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Two Tiered Mobility Management For Mobile Wimax Networks

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Abstract

Conventional wired broadband shall be replaced by wireless networks called WiMAX (IEEE 802.16). High Data speed with multiple users can be achieved through this technology. In mobile WiMAX multiple access technique allows many users to share the same bandwidth. Future wireless system the research challenges are to design the clever mobility management techniques that will have advantages of IP based techniques to achieve roaming of the wireless networks. Mobility management provide support mobile wireless network to find out the place of nomadic terminal for call delivery and to preserve connection as the terminal is moving into a fresh service area. Location and Handoff management are the two processes involving of mobility management. ASN and CSN anchored mobility are considered to be the two tier mobility management schemes. In order to reduce handover delay and packets dropping gateway relocation methodology is employed. The gateway relocation is bridged by using Multi Protocol Label Switch

Keywords: WiMAX networks, Mobile management, ASN and CSN anchored mobility, Location management, Handoff management.

1. Introduction

WIMAX originated from the IEEE 802.16 standard which specifies wireless interface MAN with its range of spectrum 10-66GHZ with physical layer and medium control layer. Later this standard structured as WiMAX (Wireless Interoperability for Microwave Access). Wireless broadband access with high speed, low cost, more reliable can be achievable through this standard and it can also extendable through our normal fibre optic communication system. This standard eliminates the line of sight problem that exists in cooperate in the frequency range of 2GHz–11GHz with licensed and unlicensed frequencies. This standard is further extended to mobile WiMAX and formed as IEEE 802.16e. The mobile WiMAX provide the facility of effective mobility management by which it allows the terminal to roam in to different service locations for call delivery without loss of the connection and facilitates mobility management. Mobility management consists of two methodologies Location management and Handoff management. Paging and Registration are the two important functions of location management. Registration is the process of identifying the location of the user equipments (UE) for incoming and outgoing calls handling of paging (or) arranging the UE at the time of call setup. Modifying the systems to follow the mobile terminal attachment points between the successive communications is the key function of location management.

2. Literature survey

In 2006, Rui L. Aguiar, et al., [13] proposed IP based architecture on different wireless environment they introduction monitoring and resources management function along with mobility function this method improves integrated security with advanced AAA (Authentication Authorization and Accounting) functionalities. Youn-Hee Han, et al., [12] proposed the current standard technologies for movement detection and duplicate address detection scheme which is simple and robust the end-to-end policy of this process allows an access router and an Mobility Anchor Point to assist the handover. This substantially reduces the signalling load on wireless and its handover latency which is enough to support seamless services. Leonardo Badia, et al., [11] proposed OFDMA (Orthogonal Frequency-Division Multiple Access) adaptive modulation and coding mode to manage physical resources and the proposed joint scheduling and resource allocation algorithm. This algorithm is able to trade-off fairness requirements imposed at the flow level with physical efficiency metrics such as power consumption and exploits the diversity naturally present in the system. In 2008 Alexandre V. Garmonov, et al., [10] proposed the QoS (Quality of Service) oriented intersystem handover between the IEEE 802.11b networks. Stefano Salsano, et al., [9] proposed two independent implementations for the mobility management server and mobility management client and session initiation protocol proxy for establishment of connection between two different wireless networks. Pouya Taaghol, et al., [8] proposed the integration of mobile WiMAX with evolved 3GPP networks. This method is well efficient to satisfy the tight mobility requirement of next-generation mobile networks. In 2009 Kumudu S. Munasinghe, et al., [7] proposed the internetworking architecture for WiMAX and 3G Cellular networks the application layer based on IMS (IP Multimedia Subsystem) processing and compared end-to-end delay and jitter parameters for considered scenarios incorporating for real-time VoIP communications. In 2010 Enrique Stevens, et al., [6] proposed the mobility scenario for 3G cellular/802.16e interworking and extended the VP (Virtual Partitioning) with pre-emption technique to be used for admission control in cellular/802.16e interworking. They have formulated blocking/dropping cost-minimization and packet-level QoS (Quality of Service) optimization. Taehoon Kim, et al., [5] proposed a service history based vertical handoff algorithm to support QoS through preventing instable vertical handoff decisions in heterogeneous networks. This vertical handoff algorithm will support QoS by preventing instable VHO decisions in heterogeneous networks. Ji Hoon Lee, et al., [4] proposed Mobile WiMAX which includes the multicast/broadcast service zone to reduce the multicast/broadcast service disruption during handovers. They proposed an MBS handover and zone-planning scheme based on LMAs to save the wireless-link bandwidth. Subsequently Stenio Fernandes, et al., [3] proposed a comprehensive review of the literature on mobility management architectures for seamless handover of mobile users in heterogeneous networks. Dong Ma. Et al., [2] proposed the investigate several important issues for the interworking of WiMAX (Worldwide Interoperability for Microwave Access) and WLAN (Wireless Local Area Networks) networks. They used tightly coupled interworking architecture as the platform and used seamless and proactive VHOM (Vertical Handoff Manager) scheme for stations to control the vertical handoff operations and have proven feasibility and effectiveness of the networks. Zong-Hua Liu, et al., [1] proposed GRAC (Gateway Relocation Admission Control) which considers admission control and ASN GW (Access Service Network Gateway Relocation) relocation jointly to improve the performance of WiMAX networks and so for handover MSs (Mobile Stations), the WP (Wiener Process) based prediction algorithm can trigger the ASN GW relocation at an appropriate time. This leads to reduction of handover delay and dropping probability.

3. Mobility management

Mobility management provides secured and continuous connectivity without interruption at any cause access with Internet Protocol based wireless networks systems. With this system all types of multimedia applications and service include real-time applications such as voice and video streaming and also non-real-time services such as emails, webhosting, and FTTP. In future generation, mobility management in wireless networks should support of all forms of mobility, to support the mobility for both real-time and non real-time application and service and also to support the users continuously moving across different wireless networks in the same or different administrative domains. This will also support of an on-going user application session to continue without significant interruption to a continuously moving user. Effective Mobility management will track and communicate with the continuously moving user from a place to place in the coverage of a single wireless mobile network or in a multiple wireless network without breaking the communication at any cause. Mobility management is a key component the effective operation of wireless networks to deliver wireless internet service. Wireless networks provide to their subscriber in the coverage area. Such area is populated with base, each of which is responsible for relaying communication services for the mobile travelling in its coverage called cells. When mobile user engaging a communication and moving from one cell to another, the base station in the new cell will allocate a channel to continue to provide the service to the mobile user without interruption. This switch from one channel to another is the handoff. One of important aspects of the mobility management is the handoff management. When users do not engage any communication and move around the systems has to track them in order to locate the user in a particular network so that if the user moves the systems could locate them based on the previously reported information. This process called as location management (sometimes is called mobility management). Location management enables the systems to track the attachment point of mobile terminals between consecutive communications. It includes two major tasks. The first is location registration or location update, where the mobile terminal periodically informs the system in order to update relevant location databases for that particular user. In order to reduce handover latency and call blocking probability a new methodology called as gateway relocation methodology was introduced. In that gateway relocation process all ASN nodes are connected by tunnelling protocols. Hence during the process of handover, the packet flows through the tunnel during the handover interval.

4. Gateway relocation Mechanisms

Gateway relocation mechanism is a process where the ASN gateways of the serving base station and target base station are connected through Multi Protocol Label Switching tunnel. Multi Protocol Label Switching (MPLS) is the multi protocol tunnel link used in telecommunication networks and it usually used as backhaul network as shown in Figure 1.

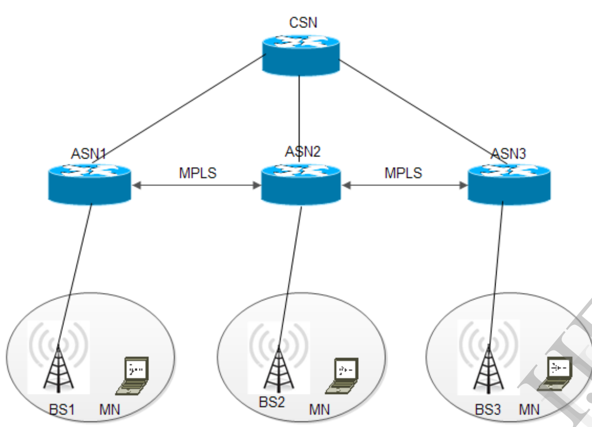

Figure 1. Gateway relocation Mechanisms

4.1. Mobility management algorithm based on gateway relocations

In this paper the handoff is imitated during mobility based on the signal strength. And in our mechanisms the multi protocol label switching tunnel is to connect the different ASN named as gateway relocation mechanism. The mobility management algorithm consists of the following steps as shown Figure 2.

i) At first the registration process will take place. In this process each base stations is registered with the corresponding ASN through a request message and the ASN confirms it through the acknowledgement to their respective base station.

ii) During call the received signal is less due to mobility and the handover initiation takes place.

iii) The mobile stations is searching for different base station and call is handover to the new base station based on signal strength.

iv) For handover the base station must register the arrival of new mobile station to their ASN and get acknowledgement.

v) During the registration the data flow will pass through MPLS tunnel and the data floe will not get disturb handover.

vi) Now the data session will continue through the new base station.

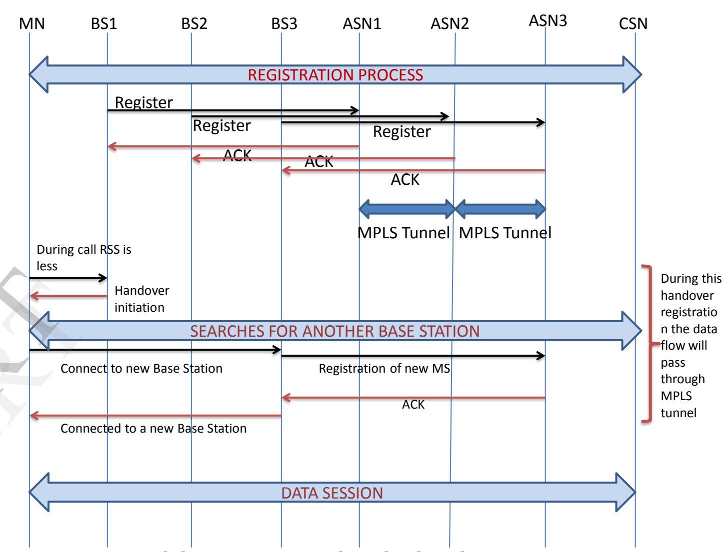

Figure 2. Mobility management algorithm based gateway on relocations

6. Result and analysis

6.1. ASN Architecture

It consists of one ASN Gateway and many base stations. Here ASN gateway is connected to all base station available. Here the delay is less with few packets since the base stations pass through a single gateway but under a larger area single router cannot maintain the connectivity of all the base station as shown in Figure 3.

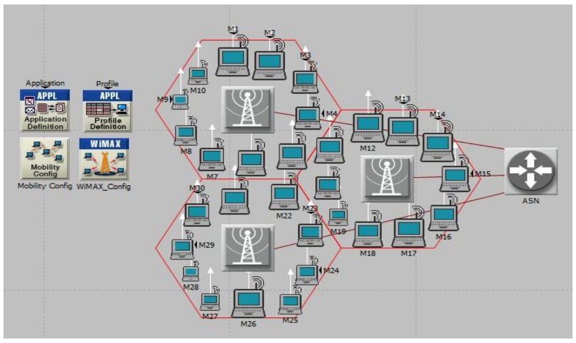

Figure 3. ASN Architecture.

6.2. CSN Architecture

Connectivity service network is a router node which connects all ASN gateway networks as shown in Figure 4. CSN handover refers to the process of changing the traffic anchor point from one base station to another.

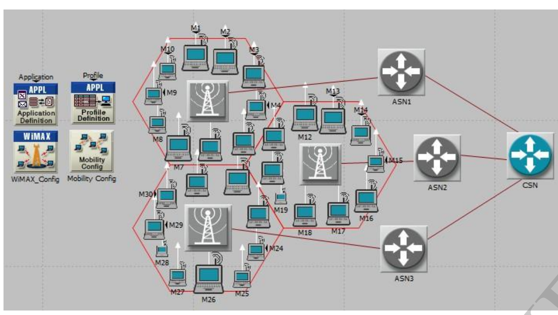

Figure 4. CSN Architecture

6.3. CSN Architecture with Gateway Relocation

In order to reduce the handover delay and packet dropping the entire ASN router in CSN architecture are connected by MPLS (Multi Protocol Layer Switch) tunnel. Therefore during handover process the MS's ongoing data will be transmitted through the intermediate MPLS tunnel till the handover process is completed as shown in Figure 5. The process of switching the ASN gateways through tunnelling is called as Gateway Relocation.

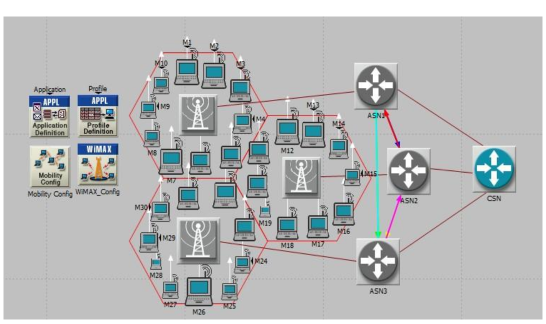

Figure 5. CSN Architecture with gateway relocation.

6.4. Handover Delay

Handover delay defined as the time taken for the mobile station to switch to a new base station from an old base station without retardation (cut off) of ongoing communication (transactions). Figures 6 and 7 shows the handover delay of voice and video applications respectively. In ASN architecture the handover delay is less due to the reason that the switching of base station is controlled by a single ASN gateway but in practical scenario a single ASN gateway cannot control a large network environment.

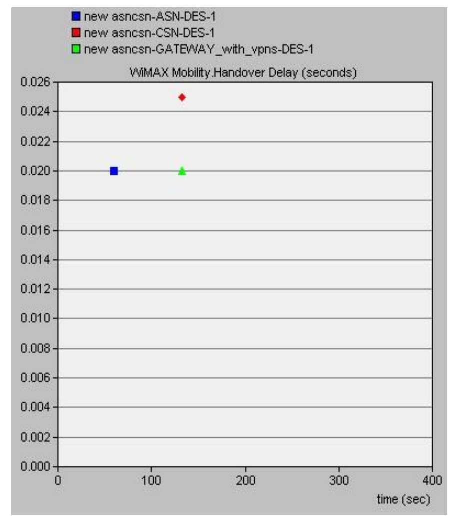

Figure 6. Handover delay for voice.

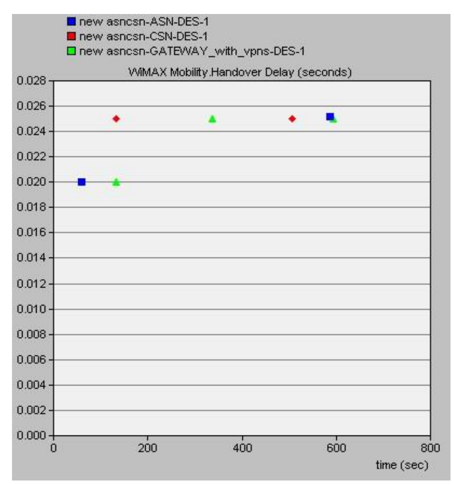

Figure 7. Handover delay for video.

In order to reduce such delay gateway relocation methodology is employed in CSN architecture here during handover process the MS's ongoing data will be transmitted through the intermediate MPLS tunnel till the handover process is completed handover delay is reduced.

6.5. Uplink Packet Dropped

Uplink is the connection between mobile nodes to base station, In ASN architecture no. of packets dropped are low due to the reason that the switching of base station is controlled by an individual ASN. In CSN architecture the base stations are connected to ASN gateway and all the ASN gateways are controlled by CSN gateway. For switching of MS the connectivity has to be switched from BS to ASN GW and from ASN GW to CSN GW, therefore the packet dropping is higher. Using gateway relocation methodology is employed in CSN architecture here the MS's ongoing data will be transmitted through the intermediate MPLS tunnel hence packet dropping is lesser when compared to normal CSN architecture as shown in Figure 8.

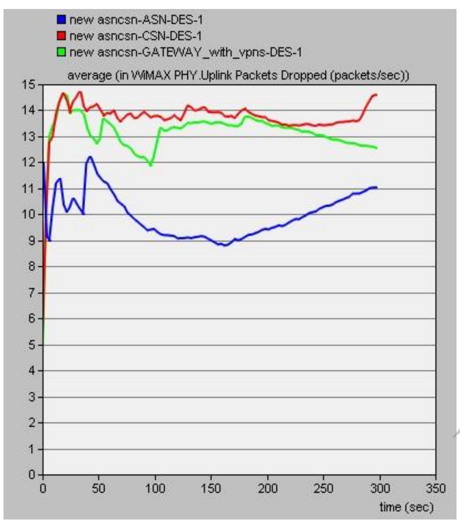

Figure 8. Uplink packet dropped.

6.5. Downlink Packet Dropped

Downlink is the connection between base-stations to mobile nodes, the packet dropped in CSN architecture with gateway relocation is reduced since waiting time of packets are reduced as shown Figure 9.

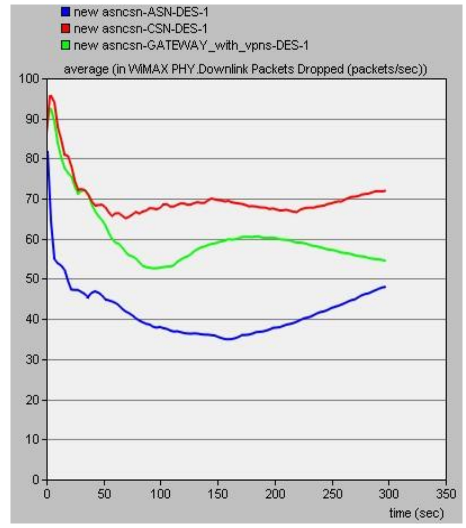

Figure 9. Downlink packet dropped

6.6. Signal to Noise Ratio

Signal to noise ratio is a technical term used to characterize of the signal detected. In ASN architecture the packet loss is less and therefore the signal strength is higher. In CSN architecture the packet loss is higher and therefore the signal strength is lesser. Similarly in Gateway Relocation the packet loss is reduced and therefore the signal strength is much better than SNR of CSN architecture. The SNR of uplink and downlink are shown in Figures 10 and 11 respectively.

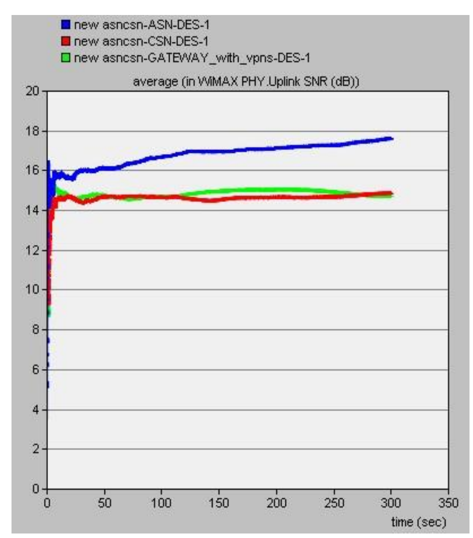

Figure 10. Uplink SNR.

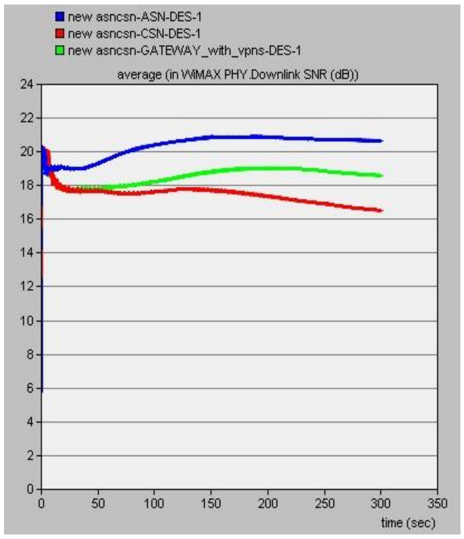

Figure 11. Downlink SNR

5. Conclusion

The main consideration was provided to improve the performance of mobility management. The simulation was performed using OPNET modeller 14.5 to provide real time environment in WiMAX network. First, we simulated the handover delay using OPNET. Three handover scenarios have been studied. First the handover ASN architecture where all base station is connected to a single gateway. Here the delay is less with fewer packets but under a larger area a single router cannot maintain the connectivity of all base station. The second architecture is CSN architecture where base station connects to ASN gateway, ASN gateway to CSN gateways. Here during handover the switching of base stations will take place only after the switching to their corresponding ASN gateway during handover. The third and our proposed architecture is CSN handover with gateway relocation. Here in the CSN architecture all ASN connected by MPLS tunnel. Hence during the process of handover, the packet at the old ASN gateway reaches the new ASN gateway through tunnel until the complete handover process is completed. Therefore results in reduction of handover delay and reduction in packets dropped. Furthermore the performance of signal to noise ratio was also considered to provide in depth analysis. The proposed CSN based architecture with gateway relocation outperforms the CSN based architecture in terms of low packet loss and high signal to noise ratio.

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