THE PERFORMANCE OF LMA BASED ON RSSI AND DISTANCE ON HANDOVER DELAY IN WIMAX NETWORK

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ABSTRACT

One of the main keys of positioning and ranging technologies in wireless telecommunication networks is the values of distance and RSSI (Received Signal Strength Indication), this relationship has a significant effect of the network quality in terms of quality in services and connectivity, and not less in the roaming stage. Many researches results drove to influence these keys to the handover delay in the broadband network, so in many cases that MT handover between boarders of location areas or zones has been affected by long time delay and packet data lost. Over recent years many signal propagation schemes has been presented to describe the relationship between distance and RSSI. In this paper, the modify scheme of location management area (LMA)-based multimedia broadcast services scheme has been presented , the distance between BS and MT and the RSSI , are play the main parameters to influence the handover delay. The analytical algorithm results showed the reduction of the handover delay in smaller perimeter cell size comparing to the large cells in location management area.

KEYWORDS

WiMAX Network, LMA, Distance, RSSI, Handover Delay.

1 INTRODUCTION

Mobile WiMAX consists of three entities: mobile station (MS), access service network (ASN), and connectivity service network (CSN) [1]. The BS performs radio-related functions, which is located in the ASN. The CSN provides connectivity to the Internet, ASP, other public networks, and corporate networks. The CSN is owned by the NSP and includes AAA servers that support authentication for the devices, users, and specific services. The CSN also provides per user policy management of QoS and security. The CSN is also responsible for IP address management, support for roaming between different NSPs, location management between ASNs, and mobility and roaming between ASNs [2].

To provide MBS, a new functional entity, multicast and broadcast service controller (MBSC), is introduced in [LMB], the handover delay of an MBS session includes two types of delay: 1) the delay due to the link level messages during the IEEE 802.16e handover; and 2) the delay due to the MBS signaling messages. The IEEE 802.16e handover mechanism consists of cell selections, handover decision, synchronizations, ranging and termination with the serving BS, since the 802.16e embraces the functionality for elaborate parameter adjustment and procedural flexibility.

RSSI and Distance will take apart in the signaling between the current BS and the Target BS. the exchange data shall be via MOB-NBR-ADV The MT is analysis all received data particularly the signals strength, among many neighboring BSs data information it will compare the strongest signal, The Received signal strength is a strength which is used to measure the power between the received radio signals [3]. For each base station there is a threshold point below which connection break with active base station. Therefore the signal strength must be greater than threshold point to maintain the connection with active BS. The signal gets weaker as mobile moves far away from active base station and gets stronger signal towards new base station as it move closer.

In the modified LMB , RSSI and the distance between BS are takes a major part as a parameter in this algorithm , however, MOB-NBR-ADV message it containing on the strength signal power information's of the neighboring BSs , the MT compare among all these signals to select the appropriate one to take the initiate decision for the handover, however,

This paper is organized as follows: second Section the summery and related work has been presented, the WiMAX handover and MAC layer was described in section three, in terms of scanning and ranging procedures, in section four, the fundamentals of RSSI ranging is described ,the modified model analysis and the results in section five and six respectively. Finally the conclusion in section seven.

2 RELATED WORKS

2.1 LMA-based on Multimedia Broadcast Services

The iner MBS zone handover is critical issue when the network planning promote real-time multimedia services as (QoS) function, as the inte MBS handover zone increases the BSs numbers where multicast packet increases in most time no much users, which will cause a waste of bandwidth channels , beside the packet delay and lost. It is unnecessary to maintain inte MBS zone handover in the network planning, to avoid it, the planning design is adopted the large MBS zone to eliminate the inter MBS handover zone effect.

In [4] MBS zone is divided into multiple location management areas (LMAs) and then MBS data packets are transmitted only to the LMAs in which MBS users currently reside. An LMA is a group of geographically adjacent BSs. It is larger than a single BS, and smaller than a whole MBS zone. Managing MBS subscribers in each LMA is incarnated by the WiMAX framework on location management. In IEEE 802.16e, a paging group,] which is a given set of adjacent cells is used to track the locations of MTs. A paging controller (PC) manages the up-to-date information as to which MSs are located in which paging groups. The location of an MT in ordinary mode is tracked by the PC at the level of BSs. Whenever the IEEE 802.16 MAC layer handover is performed, the target BS reports this action to the PC. Thus, the PC keeps track of the current BS and the current PG of an MS in ordinary mode.

[5]When a mobile terminal stays in a link, it listens to the Layer 2 neighbor advertisement messages, named MOB_NBR-ADV, from its serving base station (BS). A BS broadcasts them periodically to identify the network and announce the characteristics of neighbor BSs. Receiving this, the MT decodes the message to find out information about the parameters of neighbor BSs for its future handover. With the provided information in a MOB_NBR-ADV, the MT may minimize the handover latency by obtaining the channel number of neighbors and reducing the scanning time, or may select the better target BS based on the signal strength, Quality level. All the handover mechanism has been included in the handover procedure where is conceptually divided into" handover preparation" and "handover execution".

[6] Handover preparation can be initiated by either an MT or a BS. Within this period, neighbors BSs are compared by the metrics such as signal strength or QoS parameters, and a target BS is selected among them. As selection procedure completed, the MT start to associate initial ranging with candidate BSs to implement a new handover. Once the MT decides to handover, it notifies its intent by sending a MOB_MSHO-REQ message to the serving BS (s-BS). Based on this notification, The BS then replies with a MOB_BSHO-RSP containing the recommended BSs to the MT after negotiating with candidates. Optionally, it may confirm handover to the target BS (t-BS) over backbone when the target is decided. Alternatively, the BS may trigger handover with a MOB_BSHO-REQ message.

After handover preparation, handover execution it will take place to start. The serving BS will receive a MOB_HO-IND message from the MT as a final indication of its handover.

After ranging with the target BS successfully, the MT negotiates basic capabilities such as maximum transmit power and modulator/demodulator type. Then performs authentication and key exchange procedures, and finally registers with the target BS. However,

3 HANDOVER IN WiMAX

The good way to adjustments the MAC layer is to follow up the HO process for various scenarios**.**

3.1 MAC Layer Handover Procedure

A. Network Topology Advertisement

The BSs periodically broadcast Mobile Neighbor Advertisement Control Signal (MOB_NBR_ADV). These signals contain both physical layer (i.e., radio channel) and link layer (e.g., MAC address) information.

B. Scanning/ranging

The MT scans and synchronizes with the neighboring BSs based on channel information from the neighbor advertisement. If the synchronization successes, it then starts the ranging procedure. The scanning and ranging processes are shown in Fig (1). The MT starts to be allocated a ranging slot by the neighboring BS. Then the MT starts a hand-shake ranging procedure with the neighboring BS for the OFDMA uplink synchronization and parameter (e.g., transmission power) adjustment. This process may contain multiple messages (Ranging Request (RNG-REQ) and Ranging Response (RNG-RSP) transmission and parameter adjustment transactions. This procedure ends after the MT has completed ranging with all its neighbors. In the ranging phase, a MT may switch to a new channel, thus temporally loosing connection with the serving BS.

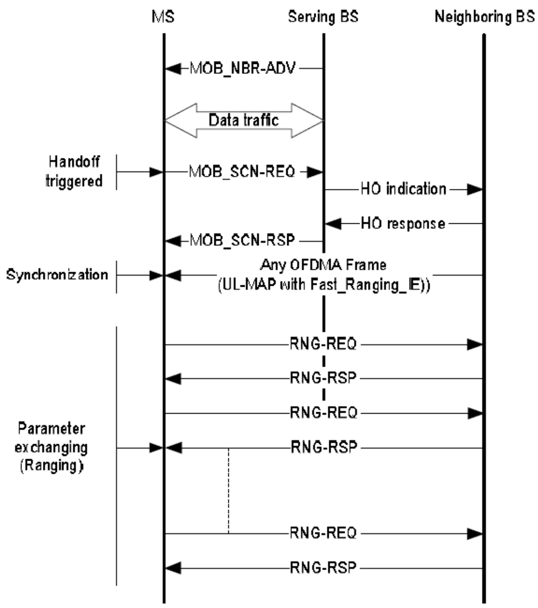

Figure 1. Scanning and Ranging [7]

C. Handover Decision and Initiation

The HO trigger decision and initiation can be originated by both the MT and the BS using a MT HO Request message (MOB_MSHO-REQ) or a BS HO Request message (MOB_BSHO-REQ) respectively. This procedure is illustrated in Fig (2)

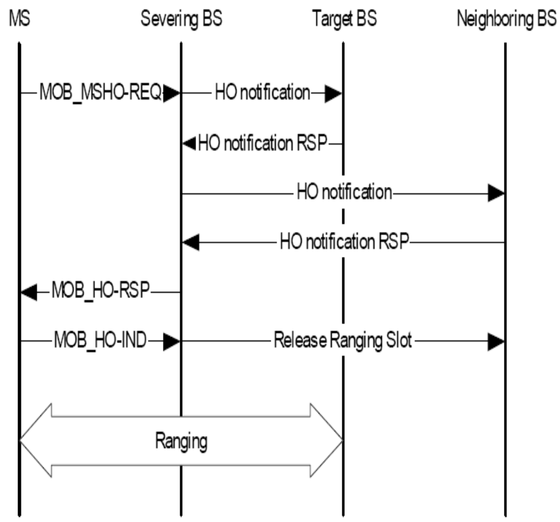

Figure 2. HO decision and Initiation [7]

4 FUNDAMENTALS OF RSSI RANGING

The fundamentals of RSSI ranging [8], explaining the relationship between transmitted and received power of wireless signals and the distance among node, This relationship is illustrated in (1). P_t is the transmitted power signal. P_r is the received power signals. d is the distance between the sending and receiving nodes. n is the transmission factor whose value based on the propagation environment [9].

$$Pr = Pt * \left[\frac{1}{d}\right]^n \quad (1)$$

Take 10 times the logarithm of both sides on (1), the Equation (1) is becomes equation (2).

$$10 \lg P_r = 10\lg P_t - 10n \lg d \quad (2)$$

P_r , the transmitted power of nodes are given. Is the expression of the power converted to dBm Equation (2) can be directly written as Equation (3).

$$P_R\,(\text{dBm}) = A - 10n \lg d \quad (3)$$

By Equation (3), it's clear that the values of parameter A and n determine the relationship between the strength of received signals and the distance of signal transmission.

5 THE MODEL ANALYSIS

As the location management multimedia multicast services algorithms is presented in [1] and [4] Where, p is the mobile destiny (mobile/m$^{2)}$; v is the moving velocity (m/s); the mobile terminals is moving in various velocities, and l is the cell perimeter (m). Mobile terminals move across a boundary in two directions, However only one direction needs to be considered. The paging area boundary crossing rate r_p is:

$$p = \frac{pvL}{\boldsymbol{\pi}} \quad (4)$$

The received signal strength can be as a function of user's position and the base station position as follows [10]:

$$RSS = h\,(X, Si) \quad (5)$$

Where,

$X\,(x, y)$: is the user's position.
$S_i\,(S_{i,x}, S_{i,y})$ is the position of the base station i .

To calculate the function h, we calculate its gradients, Where d_i is the distance or the range between the user and the base station i .
However if the received signal strength can be considered either in the following logarithmic curve [11]:

$$Y = -22.98 \log10\,(X) - 23.89 \quad (6)$$

Where,

Y : is the received signal strength.
X : is the distance between the BS and SS.

Generally, The MT select those BSs whose RSSI value is higher than the serving BS which results in a better link for communication with the target BS with lower bit error rate (BER). Typically handover initiated when the RSSI of the serving BS is less than the targeted BS, and executed only if there is another BS having RSSI is at least H higher than the threshold drop. It is mean that the distance between base stations and the mobile terminals and RSS is play a main key to the handover operation, Using a location management area mathematical algorithm in [4] as fundamental to the modified algorithm (7) has been adopted these new factors and pay more attention to these factors performances to present the effect to in different scenarios, particularly under the conditions , when the Mobiles terminals in the mobility in different velocities categories

$$\frac{(\lambda_l-\lambda_z)}{\lambda_s}\left[e^{-\lambda_i A_l}.D_{L1} + \left(1 - e^{-\lambda_i A_l}\right).D_{L2}\right] + \frac{(\lambda_l-\lambda_z)}{\lambda_s}.D_{L3} + y \quad (7)$$

6 THE ANALYTICAL RESULTS

Figure (3) shown the relation of MT speed & RSS and Distance between BS and MT, it's clear that the increasing of the MT speed it led to the increasing in the RSS too, a a complicity relations of different factors functions is explain the handover delay becomes less in terms of the RSS and distance , the distance between the MT and the targeted BS becomes smaller , the RSS becomes high on the other hands the RSS is becomes smaller when distance becomes far from the serving BS, the signal strength is becomes then less than the threshold point, the target BS receive many control signals from many MTs as in same time MTs located many power signals from neighboring BSs .its heavy signals will targeted the selected BS, for handover, the BS channel will be busy and bandwidth delay or block many traffic cause the bandwidth limitations . its clear with the distance increasing from the serving BS the RSS will be a higher to the targeted BS.

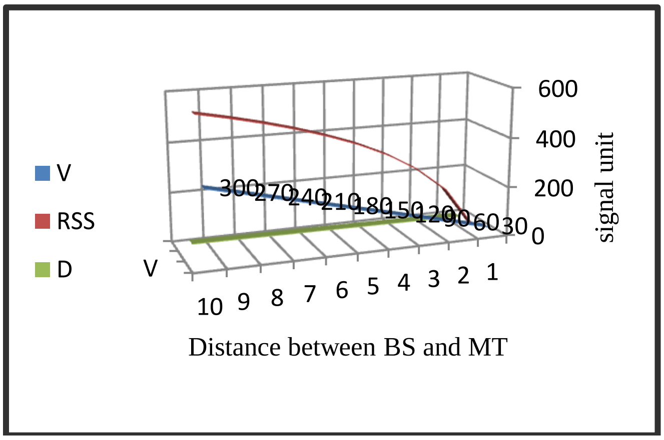

Figure 3.Effect the Distance to the RSSI when the MTs in Different Velocities

Figure (4) shown the effect of RSS and distance between MTs and BS to the handover delay, When the MTs velocity increases the RSS increase too, considering the velocity of the MTs where it becomes high, the effect of the RSS to the handover delay it becomes very influence, note that distance range from 7 to 10, the level of speed of handover delay is lower compare to the distance from 6 to 1, starting from 210 MT velocity the handover delay change to be more steady in increases value, the distance between the BS and MTs coincide with the delay,

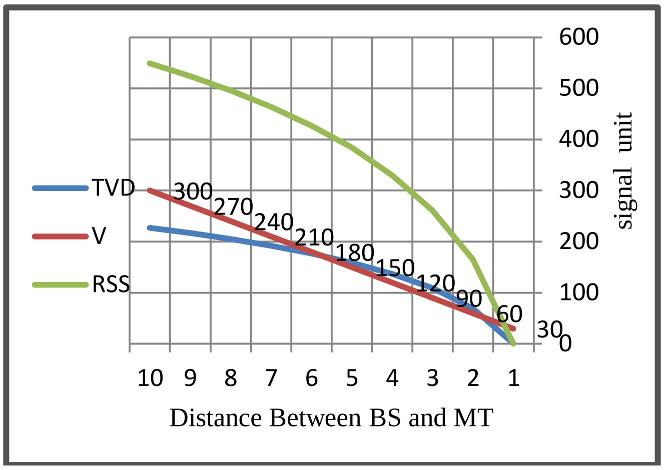

Figure 4. Effect RSS to the Handover Delay

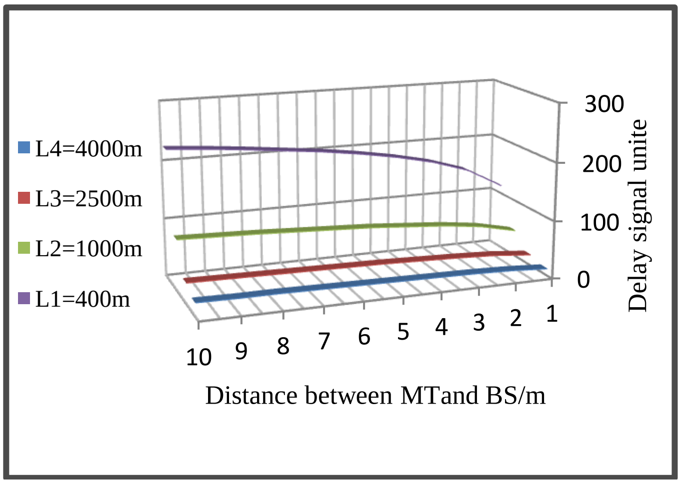

Figure 5. Effect perimeter of the Cell of LMA to the Handover Delay

The results shown that the cell size of LMA has an impact to the delay, the different perimeter of the cells in different levels has been investigated, with respect the different velocities levels of the mobile terminals, as described in the figure (5), the increasing of the delay is patent in the small perimeter of cells comparing to the large one. Because the numbers of consecutive times of approaching and crossing a high numbers of traffics within small cells size into the LMA where many signals cross the boarders, will waste the channels bandwidth , many processing will it take place in the handover operation , such as updating , registration, paging, where these processing mainly unnecessary. However, Its clear approach that, the large cell size will eliminate the signals volume from approaching the target BS at the same time, the pressure to the ba

ndwidth channels almost decrease, coinciding with this, the handover delay will decreases too, RSS has advantages ahead when becomes very close to the target BS, with strong signals, it support the MT to carry on the handover decision in short time, with no much delay.

7 CONCLUSION

It's still the handover delay in the WiMAX network has a major impact to the QoS ,in this paper we presented RSS and distance as factors in the modify algorithm , the results shown that the received signal strength in the high velocity mobile terminal is increasing parallel with the distance between the MT and BS, on the other hands, the increasing value could be steady after certain velocity, No much distance can affect the handover delay in high distance but it's clear that the handover delay record less delay in small distance, the reason is the RSS is becomes so higher to the target BS, which the chance to handover be high with respect the channel bandwidth. And with using different perimeter cells lengths, RSS records lower delay in a high perimeter cell size comparing to the lower cell size perimeter.

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