IMPLEMENTING DATABASE LOOKUP METHOD IN MOBILE WIMAX FOR LOCATION MANAGEMENT AREA BASED MBS ZONE

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ABSTRACT

The mobile WiMAX plays a vital role in accessing the delay sensitive audio, video streaming and mobile IPTV. To minimize the handover delay, a Location Management Area (LMA) based Multicast and Broadcast Service (MBS) zone is established. The handover delay is increased based on the size of the MBS zone. In this paper, Location Management Area is easily identified by using Database Lookup Method to obtain efficient bandwidth utilization along with reduced handover delay and increased throughput. The handover delay and throughput is calculated by implementing this scenario in OPNET tool.

KEYWORDS

MBS zone, LMA, Paging Group, Database Lookup Method, Handover Delay.

1. INTRODUCTION

The most popular Internet Access technology for Metropolitan Area Networks (MAN) is WiMAX (Worldwide Interoperability for Microwave Access), because WiMAX supports all Internet Protocol core network architecture [6]. In WiMAX, recent research is going on in the area of Broadband access which plays a vital role in mobile services. There should be a handover delay in these sectors. Mostly, the handover delays are reduced in previous researches, although it's not more efficient at the user's point of view, so the motivation is to reduce the bandwidth usage and handover delay [15]. WiMAX is an emerging 4G technology, which can provide wireless broadband access at the data rate of 70 Mbps over 50 kilometers to both home and business customers. WiMAX is cost effective and offers higher data rates than other wireless networks. It supports both fixed and mobile applications. WiMAX is easier to deploy as compared to other networks and has flexible network architectures. One of the major challenges concerning the performance of Mobile WiMAX is seamless handover. The handover in an MBS session involves a delay, due to the link-level messages, which are exchanged during the mobile WiMAX handover and due to the MBS signaling messages [4]. Whenever a Mobile Station with an ongoing MBS session switches to a new Base Station, the former delay occurs, irrespective of its MBS zone or LMA. The latter delay only occurs when an MS moves from one MBS zone to another. MBS handovers can be classified into intra-MBS-zone handover and inter-MBS-zone

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handover. Handover occurs within an MBS zone is mentioned as intra-MBS-zone handover and inter-MBS-zone handover takes place between different MBS zones.

2. RELATED WORKS

The standard Internet Protocol (IP) multicast protocols are employed by Universal Mobile Telecommunications System (UMTS) multicast architecture [9]. A multicast mechanism for UMTS has been proposed [10] establishes a multicast tunnel throughout the UMTS network, which allows multicast packets to be transferred on shared links towards the multiple destinations. For one-to-many packet-delivery services in the UMTS, the tradeoffs between the broadcast, multiple-unicast, and multicast approaches have been investigated [11]. However the MBS zone creation will also waste the bandwidth of the wired-backhaul network, but we focus on the wireless link so the bandwidth is also reduced. It is assumed that the standard UMTS mobility mechanisms, handles the mobility. On the other hand [12], a routing list can be introduced into the nodes of the UMTS to support resource-efficient multicast transmissions, which are combined with a reassessment of the mobility management mechanism and handover types in the UMTS. Unless handover-delay issues are taken into Account, however, multicast-service continuity still cannot be assured. There is some ongoing research on the support of real-time services such as video streaming (IP television) and voice over IP in mobile WiMAX [13], [14]. The hard handovers by IEEE 802.16e make seamless mobility with imperceptible interruption of service difficult to achieve in Mobile WiMAX. The aim of [2] is reducing both bandwidth usage and service disruption. Some previous studies have addressed the issues of network planning for wireless multicast and broadcast services. So they used paging method which reduces the service disruption, but in this case the handover delay and the bandwidth are not much efficient. In this paper, the Database Lookup method is introduced which is implemented in AAA server. By this the bandwidth and handover delay is reduced and throughput is increased.

3. MBS ZONE

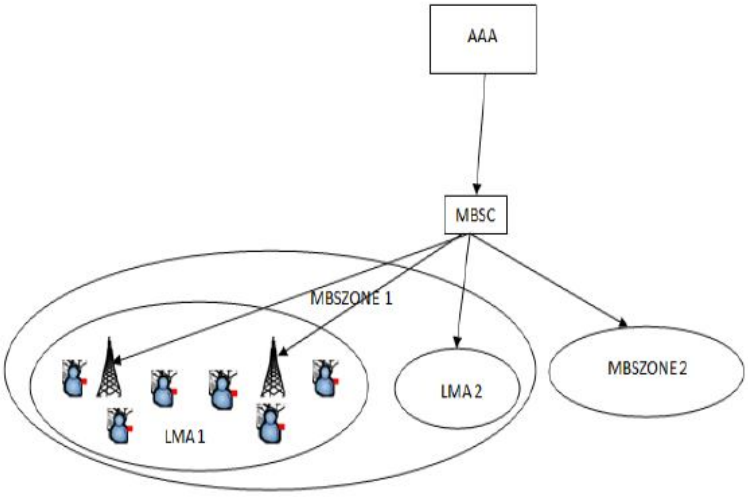

Figure 1. LMA in MBS Zone

A WiMAX network basically consists of Mobile Stations, Base Stations, and gateways with an authentication, authorization, and accounting server [5]. The group of Base Stations is named as LMA's within an MBS zone. The LMA contains a group of base stations and mobile stations.
The MBS zones are controlled by the MBSC (Multicast and Broadcast Service Controller) which has a direct link to the AAA server in that the Database Lookup LMA is implemented, as shown in Figure 1. The MBS zones can be deployed, once the MBS-zone sizes are determined by a network operator [3]. Every Base Station in an MBS zone has a shared multicast connection for the same multicast transmission. Therefore, a Mobile Station to create a new connection during handovers between Base Stations in the same MBS zone is not needed, which reduces the handover delay and bandwidth usage. The service disruptions are reduced by increasing the size of the MBS zones for a given level of mobility; hence the wireless-link bandwidth will be wasted in the sense that every Base Station broadcasts the same MBS packets, in the same MBS zone regardless of the presence of a user. This will also result in increased probability of blocking a new MBS session.

3. EXISTING METHOD FOR MBS ZONE

In Existing method, they have proposed an MBS architecture based on Location Management Areas (LMAs), which is a set of geographically adjacent BSs within the MBS zone [2]. The Paging Group (PG) in Figure 2 is used to track the Location of Mobile Stations.

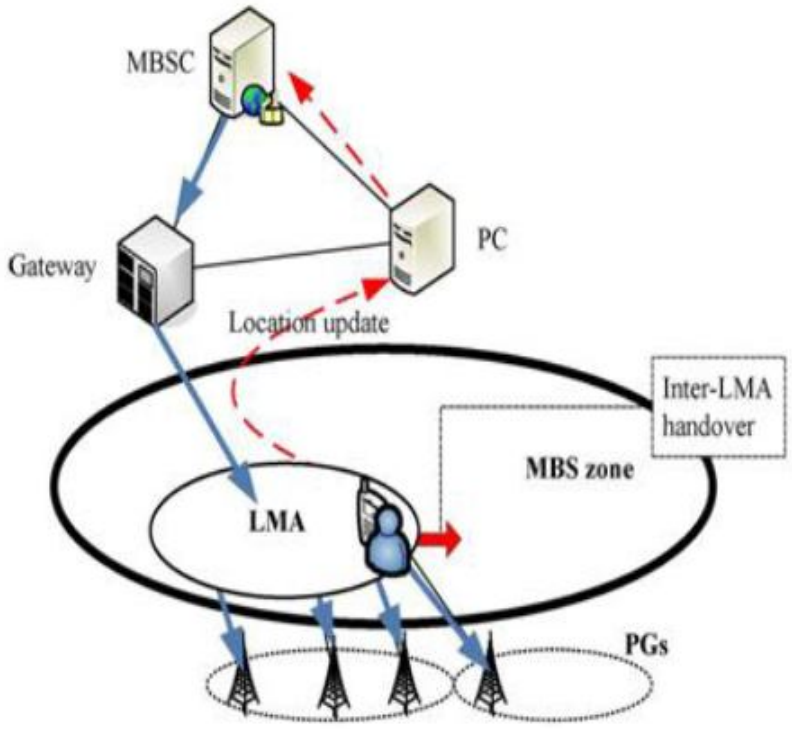

Figure 2. Paging Controller to Tract MS Location

With an LMA-based MBS, intra-MBS-zone handovers are again classified into intra-LMA handovers, which result from a movement of the Base Station within the same LMA, and inter-

LMA handovers between Base Stations in different LMA's [3]. Figure 3 shows the signalling messages required for inter-LMA handovers. LMA containing current mobile users of a specific MBS session is called as active LMA's with a remainder called as inactive LMA's, with respect to the session. In Figure 3, the Paging Controller (PC) updates location information about an MBS user within the zone. The Paging Controller, which controls the paging group, informs the MBSC of the new location of the users. If the MS has shifted into an inactive LMA, multicast-distribution tree update must be done. If the LMA is active, the time required for location update and location update notification does not contribute to the handover delay, which only consists of the time required to finish IEEE802.16e MAC layer handover. The delay involved in an intra-LMA handover is equivalent to the intra-MBS-zone handover.

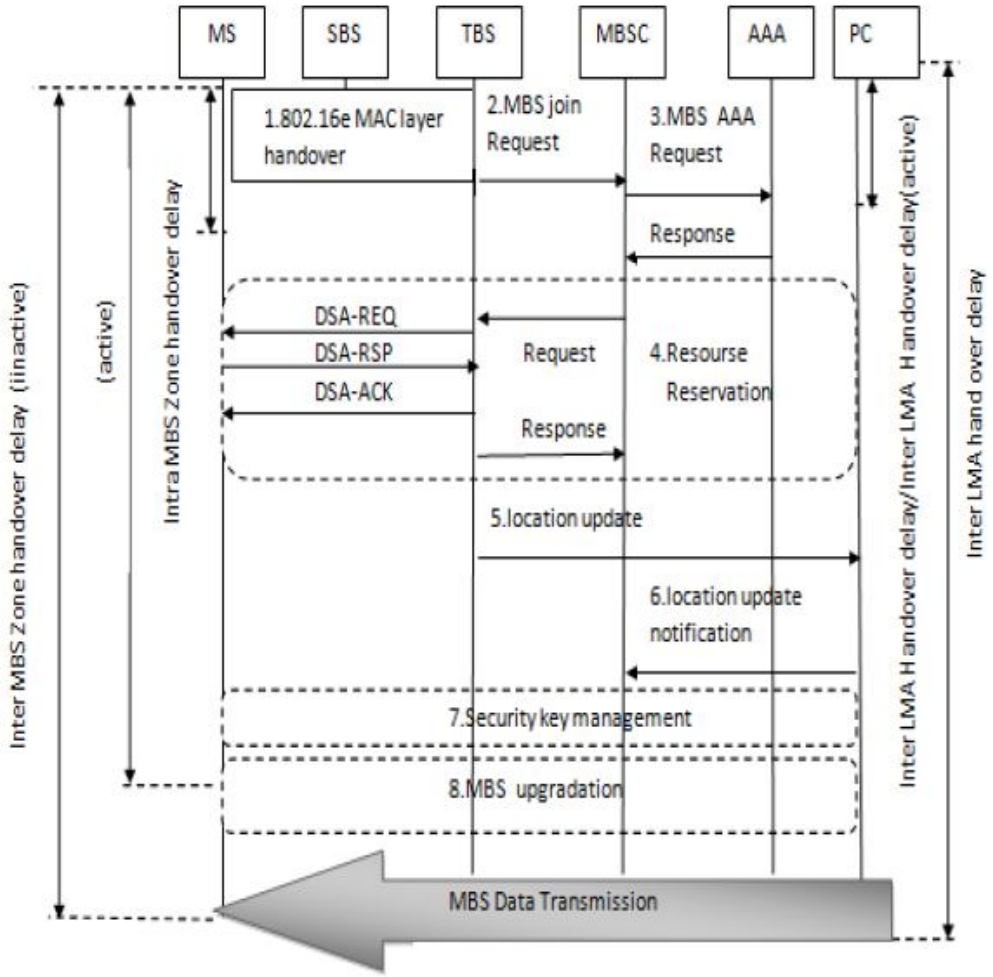

Figure 3. Signalling Messages in LMA Handover

4. PROPOSED WORK FOR MBS ZONE

The drawback in the existing work is the usage of Paging Group for Multicast and Broadcast Services, which consumes increased bandwidth along with the delay. In this paper the Database Lookup Method (DLM) is introduced which already contains all the information about the mobile

users of the particular area which serves under the respective AAA server. When the handover occurs, it is not necessary to spend time in PG to collect the data of the subscribers. Directly, the location updating can be done during MAC layer handover. So that the handover delay is reduced and bandwidth utilization is decreased with increased throughput. In the proposed work, the MS location is determined from a static database in the AAA server.

Once the network receives a location request, it identifies the cell ID of the BS serving the MS and looks up the geolocation of that BS [5]. This provides the reduced handover delay with efficient bandwidth usage.

The Figure 4 explains about the complete operation of this paper. In this figure, the operation is between the MS, SBS (Serving Base Station), TBS (Target Base Station), MBSC, AAA (with DLM). At First, the MS sends a IEEE802.16e MAC layer handover configuration to the TBS, the TBS sends an MBS joint request to MBS Controller, which sends an MBS authorization request to the AAA server. After the response from the AAA to the MBSC, if the user is valid then only the MBSC sends a request to TBS and the TBS sends a DSA (Dynamic Service Addition) request to MS. The MS sends a DSA response to the TBS only when the user is authorized and the DSA acknowledgment is sent to the MS [8]. A Response is sent to MBSC from TBS. After the resource reservation step, the location is updated to the AAA server from TBS. Then the location update notification is sent to the TBS from the AAA server. Then normal process such as security key exchange, MBS updating process, MBS data transmission is preceded.

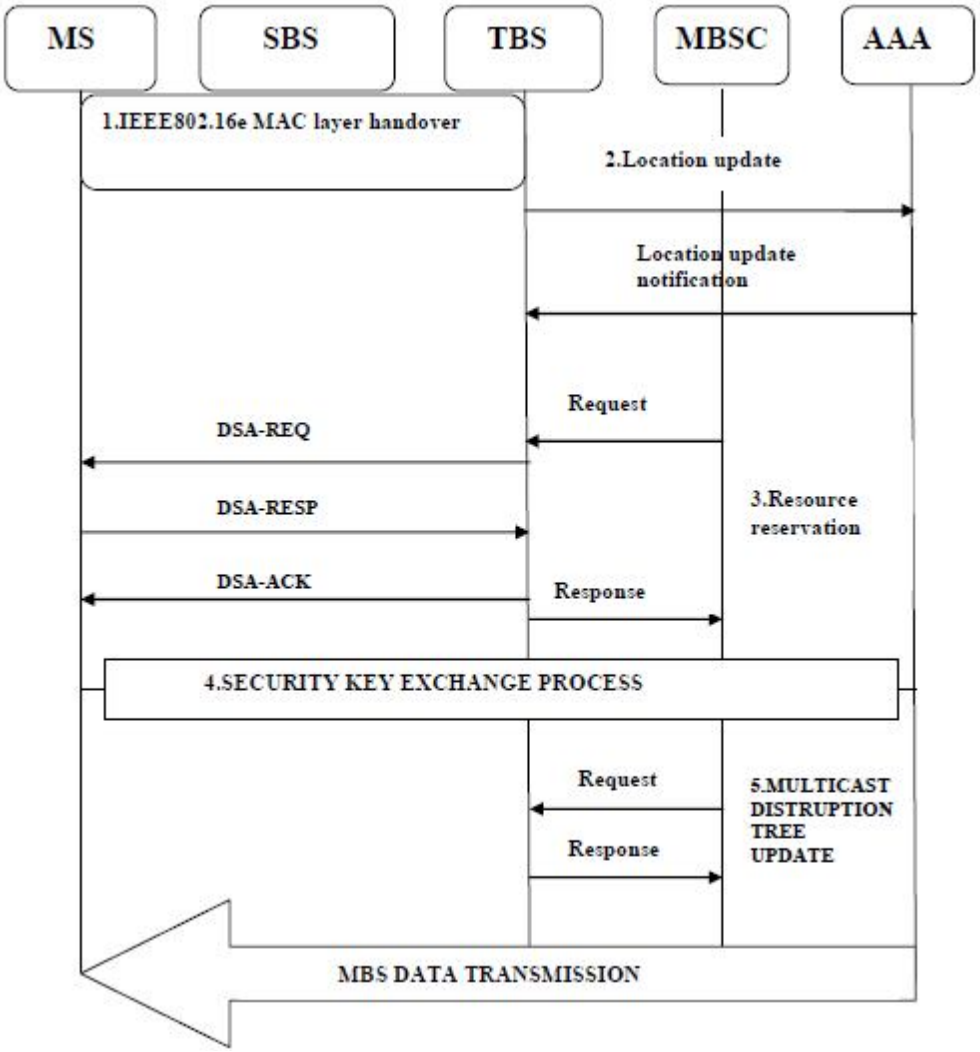

Figure 4. Database Lookup Method implemented in AAA Server

The Database Lookup Method [5] for implementing LMA based MBS zone should enhance the throughput of the network by the elimination of Paging Group and thus the handover delay is also reduced efficiently. The bandwidth utilization is also effectively used in the removal of paging controller.

Table 1. Algorithm for Proposed LMA Based MBS Zone

```
Algorithm:
STEP1: TBS sends an MBS joint request to MBSC.
STEP2: MBSC sends an MBS authorization request to the AAA server
        If request is accepted   // by AAA server.
                Response is sent          // from AAA to MBSC.
        else
                reject   //the  zone formation is not allowed.
        end
                Request is sent  //from MBSC to TBS.
                Request = DSA-REQ    //TBS to MS.
        If DSA-REQ is accepted          //by MS.
                Response=DSA-RESP  //MS to TBS.
                TBS sends DSA-ACK  //with MBS ID, FID, MBS zone ID
                                              and MBS carrier information.
                 Response is sent                 //from TBS is MBSC.
        else
                reject            // failure of resourse reservation.
        end
STEP 3: Find the location of the user.
STEP 4: TBS sends a location updation to AAA server
        If response= location update notification  //AAA to MBSC.
STEP 5: security key exchange process begins
STEP 6: MBS updating process begins
STEP 7: Finally, MBS data transmission is done.
        else
                 reject            // the invalid user.
        end
```

5. SIMULATION RESULTS

OPNET simulator is a tool to simulate the behavior and performance of any type of network [7]. The main difference with other simulators lies in its power and versatility. This simulator makes possible working with the OSI model, from layer 7 to the modification of the most essential physical parameters [1]. The proposed work is implemented using this OPNET tool and the results are obtained.

The Figure 5 is the scenario of existing work (LMA based MBS zone) in opnet simulator. It has paging controller to track the MS location and the paging group is also created by grouping of nearby Base Stations. The increased throughput and the reduced overall delay are calculated as in Figure 6.

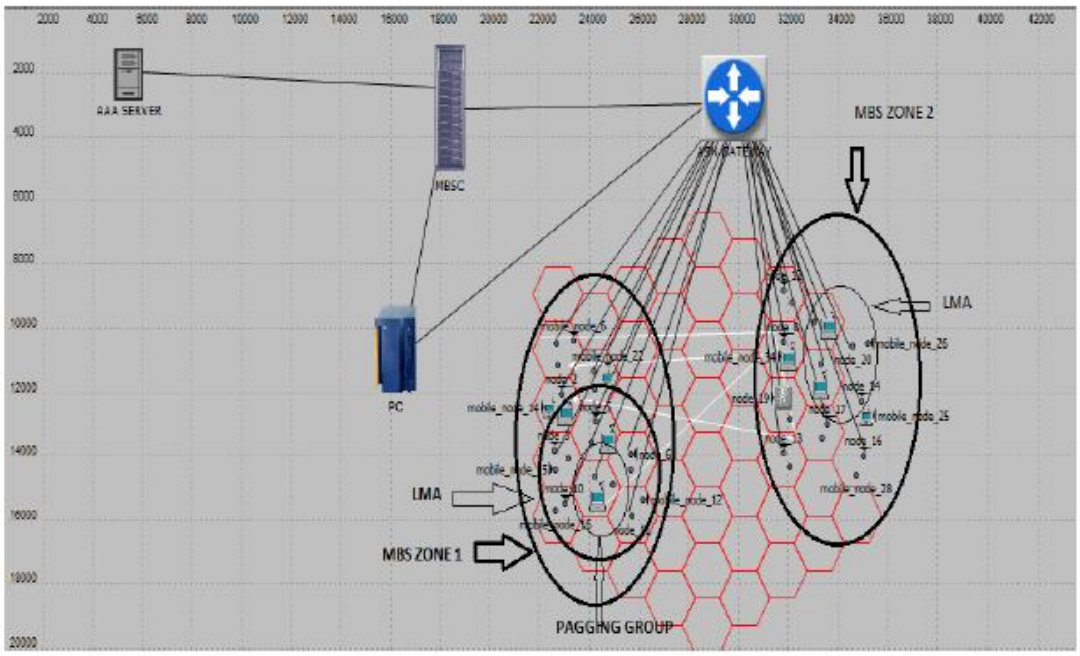

Figure 5. LMA Based MBS Zone in Existing Scenario

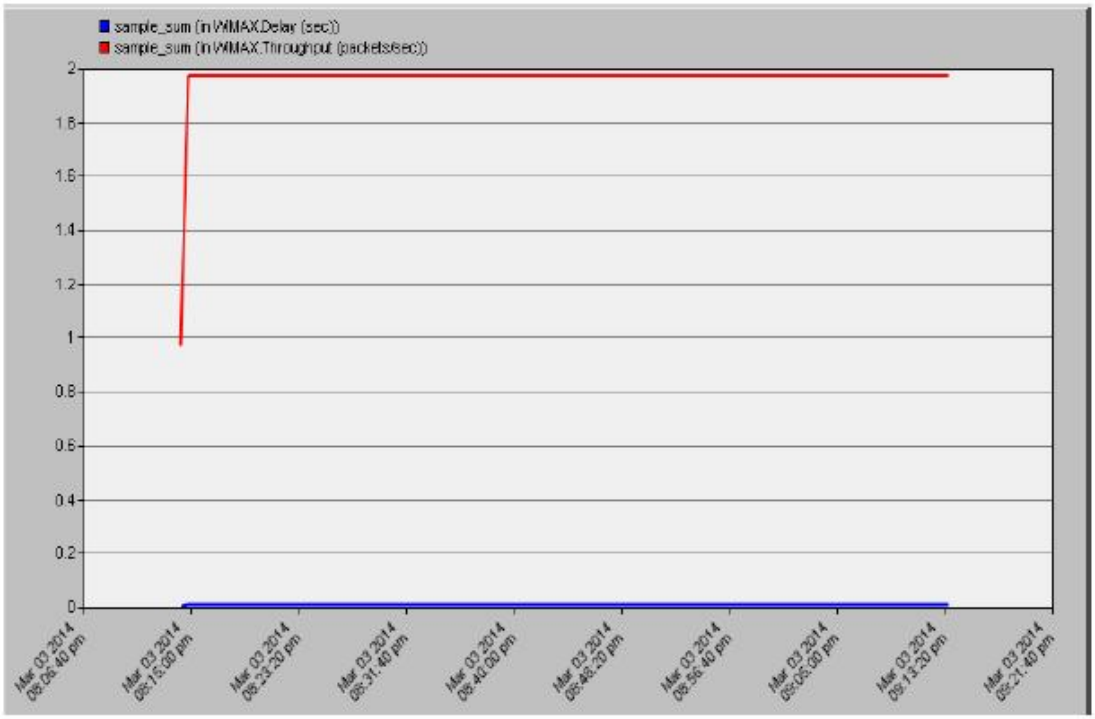

Figure 6. WiMAX delay and Throughput for Existing Scenario

As in Figure 7, the handover delay for a particular node (node 6 and 22) is calculated while the LMA handover takes place. The handover delay is calculated as 0.025 seconds, which is

maintained constantly in node 6. But, in node 22 the handover delay is increased from 0.020 seconds to 0.024 seconds.

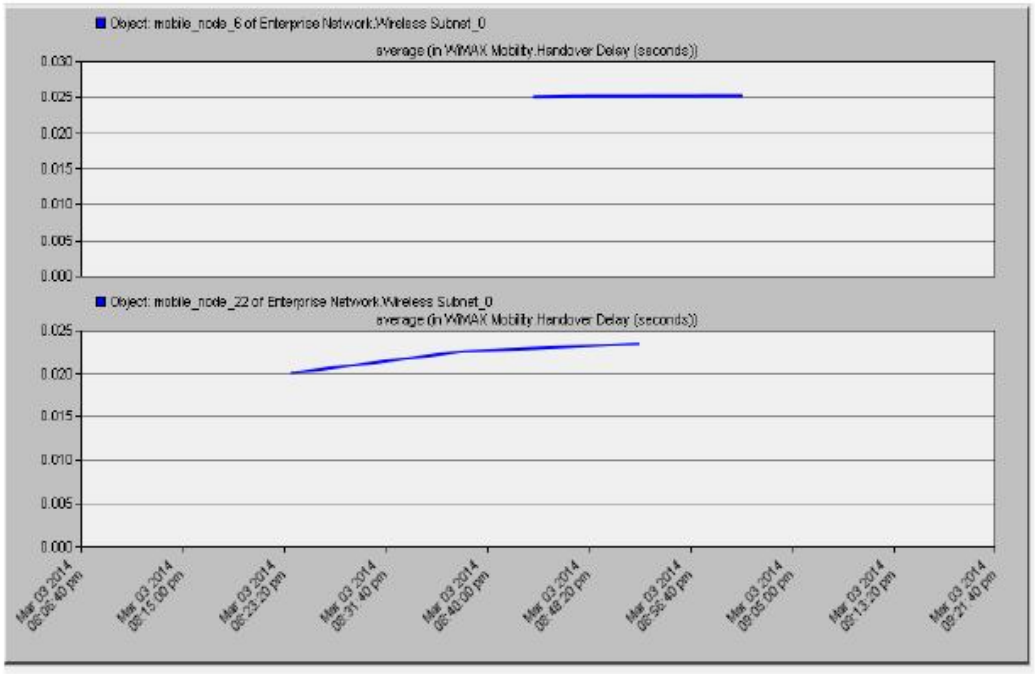

Figure 7. Handover delay for Specific node in Existing Scenario

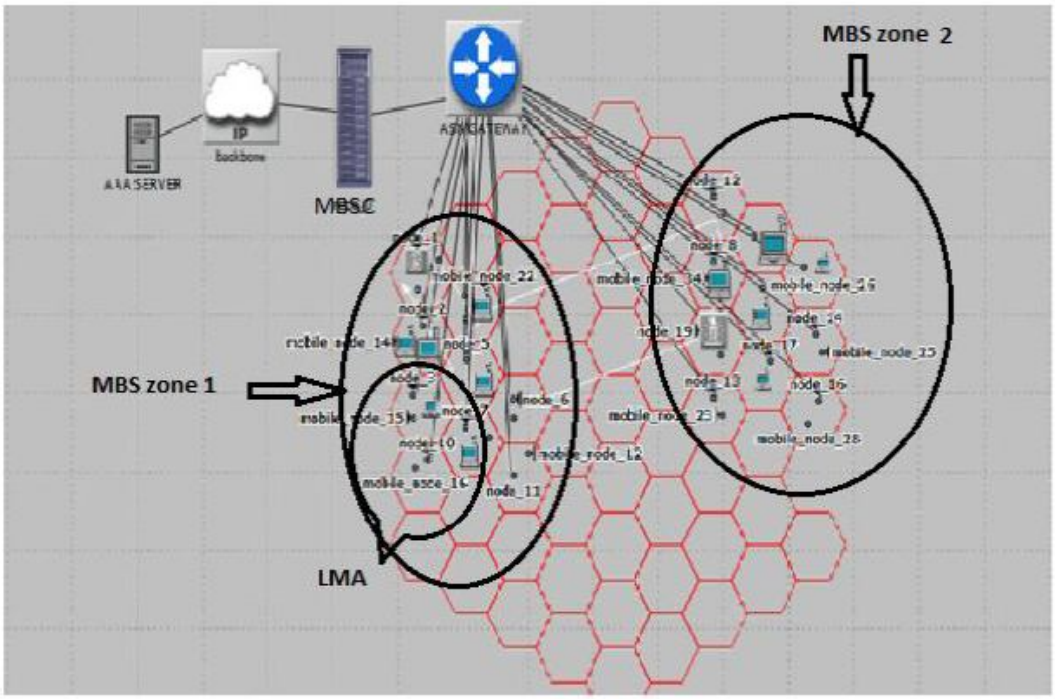

Figure 8. Proposed LMA Based MBS Zone

The proposed scenario is created as in Figure 8 in the opnet tool which has the MBS zone and group of LMA's. The Paging Group used to find the current position of the user is eliminated in the proposed LMA based MBS zone [3]. Instead of that, a database lookup LMA is introduced, in that the location of a MS is maintained in a database. The database is handled by the AAA server. Hence the throughput is increased and the delay is minimized as compared to existing work. The corresponding graph is shown in Figure 9.

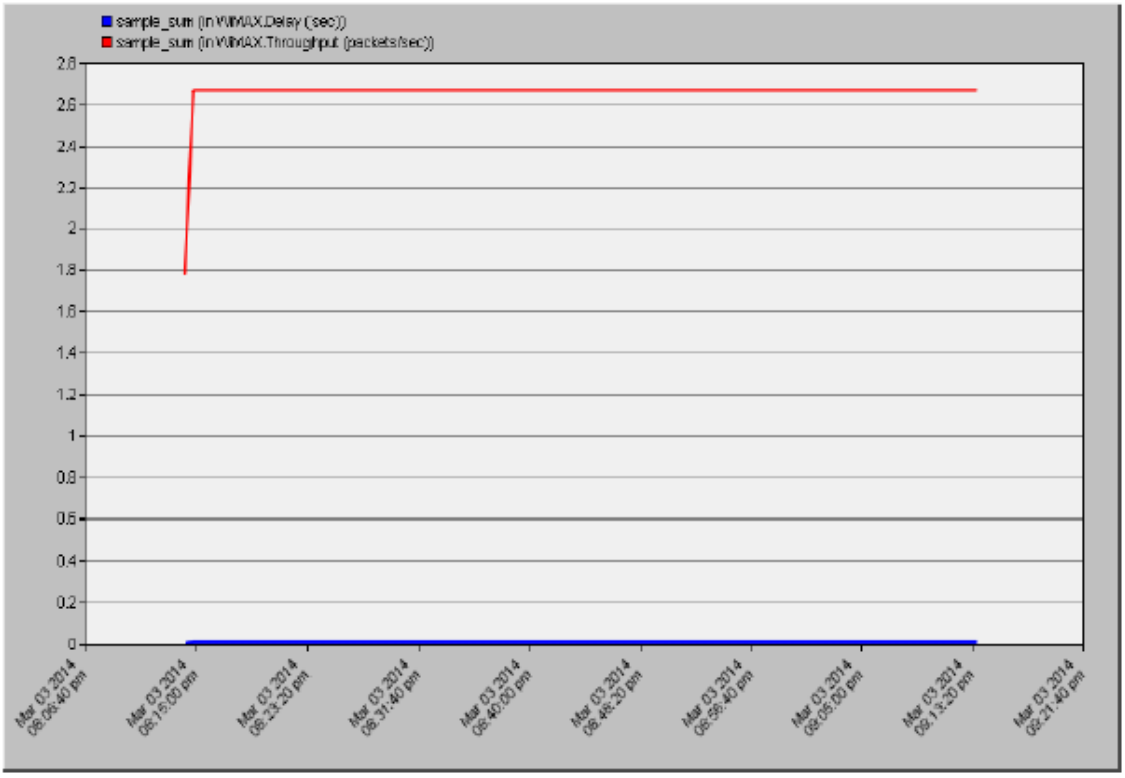

Figure 9. Delay and Throughput in Proposed Work

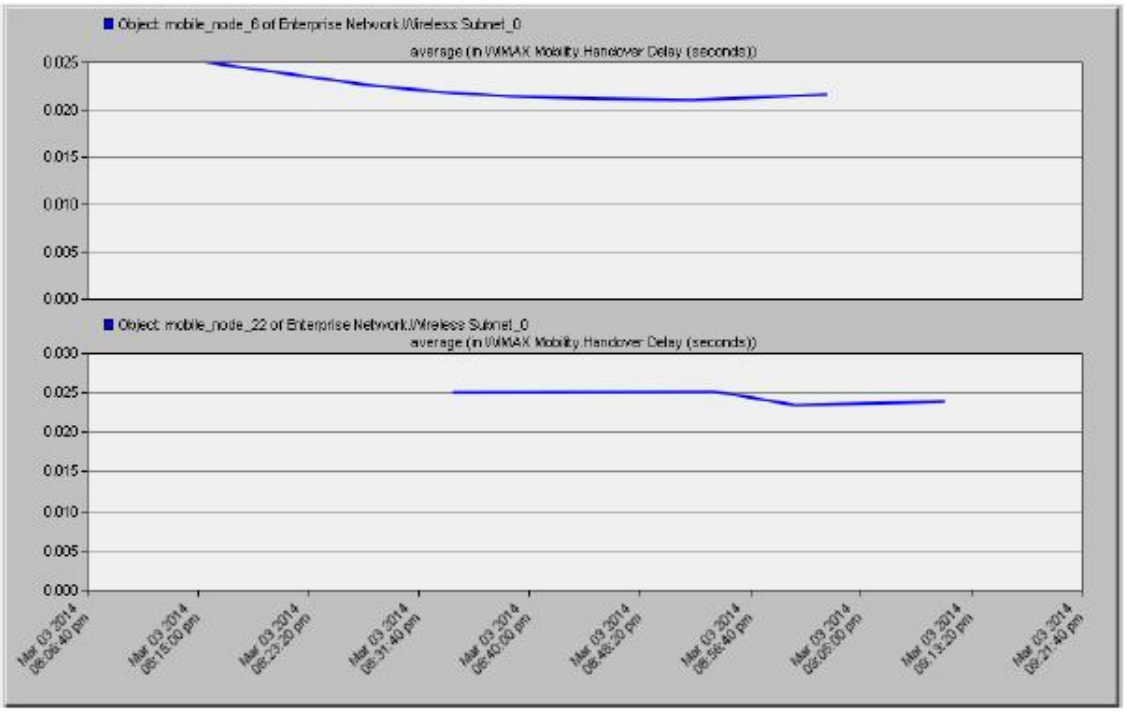

Figure 10. Handover delay for Specific node in Proposed Scenario

The Figure 10 explains that the handover delay is reduced from 0.025 seconds to 0.021seconds during node 6 mobility.Thus the handover delay is minimized due to the removal of Paging Group in MBS zone. Similarly, during node 22 mobility also the handover delay is minimized when compared to the value in Figure 7.

6. CONCLUSION

Mobile WiMAX (IEEE802.16e) includes the MBS zone to reduce the MBS service disruption time and handover delays, but this requires all the BSs to send the same packets in the MBS zone. The DLM implemented in AAA server has to maintain the updating of the mobile users. By using LMA in MBS zone, the handover delay while streaming in the MBS zones and the service disruption time will be reduced to an extent by maintaining the Database Lookup in the AAA Server. The service-disruption time, which is dominated by the transmission delay between the MBSC and the Base Station. If the LMAs are small, the disruption time of the LMS is hardly affected to all by the wireless-transmission delay. In this paper the handover delay is calculated as 0.021 seconds, which is less than the handover delay in existing scenario.

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