFDMA)	1.25/2.5/5/10/20 1.75/3/3.5/5.5/7
Mobility/Handoff Support	No	Yes
Multicast/Broadcast Support	No	Yes
Frequency reuse	1 cell reuse not supported	1 cell reuse can be supported
Duplexing	FDD/TDD /Half Duplex FDD[5]	FDD/TDD /Half Duplex FDD
Modulation	256point FFT with QPSK, 16QAM, 64QAM, 256QAM	256point FFT with QPSK, 16QAM, 64QAM, 256QAM OFDMA modulation scheme with variable FFT sizes

4. HANDOFF IN WiMAX

Handoff (Handover or HO) is one of the key constraints to improve mobility management and Quality of service for the subscriber in IEEE 802.16e. WiMAX networks will initially be deployed for fixed and nomadic applications and then evolve to support portability to full mobility over time. Uninterrupted service is achieved by supporting handoff process. Whenever a cellular subscriber passes through one base station (BS) to another, the network automatically switches to the other respective base station (BS) and maintains the coverage responsibility. This behavior called "hand-off" (Handoff) or "hand-over" (Handover).

The handoff is generally classified into two types' horizontal handoff and vertical handoff.

4.1 Types of Handover in WiMAX

4.1.1 Horizontal Handover (Handoff)

Horizontal handover is when a mobile terminal changes its point of connection within a same type of network like from a cell to another in GSM and from an access point to another in Wi-Fi. The main reasons behind handover are worse signal quality or loss of signal, traffic load balancing, cost etc. the user uses same network access technology and mobility perform on the same layers of system. In handover in GSM, the network takes the handover decisions and the mobile terminal supervises and reports its signal quality. Three types of handover are available in GSM handover-Intra BSC handover, Inter BSC handover and Inter MSC handover. In handover in WiFi, the mobile node chooses new AP to re-associate with and the network exchanges information after re-association.

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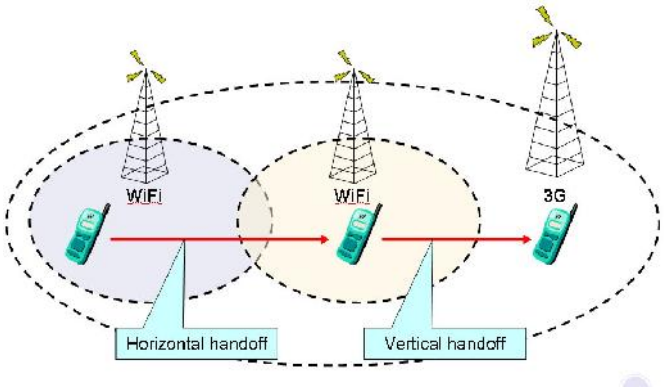

Figure 1 Horizontal and Vertical Handoff.

4.1.2 Vertical Handover (handoff)

Vertical handoff means handoff between two network access points or base stations that uses the different network access technology like wired Ethernet connection to an access point in WiFi or an access point in WiFi to a cell in UMTS. The main objective of handover is seamless handover i.e. smooth (low loss) and fast (low delay) handover. Vertical handoff refers to the automatic fall over from one technology to another in order to maintain communication.

5. PROPOSED NETWORK ARCHITECTURE

The primary objective of this paper is to keep mobile stations always being best connected, for that purpose ad-hoc technology is being implemented. In existing system whenever stations are out of range of all APs and BSs then there is no communication for that particular stations. But In proposed system whenever a mobile station is out of range of all APs and BSs, then it can communicate through any other station which are in range based on ad-hoc network technology.

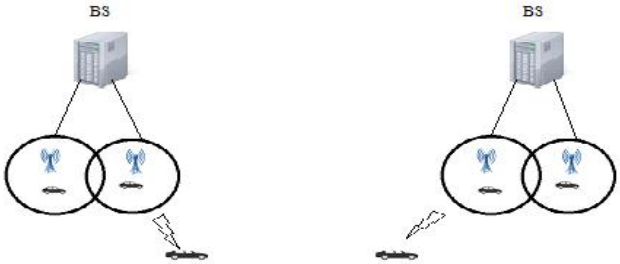

Figure 2 Proposed Connectivity based handoff management

Figure describes the proposed solution for connectivity based handoff management for the mobile wireless. According to the figure shown above proposed network architecture have two Base Stations (BS), four access points (AP), and several mobile stations (MS) are used. These all are describe as:

Mobile Station (MS): The MSs are the users which connect with WiMAX through any of the APs, which are moving from the range of one AP to another AP whether they are belonging to same BS or not. MS[13] is a mobile device used by the subscriber for connectivity between mobile subscriber equipment and BS equipment. Mobile Stations may also be used as the form of a dongle for a laptop, etc.

Base Station (BS): The base-station is an important part of the WiMAX network. It facilitates the air interface connectivity between mobile stations and subscriber and also provide additional functionality similar to handoff triggering and tunnel establishment, radio resource management, Quality of services policy

enforcement, traffic categorization, DHCP (Dynamic Host Control Protocol) proxy, key management, session management, and multicast group management.

Access Point (AP): The Access Point allows wireless devices to connect to a wired network using Wi-Fi, or related standards. The AP usually connects to a router (via a wired network) as a standalone device, but it can also be an integral component of the router itself. An AP is quite different from a hotspot, which works as the physical space where wireless services are not available.

Wireless Ad-hoc network (WANET): It is a collection of wireless devices that dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration. The smart phone ad hoc networks (SPANs) uses smart phone as a device, once embedded with ad hoc networking technology it can create ad hoc networks among other devices. Influence the existing hardware in available smart phones to create peer-to-peer networks without relying on cellular carrier networks, wireless access points, or traditional network infrastructure.

6. CONCLUSION

Proposed system provides a Handover scheme with the help of a new Architecture of WiMAX and SPANs which offer the best connected services like file transfer, audio and video streaming, messages etc to users. In the proposed system WiMAX and SPANs architectures are combined so that users are able to offer better services to users. Proposed system use ad-hoc technology which is the best option to provide the finest communication connectivity anywhere anytime to the user. This concept changes existing era to allowing millions of smart phones to create ad hoc networks without relying on cellular communications.

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