An Efficient Handoff and Buffer Management Scheme to Minimize Packet Loss Rate through Check-Point Retransmission in WiMAX 16m Networks

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Abstract

IEEE 802.16m standard redefined with many improvements on IEEE 802.16e standard to provide the best connectivity and to perform the error-free data transmission. In this paper we propose a buffer management system to reduce the packet loss rate during WiMax Communication where the internetworking involves designated distress regarding buffer range and traffic management. We evident that our proposed framework for 802.16m based network frames have efficient buffer management with effort from BS scheduler and subscriber station scheduler. These processes incur least bandwidth utilisation thereby reducing the transmission delay. All these domains were put forth through admission control (AC) mechanism and a dynamic buffer allocation (DBA) process which directly clears packet sizing and Buffer ranging. with accession from check point constraints where the left packets will be put into retransmission. Thereby it gives effective buffer management system with improved handoff standards between the sender BS and subscriber BS.

Keywords— *Transmission delay, handoff, check point, buffer range.*

1. Introduction

In wired LAN based network, fixed buffers are used. This increases the Round Trip Time delay for queuing data buffer for sending and receiving data. In this Delay may occur due to the data processing [1],[3] in case of fixed buffer size usage. To overcome this issue, the buffer size must be altered dynamically based on the available bandwidth [2],[3],[5],[6]. This approach reduces the overall round trip time delay of the host connected in a network. Some traditional techniques are also available for estimating the available bandwidth which uses the throughput to provide a coarse estimate of bandwidth. The bandwidth availability estimation is directly related to the throughput that the sender is willing to test at any instant. On a packet loss, this mechanism provides a loose upper bound for the available bandwidth. Packet loss is actually a better estimate of buffer capacities in the network, than of available bandwidth. Additionally, the cost associated with the deployment of a WiMAX 802.16m network is relatively low[7][4]. It is now economically viable to provide last-mile broadband Internet access in remote locations. WiMAX 802.16 was a replacement candidate for cellular phone technologies such as GSM and CDMA, or can be used as an overlay to increase capacity. Fixed WiMAX 802.16 is also considered as a wireless backhaul technology for second generation, third generation and forth generation networks in both developed and developing nations.

This paper mainly concentrates on the buffer sizing which is to dynamically alter its range in comparison with receiver packet size and with the cut-off packet size. The interoperability for the medium access control using static buffers in mobile subscriber station and in BSs are directly altered through our proposed methodology called Retransmission-check.

In most of the cities, backhaul for urban operations are typically provided via one or more copper wire line connections, whereas remote cellular operations are sometimes backhauled via satellite. An integrated Wi-Fi access point provide the WiMAX Internet connectivity to multiple devices throughout the home or business and the Ethernet ports are used to connect directly to a computer or DVR instead. One or two analog telephone jacks to connect a land-line phone and take advantage of VoIP. In other regions, urban and rural backhaul is usually provided by microwave links. (With an exception to this is , the network can also be operated by an incumbent with ready to access through the copper network.) WiMAX 802.16m has more substantial backhaul bandwidth requirements than legacy cellular applications. Consequently the use of wireless microwave backhaul is on the rise in North America and existing microwave backhaul links in all regions are being upgraded. Capacities are of between 34 Mbit/s and 1 Gbit/s are routinely being deployed with latencies in the order of 1 ms. In many cases, operators are aggregating sites using wireless technology and then presenting traffic on to fiber networks. For convenience introducing various ways to transmit packets ie from where the packet loss is initiated or in other terms where the packet transmission is broken.

2. Related work

The standard 802.16m is improved with its mobility and transaction compatibilities from its prior work. Handover in IEEE 802.16m systems is hard handover and network-controlled; that is, the network decides the target 16m BS for the 16m MS to hand over to, while some flexibility is allowed for the MS to suggest alternative candidates in case the target BS suggested by the network is not reachable. Controlled handover is assumed to be the default scenario in both systems, in which the serving BS tries to negotiate with one or more candidate target BSs for handover preparation by sending a handover request message to each candidate BS. The preparation includes resource reservation at the target BS (new station identifier, etc.), setup of a data forwarding path between the serving BS and target BS, and some optional radio resource reservation such as allocating dedicated random access code/opportunity for the MS to access the random access channel during network re-entry. The target BS replies with a handover response message in response to the handover request, which carries the aforementioned information for the MS. Such information is forwarded to the MS via the serving BS.

Once the handover decision is made, the serving BS sends a handover command to the MS to trigger handover execution. Upon reception of the handover command, the MS disconnects from the serving BS (i.e., hard handover) and performs network re-entry to the target BS specified in the handover command. The network re-entry procedures in IEEE 802.16m systems include downlink/uplink synchronization, request for uplink grants via a random access channel, and security key update. The MS may use the dedicated random access code or opportunity reserved by the target BS during handover preparation to perform the random access procedure to avoid contention. Subsequently, control signaling will be exchanged between the MS and the target BS to mutually verify identity and complete the protocol is sent from UE to the target . In IEEE 802.16m the serving BS will also keep the context of the MS until expiration of the resource retain timer or upon reception of release resource notification from the target BS.

The handover completion procedures in IEEE 802.16m systems consist of the network data path switching from the original BS to the new BS. Once the MS has finished network re-entry to the target BS, the target BS initiates a data path registration request to the data path anchor to request data path switching. Upon reception of the data path registration request, the data path anchor informs the old serving BS of the last packet for the MS and stops sending packets for the MS to the serving BS. The serving BS stops forwarding packets to the target BS once it receives the last packet indication from the data path anchor. The data path anchor then responds to the target BS with a data path registration response, and starts to forward packets for the MS to the new serving BS.

The MS is required to complete the network re-entry procedure within a duration defined by the target BS during handover preparation. If the MS has failed to do that, the handover is considered failed, and the MS performs cell reselection to find an alternative target BS (which may be the original serving BS) and performs the network re-entry procedure or initial network entry procedure if necessary.

The key factor to improve the handover procedure in 802.16m is reducing its latency to provide a better end-user Experience and to perform the error free data transmission

3. Proposed Methodology

In our proposed system the process of handoff is enhanced with the framework Retransmission-check. In addition to 802.16e WiMax standard, we introduce a check points where retransmission works are carried out through the efficient allocation of residual bandwidth for the remaining packets that are blocked or failed through communication errors. The following explanation makes it very clear to understand the whole process of our proposal where it starts with handoff operation in WiMax. Admission control mechanism in our framework allow only the noncompliant applications placed in a quarantined area, or by giving restricted access to computing resources. thus increasing the security by keeping insecure nodes which can infect the network, away from the communication network. This admission control in 802.16m allows the unauthorized application not to enter into our system of packet transmission and this whole system is shown in figure 1. Parallel to this, Buffer Manager will concentrates on the size of buffer in servicing BS and the target BS. This process gets input from the acknowledgement whether positive or negative. If acknowledgement is positive, then transmission is successful else negative, if there is a failure in data transmission .

Dynamic buffer sizing is implemented to achieve time delay reduction during retransmission. In our proposed system we use dynamic duffer ranging instead of reducing the congestion window. This can be initiated by monitoring the bandwidth availability periodically. Based on the available bandwidth along with the current packet loss rate, we can dynamically increase or decrease the buffer size. This avoids the unnecessary delay in RTT. Hence data transmission is faster than the before. This process leads our system for efficient throughput of packet transmission, exact utilisation of system resources .

Due to the non availability of the resources, some of the handoff initialization by the mobile stations will be rejected by the Admission control block. Once the admission control process in Retransmission-check rejects the incoming process, it will be sent to check point where it is a point in time, as of which the state of all the packets in the system will be preserved. When the system needs retransmission, it is initialized to the state at a demarcation event. In other terms this functionality of check point comes to consideration, only when there is a transmission failure. The check-point will have the complete log about the number of packets that are sent already, number of packets failed and the number of packets requires retransmission . The check-point will store the time value at which the transmission failure happened during the data transmission. Once negative acknowledgement is received, analysis is made for check-point recovery. This can be explained by considering a transmission of elementary packets which are 100 in number and during the transmission if the failure occurs at the time value measure at 80th packet the check point clearly holds the number and retransmission will be made with the contingency sequence of packet from where the flow is blocked.

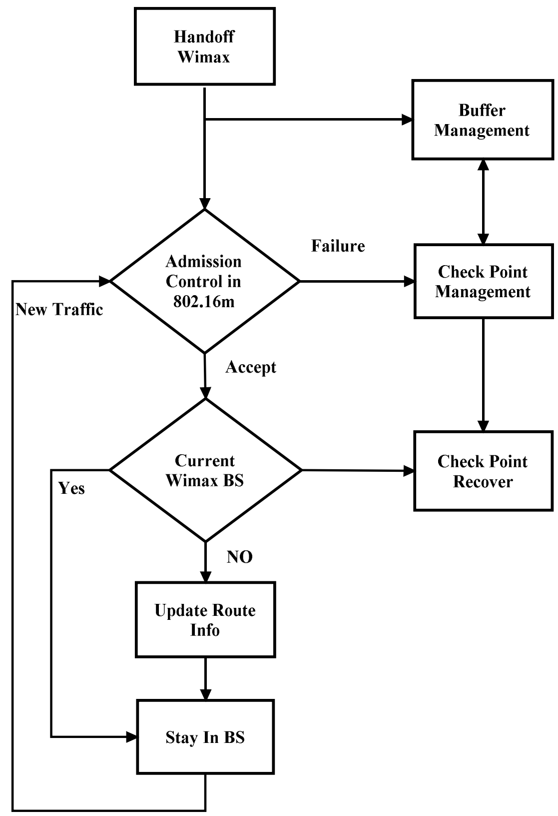

Fig.1 : Proposed frame work for WiMAX 16m Handoff

When the admission control mechanism accepts the flow is subjected exclusively to current WiMax BS. From here the handoff will be directed to two cases if WiMax BS is capable of accepting the incoming packets with respect to its size. The ranging is done in the BS's resource allocator which intern referred as buffer manager and stays in the BS subsystem. In extreme case of improper channel of bandwidth allocation the entire routing path will be examined for maximum possible optimal routing process. The new optimal route will updated in the already existing information regarding transmission control parameters like time and check points. Thus efficient routing along with improved handoff is achieved by the way of reducing time delay and packet loss during sending and receiving process at both the BSs thereby we can increase throughput of packet transmission.

4. System Implementation

In our proposed system framework, the transmission control is implemented in terms of above mentioned 802.16m protocol stack with handoff standards. The following flow will show the entire process in terms of codes with vital admission control mechanism, buffer management and check point management.

Proposed frame work for WiMAX 16m Handoff

Claim: Handoff in WiMax, buffer management, Check-Point management

Step1. Admission Control Mechanism in 802.16m

```
Admission access (acknowledgement ack)
   if ( ack == fail)
       do(buffer management && check point
           management)
          for (index packet = 0 to failure packet n)
             do ( maintain record of sent packet )
          if ( failure == 0 )
             do ( clear record )
         else
         if (failure == 1)
             do ( retransmission )
            index packet = n to failure packet m)
         else ( maintain record of sent packet )
   else (ack == accept )
         do(current WiMax BS = enable)
```

Step 2 :

```
if ( ack == Positive )
   do ( BS record = assign new traffic )
else
if ( ack == Negative )
   do ( route update ) go to Step 2.
```

5. Experimental Study

The conceptual arguments are put forth to prove efficiency standards in 801.16m is exponent when compared to the predecessors. We have presented more accuracy in terms of efficiency statistically. The consideration is made in order to show the advancement of every parameter like time, throughput, bandwidth, PDR, packet delay, admission blocking probabilities and packet loss rate.

In our proposed system with Retransmission-check for the data transmission the exactness is calculated with that of number of packets received in the mean interval of time. The following graphs are showing the analysis resultant of handoff in 802.16m with the green line indication and in 802.16e standard with the red line indication. In both the cases, time measurement is taken at equal interval which in seconds and the throughput is the average rate of successful data delivery over a communication channel. This data may be delivered over a physical or logical link layer, or pass through a certain internetworking node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot. This slot is drastically improved with a variance rate of more the 150 packets and show in figure 2.1.

The bandwidth though which the range within a band of frequencies or wavelengths is taken into consideration of our next test case and it is compared with packet delay rate. The amount of data that can be transmitted in a fixed amount of time is measured. And number of packet transmitted in that band is considered when packet loss occurs and the bandwidth is usually expressed in bits per second(bps) or bytes per second. For our system, the bandwidth is expressed in cycles per second, or Hertz (Hz). Due to imprecise handoff and dynamic buffering in both sides of base station the packet delayed rate is improved with intelligent check point management. Figure 2.2 shows incredible declination of packet delay with respect to bandwidth allocated.

In Figure 2.3 we have shown the increase of efficiency in terms of packet delay with respect to time factor again. In previous standard there is a gradual hike in the delay as the time increases incurring the conclusion that when the system begins its transaction it has least delay and when the traffic increases (time) the delay increases form direct proportionality. In our standard, packet delay is not linear and we got slight deviations and minimum delay because of dynamic buffering and periodic update of routing information for optimal routing path. Through admission blocking probability, the handoff is subjected to current WiMax BS and target BS reducing the probability more than 20 percent and is shown in figure 2.4. Eventually figure 2.5 indicates the vital packet loss rate which is taken into account with respect to bandwidth allocation and it showing that the rate of packet loss is directly proportional to size of bandwidth utility.

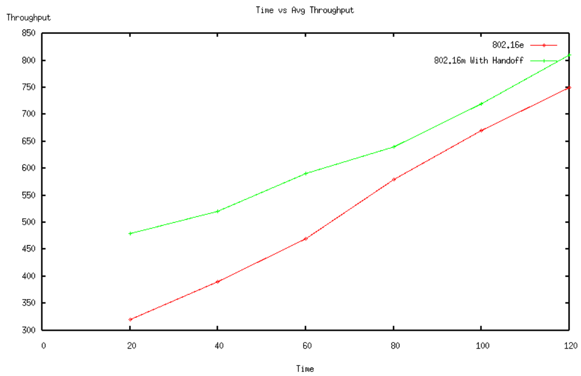

Figure 2.1 Time Vs Avg Throughput

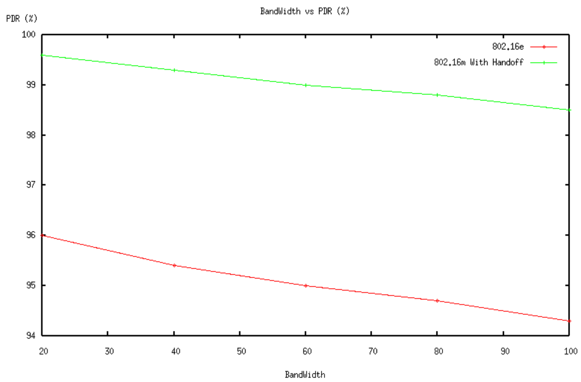

Figure 2.2 Bandwidth Vs PDR

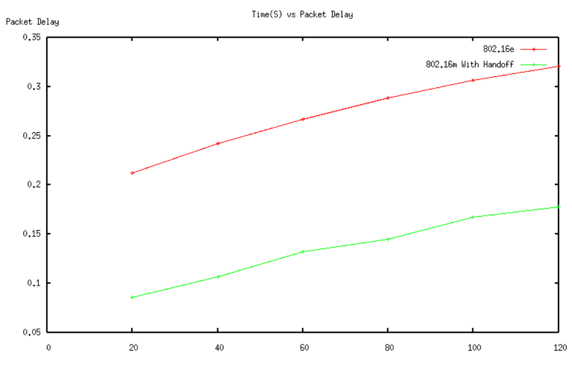

Figure 2.3 Time Vs Packet delay

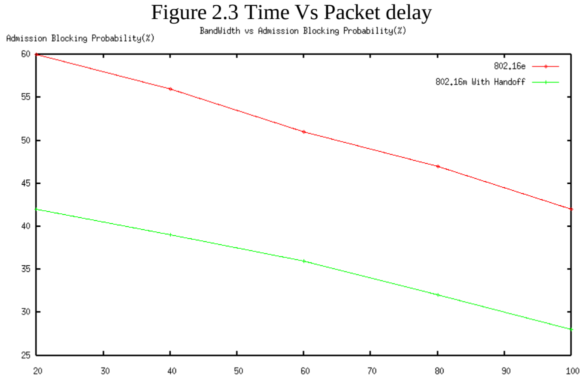

Figure 2.4 Bandwidth Vs Admission Blocking probability

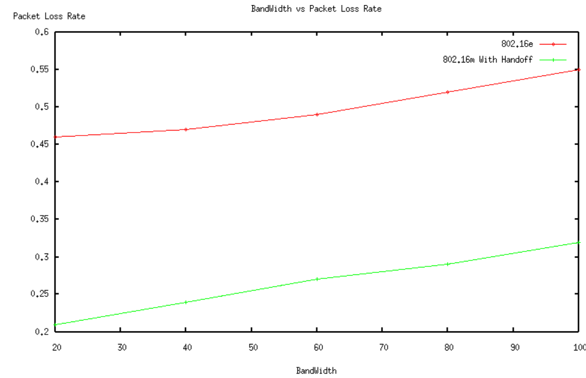

Figure 2.5 Bandwidth utility Vs Packet loss rate

All these works of experimental studies were carried out with NS-2 where the WiMax standards have verified through code and the parameters of the resultant graph is extracted through NS-2. The area of operation in WiMax handoffs and BS analysis are made under coverage region of 1500X300 consisting of 25 mobile hosts and their buffer ranging parameters with respect to packet size sent between those mobile BSs. Thus all the values which are necessary for the study is collected and simulation is made according to the outcome for the experiment and accuracy in performance evolution is given evidently.

6. Conclusion and Future Work

Our Retransmission-check framework for 802.16m delivers elevated liveliness of bandwidth across the transmission medium with efforts from 802.16m handoff and check point mechanism. Hence we can achieve dynamic buffer ranging for the failure recovery process through mechanism of check point. This suggests that the proposed model and utilization of optimization routing may be useful in terms of dynamically altering buffer ranging and handoff thereby increasing profitability of increased throughput, efficient usage of buffer, reduced overall round trip time delay and dynamically changing buffer size based on the available bandwidth according to specific Quality of Service constraints.

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