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VERTICAL HANDOVER PROTOCOL IN HETNET: REAL TIME SERVICES IN MOBILE WiMAX AND WLAN NETWORKS

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ABSTRACT–In heterogeneous network the seamless connectivity plays a challenging role in the recent years. Vertical Handover Management (VHM) in a multicast environment enabled techniques in which the Het Net Environment of the seamless connectivity is not enough to support. A wireless access technology, always connected to the technology with the best matches of goals, price points and that of the performance. To deal with the challenges of this SURF algorithm is proposed. The proposed algorithm considered the application requirements, vehicular networks, user preferences and surrounding context of Mobile Worldwide Interoperability for Microwave Access (WiMAX) and Wireless Local Area Network (WLAN). The protocol for network based gives better performance than host protocol where the serving network in Mobile IPV6, where the mobile node manages the mobility management. The mobile nodes uses different internet services without any limitation, the wireless internet services are easily accessible. This limitation occurs when mobile nodes use different wireless networks when they move to different network from each other. Many parameters affect the handover performance during vertical handover processes such as delay, packet loss and handover latency. By eliminating the false handover initiation a multicast enabled handoff technique in real time is addressed in a heterogeneous wireless network to improve performance with the minimum delay and improve the seamless handover. The proposed algorithm gives better performance when compared to the existing algorithm the current scenario is able to meet application requirements while ensuring user preferences are also met.

Keywords: Heterogeneous networks, mobile node, vertical handover, mobile WiMAX, WLAN, packet loss and handover latency.

INTRODUCTION

Mobile communicationhas become an essential of contemporary life style; they focus on variety of computing aspects. Service continuity among Heterogeneous networks is the major issue. Heterogeneous wireless networks are well defined in 4G systems, especially the standards for mobility management. The applications at the point of view by the advanced phones are increasing hastily in the down of the market to which contest between internet and data service providers contain a low cost of high data rate. Over the years the wireless (mobile) communications produced many wireless networks and the entire network will be unified to categorize user access in IP design. Wireless Local Area Network (WLAN), Wireless Fidelity (Wi-Fi) and Universal Mobile Telecommunication System (UMTS), Worldwide Interoperability for Microwave Access (WiMAX) are the wireless technologies which are interconnected and customize their design to approach internet access to mobile operators anywhere and anytime and to maintain high data rate and effective Quality of Services (QoS). To continue the same level of enactment in the wireless network the main requirement for handoff is “protocol”. When a mobile node (MN) send its network point from a existing access router to a current access router, IP handover takes place. If it is not done in an efficient way, then jitter, packet loss and end-to-end delay occur precisely impact and disrupt applications recognized quality of services. Moreover a TCP and UDP applications (e.g., VoIP and audio/video streaming applications) that depends on timely packet delivery within definite suitable levels will be aware of the length of time a MN loses comparably as the same time as performing handover and its applications yearning what is known seamless handovers.

Presently, various mobility management protocols are there to elucidate the problem of Mobile IPv6 (MIPv6) extension together with fast handovers for mobile IPv6

(FMIPv6) and Hierarchical Mobile IPv6 (HMIPv6).The protocols target the network layer to support larger part of information to the mobility management of layer 3 without the help of layer 2. Subsequently the MN accomplishes its own mobility support; the host-based mobility management protocols produce lack of control for operators. With all these characteristics, the architecture suggested by the IEEE 802.21 standard is the important element in simplifying the implementation of 4G systems. In 2009, the IEEE 802.21 Media Independent Handover (MIH) provides seamless vertical handover (VHO) among HetNet that consist of3GPP and non-3GPP called wireless and wired media. MIH describe Point of Service (PoS) and Point of Attachment (PoA). PoS responsible for the network and MU communication under MIH and PoA is the radio access technology (RAT) attachment point carryout the network side margin connected to MU. Also MIH provides various services like Media Independent Event Services (MIES), Media Independent Command Service (MICS) and Media Independent Information service (MIIS). The MIH standard affords a model of connectivity and a generic roaming enclosed by the cellular networks and all groups of IEEE.

To improve the enactment of the standard, MIH issued a number of outlines and it has some tasks and problems. Such challenges are Received Signal Strength (RSS), due to the unconfirmed networks the number of un successfuland numerous hangovers is increased, existing IP networks have high costly variation and it experienced from Ping-Pong effect. In heterogeneous networks a Vertical Handover Management (VHM) is essential in order to give generic connectivity and for all parameters be present for each network. Some of the parameters are generic in heterogeneous networks, but other parameters will influence the performance in each network in heterogeneous deployment. The vertical handover is modified directly or indirectly by data rate, speed of a mobile node (MN), bandwidth, cost, RSS, Signal to Noise Ratio (SINR).

In this work, the improvement of multicast enabled vertical handover technique for heterogeneous wireless networks in real time to improve the performance. One of the critical issues in wireless networks is Handover; subsequently it is essential to maintain uninterrupted services form one location to another location during the movement of mobile nodes. To aim this\

i. To evaluate the detection of handover mechanism and network condition
ii. Proposed a multicast enabled handover mechanism by multicasting the data packets to MDD without the wastage of resources.
iii. The proposed algorithm gives better performance when compared to the existing algorithm and it is able to appropriate application requirements while establish user preferences.

1. LITERATURE REVIEW

This section presents the previous studies for vertical handover for heterogeneous networks. By achieving the 4G network, the mobile terminal can roam between a choice of wireless networks in a high data rate as well as using a number of services collected due to wide bandwidth approaches [1-2].In 4G network the most common access systems are WLAN, Bluetooth, WiMAX and cellular telephony networks [3-5]. MIH proposed a new protocol layer 2.5 [6] that come together the functionality of the network from other access technologies into a general setoff commands, events and information services. The literature survey of vertical handoff delay analysis is investigated in [7].Session Initiation Protocol (SIP) is the mobility management protocol which connects WLAN and UMTS also soft handoff method is applied in SIP.

Different mobility management protocols for allowing mobility service have been introduced. In detail, mobility support in the network layer and has been progressed by the Internet Engineering Task Force (IETE), MIPv6 specification was published [8]. A comparative performance of MIPv6, FMIPv6 [9], HMIPv6 [10] and a combination of FMIPv6 and HMIPv6 are addressed [11] and calculated in terms of handover latency, signalling cost etc., [12]. A handover performance studied has been presented and it showed that PMIPv6 overtake other IPv6 mobility management protocols subjection to its simplest handover procedure [13] also PMIPv6 and HMIPv6 are analysed in terms of cost of power consumption, updates the location and packet delivery [14]. MIPv6, FMIv6, HMIPv6 and PMIPv6 are the IPv6 mobility management protocols [15] addressed the performance of the above mentioned protocols in terms of cost. The cost analysis enactment don't need any help to recognize the handover performance of IPv6 mobility management protocols.

Using utility/cost function with different user preferences of different user consumer will have different utility values for the product [16]. Therefore the different preferences should be considered into the account in cost evaluation and also network selection issue is evaluated. The selection issue can be evaluated based on cost/utility functions [17] proposed an algorithm for network selection based on average signal strength received , distance and outage probability. The network selection is carried out by scanning process, i.e., periodic (MN period [18]opens a detailed interface and scans the available networks) and adaptive scanning (either fixed or randomly assigned during the scanning phase).In VHD, the fuzzy logic method is used for network selection and different ways to use fuzzy logic in selection scheme such as in core network, combining fuzzy with MADM algorithms and in recursion methods [19]. After handover mechanisms among various radio technologies the common functions that need to be considered [20]resource monitoring, network discovery, decision making, network selection and decision enforcement. The handoff decision objective is to select a network for a particular service that can satisfy objectives based on some criteria and some technique used for network centric solutions is addressed [21]. IEEE 802.21 was formed to overcome the diversity in the handover mechanisms and to reject a drawback of user-centric methods [22]. In a heterogeneous environment MIH support seamless vertical handover without service interference and maintains the user's quality of services (QoS) [23-24]. MIH only provides a general framework to select an appropriate network and perform handover at suitable time is undefined [25].

The first handover scheme by allowing handovers among the AT&T, Metricom Ricochet Network and IBM infrared WLAN in wide area wireless technology, etc., that was available in those days [26]. Mobility and Mobile IP are the major issues and it deals with HetNet during vertical handover. In the recent years, numerous works have undertaken VHO with a large variety of wireless technology. Most of the literature considers wireless surroundings where the user equipment is hand held devices within pedestrian mobility scenarios with low mobility [27].

1.1 Protocols in HETNET for Handover

The purpose of MIH is to make available of a homogeneous function interface between heterogeneous network technologies and it addresses [28] the performance of MIH technology and implementation of many devices and operating systems.MIH standard defines MIHF protocol describes the messages exchanged between peer MIH entities, offering a common message payload across different technologies. The basic services offered by the MIHF are the media-independent event service (MIES), the media-independent command service (MICS) and media-independent information service (MIIS). MIES detects the changes in the lower layers and notifies events occurring in the lower layers to the MIH users as they had requested. The MIES covers events such as network initiated, predictive events and state change events. The MIIS allows the MIHF to discover its network environment by gathering information that the upper layers use to make decisions. The information elements refer to the list of available network location of PoA, cost, operator ID, security, PoA capabilities, QoS, roaming partners and vendor-specific information. Finally, the MICS allows the MIHU to take control over the lower layers through a set of commands. With the information gathered by the MUES and MIIS, the MIHU decides whether to switch from one PoA to another. The commands allow the handover entity not only to execute the handover but to set different parameters in the lower in the lower layer elements as well. This paper studies the Multicast enabled vertical handover techniques for heterogeneous wireless networks in real time to improve the vertical handover performance.

2. MULTICAST ENABLED HANDOVER TECHNIQUE IN HETNET

The Entities involved in multicast enabled technique are i) AAA server (Authenticating, Accounting and Authorization) which is responsible for MN before entering into the network shown in Fig. 1. ii) Multicast manager (MCM) acts as a server between mobile WiMAX and WLAN networks. The information is stored in multicast manager about the MN's and MDD. Before entering into the network the AAA server in multicast manager checks the MN whether it is authorized or not on the available information. Multicasting avoids the unnecessary data transmission in networks and aids to keep the bandwidth resources because it can send data packets simultaneously in multiple devices. In IP, Multicasting enables the user to send packets to more than one device simultaneously, but in broadcasting all the devices receive data packets whether they require data packets or not [29].Generally in heterogeneous networks, false handover occurs during handover process. If handover initiation is false, it results in an unsuccessful handover. The current handover initiation process becomes false if one of the following cases occurs. Consider two cases of handover process; in case 1 the MN indicates that RSS from the previous base station is greater than the current base station, since the MN switch bank to the cell covered by the previous base station. In case 2, the RSS from the previous base station is still weaker than the current base station and the MN indicates that the RSS from another base station becomes greater than the number of base station, hence the MN varies its moving direction to the BS unlike from the number of base station.

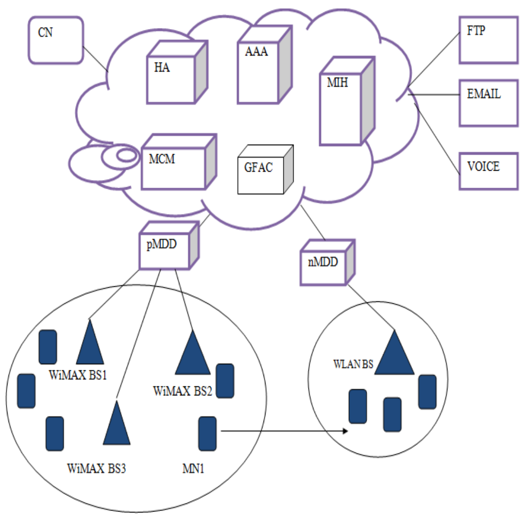

Fig. 1 Multicast enabled handover technique

Due to this packet loss and out of sequence packet problem which occurs frequently, the multicast manager transmits the packets of data to MDD using multicasting. The handover process is performed between two domains mobile WiMAX to WLAN and the data from the correspondent node (CN), transmitted to the network by multicast manager iii) Mobile detects devices plays a major role of both mobile access gateway and local mobility anchor which are maintaining the mobile node movement and update the present status of the mobile nodes location using its prefix and ID.

3. PROPOSED ALGORITHM: SURF ALGORITHM

SURF algorithm plays a vital role to select the best of the network and it is the process before the handover execution phase. The algorithm considering the available types of wireless networks, user preferences, surrounding context, location/navigation features to pick the most suitable CN. The algorithm uses MIH standard using MIIS to collect networking information, the MICS to work together with different network interfaces and the MIES to sense the state of the networks. Furthermore the location and navigation information improves the surrounding context by allowing mobile devices to continuously gather information from the current neighbourhood and soon to be achieved. The proposed algorithm is grouped into networking, decision making and neighborhooding that achieves faultless handover to the most suitable CN.

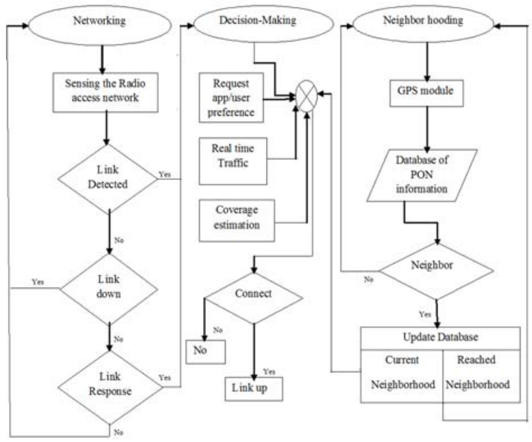

Fig. 2 Surf Algorithm

3.1 Components of Neighborhooding task

In heterogeneous networks, neighbourhoods are a group of information connected to the surroundings and their connectivity essentials for a given spot. The proposed algorithm introduced neighbourhood concept which uses framework information based on the vehicle location while it is moving inside a navigation route. In GPS module, neighbourhood database and useful coverage time are the modules to manage neighbourhood concept. The module provides the route to reach a certain spot and the future location if the itinerary is followed at the current average speed and also provides the current location as the output. Neighbourhood database module stores information regarding current and soon-to-be-reached neighbourhoods. Different MIIS databases located at different points of a network where MIIS service is used to retrieve information coverage, network ID and its location, cost, the simple data rate offered, PoA ID and data rate achieved by the most recent set of users. The neighbourhood is updated and it's depends on the frequency and how much distance is being considered in advance from the location sample, the current and the soon-to-be-reached neighbourhood could store the same or different information. Here the crucial process is retrieving the information and updating the neighbourhood database with consistent information. Finally the useful coverage time is the time that the mobile spends within the coverage area of a cell while able to obtain higher data rate from that cell. Due to several issues UCT time varies with itinerary tangentially crosses the coverage area or the existence of overlapping coverage areas along the itinerary path and it can also vary the cells edge which are associated with impairments the wireless signal of fading and path loss.

3.2 Networking Components

This module regularly sends and receives data about the status of the network also the module sensing the heterogeneous wireless RAN available at the OBU. Proposed algorithm uses MIES and MICS to check the link status and to receive reports. When an event occurs at the physical layer or MAC layer it receives a trigger event that launches different sequential processes through MIES. Various events are notified to the upper layers to execute the different actions defined by the higher layers are executed by the lower layers using the primitives and they provide commands to the MICS.

3.3 Components for decision making

The module has DRP, useful coverage estimation and user preferences/application requirements module. i) DRP module the proposed algorithm considers the most suitable CN to switch to but it also attempts to select the best time to leave the previous PoA and join the new one. By doing this the module estimates the packet loss conditions associated with the different distances. ii) In this module the latency is the main issue. In VHO, packet loss and service disruption occur due to high latency.

$$VHO_{Ltny} = VHO_{Ltnyx} + VHO_{Ltnyy} + VHO_{MIP} \quad (1)$$

where VHO_{Ltnyx} is latency at the link layer, VHO_{Ltnyy} is IP level, VHO_{MIP} is notifying the end nodes and updating the home and foreign IP addresses when managing mobility and time taken by MIP iii) The user preference is classified by user profiles are maximum preference, streaming, conversational and minimum cost. In maximum performance the VHDA always selects the best network performance. In Streaming the VHDA is optimized to choose the networks that offer high packet loss and achieve high throughput. The important factor in Conversational is to consider a very low packet loss and low latency per packet when choosing a CN. Finally based on the user budget it considers the price and if the budget is low the cheapest network available will be always the best choice. The average handover latency for the basic handover protocol is given in

$$Tot_{handover\ latency} = T_{LS} + T_{Reg} + 2_{TAAA,\ RS\text{-}RA} \quad (2)$$

where T_{LS} is the link switch is when the mobile node connected to the network during handover process is over, TReg is the registration delay, T_{AAA} is the authentication delay, RS is the router solicitation, RA is the router advertisement. For the proposed mechanism the average handover latency for multicast enabled handover technique is given by

$$Tot_{handover\ latecncy} = T_{Link\ Switch} + T_{Reg} + T_{AAA\text{-}MM,\ RS\text{-}RA} \quad (3)$$

where link switch delay is given by

$$T_{Link\ Switch} = T_{MN\ Con} + T_{MN\ Discon} \quad (4)$$

To interchange the router solicitation (RS) and router advertisement (RA) message is shown in equ (5) the delay of home network prefix is forward to the MN from the delay that occurred during the information interchange.

$T_{RS\text{-}RA} = T_{MN\text{-}MDD}$ (5)

For authenticating the multicast manager (MN) in the network, the delay between MN and MDD for authentication is given in equ (6)

$T_{AAA\text{-}MM} = T_{(MN\text{-}MDD\text{-}MM)}$ (6)

3.4 Descritption of SURF Algorithm:

1. Scanning for the new networks
Set N
2. Get SC_N
3. If (SC_N>1)
Compare network with real time services
4. Calculate threshold of the services
Set (χ)
5. Get date rate (R_d)
6. If ($R_d > \chi_1$)
Calculate difference of R_d andχ_1
7. else
8. handover process initiated
9. If ($R_d > \chi_2$)
10. Check_neighbor(ltn, dst)
11. else
12. if (useful_cov_time(ltn, dst, MIIS_pkt) > 0)then
13. if (dst_recp_pro(ltn, dst, MIIS_pckt) then
return (x)
14. else if
15. else if
16. if (chk_nghb(ltn, dst) > 0) then
updt_pres_ngbh(ltn, dist);
updt_soon_to_be_reached_nghb(ltn, dist);
17. allow decision process
18. else
19. insert new network
20. if (bw = low_cst = hgh) then
allow network scanning process
21. if (aplpri = low) &&
bw = hgh && cst = low then
22. continuein connected network
23. else if
24. else if
25. end

4. RESULTS AND DISCUSSIONS

The multicast enabled vertical handover in HetNet by using SURF algorithm and existing algorithm is implemented by the tool OPNET (Optimized network engineering tool). The tool is used to simulate the QoS performance and behaviour in different wireless networks. OPNET tool provides performance analysis of different wireless networks and applications. The simulation results show the comparison of delay, throughput and jitter are the Qos parameters of existing and proposed algorithm of hybrid users and Mobile WiMAX/WLAN networks for real times services. Using the protocols in OPNET software the real time traffic performance of end-to-end-delay for voice, latency, jitter, throughput and downlink/uplink packet drop and SNR is measured. Figure shows the architecture of EMIPv6, AMIPv6 and AMIPv6-MIH in mobile WiMAX/WLAN networks.

Table 1

4.1 Simulation Parameters

PARAMETER	VALUE
Network Interface Types	Phy/Wireless Phy/OFDMA
Propagation model type	Propagation/OFDMA
MAC type	MAC/802.16/Base Station
Routing protocol	NOAH
Antenna model	Omni directional antenna
Link layer type	Logical link layer
Frame size (msec)	5 (msec)
Modulation and coding scheme	QPSK 16
Duplex scheme	TDD
Packet Rate	4 packet/sec
Simulation time	30 minutes

4.2 Simulation model

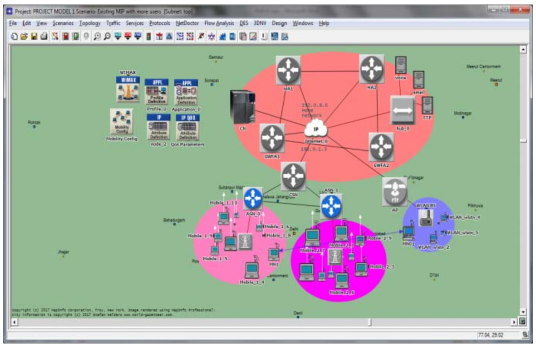

Fig. 2 Architecture of Mobile WiMAX/WLAN with EMIPv6

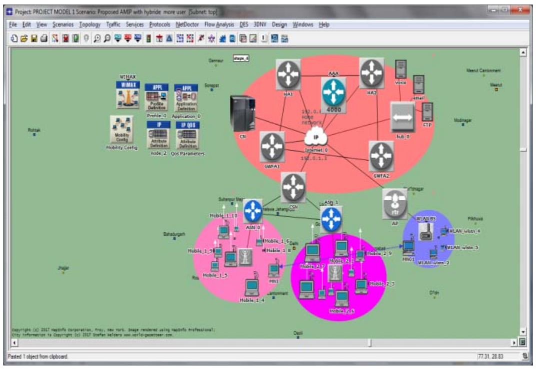

Fig. 3 Architecture of Mobile WiMAX/WLAN with AMIPv6

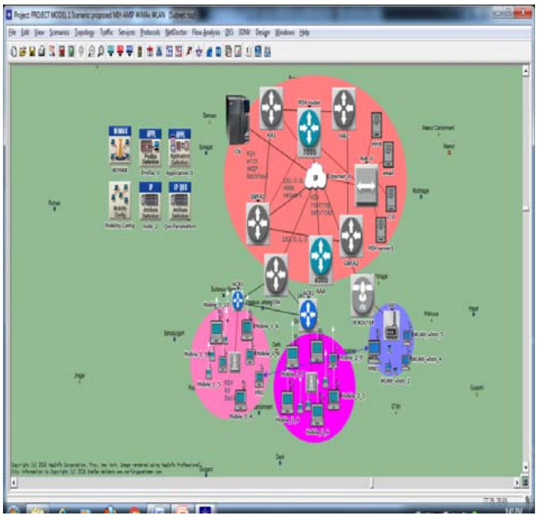

Fig. 4 Architecture of Mobile WiMAX/WLANwith AMIPv6 – MIH

Using the protocols in OPNET software the real time traffic performance of end-to-end-delay for voice, latency, jitter, throughput and downlink/uplink packet drop and SNR is measured. The figure shows the different architecture model for mobile WiMAX/WLAN in three different protocols. The existing and proposed algorithm is compared to the different scenarios of mobile WiMAX/WLAN architecture. Fig. 2 shows the GFAC (Gateway foreign agent controller) are connected to an HA to access the real time traffic. When an MT moves through FAs belonging to the same group, the GFA of this group multicasts the packet received (coming from the HA) to the MT. When the MT moves out of the group, the new CoA is registered to the GFA of the new group to which the MT is currently evolved.. In Fig. 3, secured wireless networks are simulated. The main purpose of AAA is to be verified the MN either it is authorized or not before inward into the network and it uses Host Identity Protocol (HIP) to the establishment of key. It supports to separate the transport layer from the interworking layer by using a public / private key as host identity in spite of IP address. In Fig. 4 MIH plays a major role in mobile WiMAX with MIH-AMIPV6, to scrutinize the available wireless networks and end of the process is to select a network to which MN should be handed over while evaluating the criteria gathered during the information phase.

4.3 Simulation Results

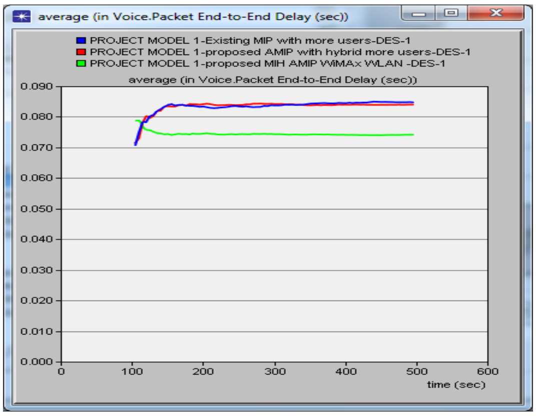

Fig. 5 End-to-End delay for voice

The figure shows the end-to-end delay which defines the time taken for a packet to send the data across a network from source to destination. Fig. 5 shows end-to-end delay for voice in mobile WiMAX and WLAN networks. The delay for the proposed algorithm is approximately 0.80 bits/sec for real time services with the neighbourhood concept of use of surrounding the context information where the existing MIP the networks with more users is 0.87 bits/sec.

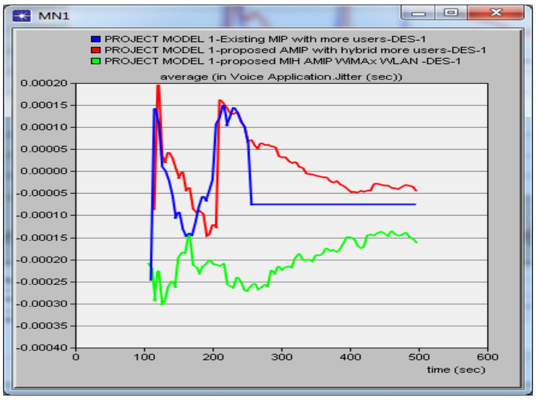

Fig. 6 Voice Jitter

Fig. 6 shows the performance of voice jitter. While transporting the voice and packet over the network, some of the data packets take more time to reach the destination and it causes time variation of data known as jitter. For the proposed method for AMIPV6-MIH in mobile WiMAX/WLAN the jitter is lower than the other two protocols.

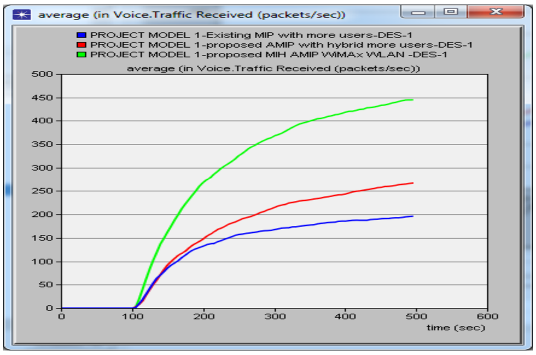

Fig. 7 Voice traffic received

Fig. 7 shows the voice traffic received. The voice traffic received for the proposed algorithm in mobile WiMAX/WLAN scenario is 450 bits/sec. This is because of using of authentication protocol and due to the variation of neighborhood in the different location. By using surf algorithm in AMIPv6-MIH the received packets is higher than the other two protocols.

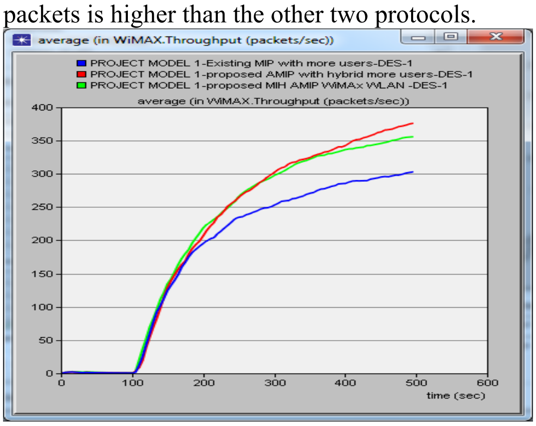

Fig. 8 Throughput

Fig. 8 shows the performance of throughput which defines the rate at which the network sends or receives the data and it measure the capacity of the channel of a communication link and connections and it measured in terms of bits/sec. The throughput is higher for the proposed algorithm than the existing algorithm. The proposed algorithm achieves the throughput by user profile and it obtains 370 Mb/s for AMIPv6 and 360 Mb/s forAMIPv6-MIH inmobile WiMAX-WLAN users. The maximum profile achieves the higher performance. This is due to the lower packet delay.

Fig. 9 and Fig. 10show the packet drop of uplink and downlink for the AMIPv6-MIH and compared it by other two protocols. The packet drop in AMIPV6 is 0.9 packets/sec where the packet drop is higher in the existing protocol is 1.2 packets/sec. The packet drop is zero for the AMIPv6-MIH in mobile WiMAX/WLAN networks. The packet drop of downlink method is 0.98 packets/sec. By surf algorithm the packet drop is lower in uplink than the downlink in different protocols

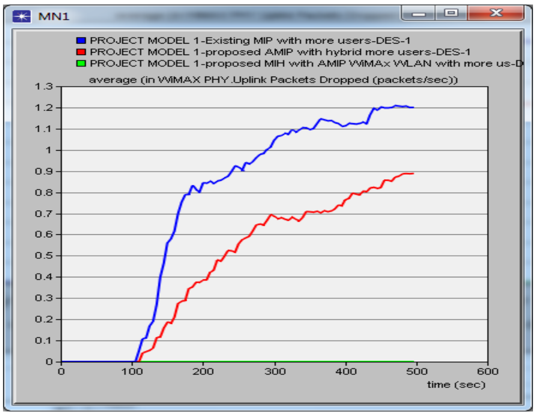

Fig. 9 Uplink Packet Dropped

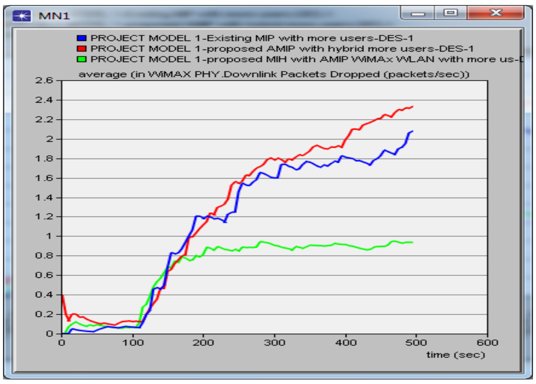

Fig. 10 Downlink Packet Dropped

Fig. 11 and Fig. 12 show the signal to noise ratio for uplink and downlink method. Proposed algorithm in uplink method the SNR ratio is 13 dB for mobile WiMAX/WLAN users and it is lower in other two protocols. For downlink method the SNR ratio for the mobile WiMAX/WLAN is 16dB and it maintains constantly.

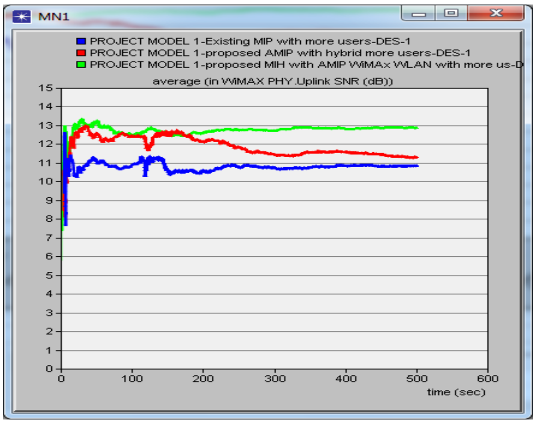

Fig. 13 Uplink Signal to Noise Ratio

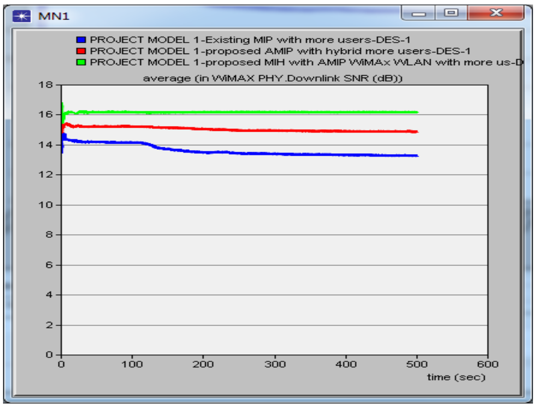

Fig. 14 Downlink Signal to Noise Ratio

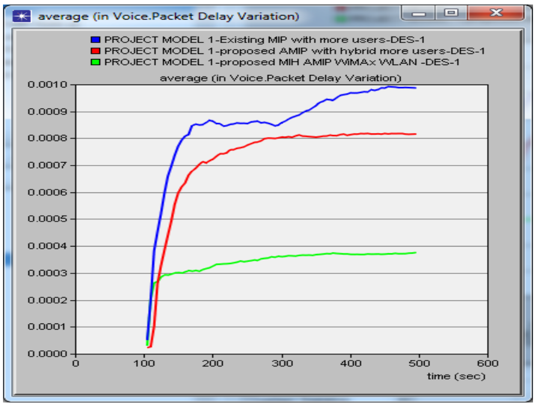

Fig. 14 Voice packet delay variation

Fig. 13 and Fig. 14 show the variation of voice packet delay for the different models. The delay variation of AMIPV6-MIH method in mobile WiMAX/WLAN is lower than the other two protocols. Due to the less drop of packets in the network the delay is low than the other two protocols.

6. CONCLUSION

The multicast enabled vertical handover technique proposed by using SURF algorithm in heterogeneous wireless networks. In this technique the tunnel establishment is avoided by the multicasting the data packets during the handover process. The algorithm targets infrastructure based on location based network section environment and it selects the same user network which fulfils the network connectivity requirements taking into the accounts the user preference, requirements of user applications and context information in the mobile location. The proposed algorithm has many features such as multiple network interfaces, powerful computing resources, GPS based location and navigation and continuous power supply. The algorithm is use to select the best user network according to the requirements of user preferences and user requirements applications. The MIH standards help to empower the proposed algorithm to achieve higher throughput, low end-to-end delay and jitter are simulated.

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