

Analysis of Adaptive Power Saving Mechanism in WiMAX Network for Wireless Communication

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Abstract--To give extra amplification and power for wireless access device like mobile terminals we use sleep mode operation using sleep mode time technique, initial size of sleep window, size minimum, size maximum and size window to listen the energy which can be efficiently utilized. This Paper, proposed a novel scheduling scheme that supports the efficient energy usage by regulating the sleep parameters for both the uplink and downlink traffic. The base station calculates the sleep parameters for real time applications by considering available battery life and traffic rate. The users of WiMAX and how they are utilizing the frequency efficiently in WiMAX network within the cell boundaries by the arrangement of the usage of power consumption at the WiMAX nodes and we have also used different delay constraints and traffic constraints.

Keywords-- WiMAX, Sleep period, Uplink, Traffic flow, Base station, Mobile station.

I. INTRODUCTION

The Wireless Interoperability for Microwave Access (WiMAX) is a wireless broadband access networks which is a very advanced technology recently and has a rapid progress. For batteries life in Mobile Station (MS) by power optimization usage in 802.16e IEEE has proposed the SM and mode of idle will decrease air disturbance in Base Stations (BS). An MS goes into serving BS for sleep cycle after negotiating in Sleep Mode (SM). Even more power saving is allowed the idle mode. Once enters into the idle mode a subscriber mobile station periodically receives downlink broadcast messages in interval of discrete. Re-registration or no handoff is needed though a mobile station move across base stations and hence

mode of idle is simple than the mode of sleep. The mobile WiMAX working group has listed these two modes as power saving mechanism that must be Implemented by electronic terminals. To Downlink

(DL) or Uplink (UL) traffic and they get formatting by MS as in serving BS and for MS the sleep mode adoption is optional but for BS it is compulsory. A connection-oriented is the key attribute of 802.16 IEEE which is on layer of MAC. Connections are recognized between a BS and a MS which can have unlike QoS (Quality of Service) parameters terms that service categories of normal operation, sleep state management for all MSs registered to it is performed by a BS. It buffers data in the register of MS in the interval of sleep and MS get notified through the indication of message to a switch in wakeup position. A mobile station continues to retain the management connection and perform periodic ranging at the sleep position. The BS will keep one or more contexts, for every involved MS, and it is related to some Power Saving Class (PSC). The demand properties have common group of connections and that can be described as Power Saving Class.

According to their activation/deactivation procedures, parameter sets and MS policies availability for transmission of data are of 3 types of classes of saving power named PSc of 1, 2 and 3 types. These three PSCs entail unlike saving power strategies to outfit for various business. The PSc of 1st type is used for links which are recommended for (PSnrt) Polling Service of non real-time and Service of (BE) Best Effort. A PSc's 2nd type be used for connections of the Polling Service real-time (PSrt), Polling Service of extended real-time

(PSert) and (UGS) Unsolicited Grant Service and a 3rd type be PSc is designed for the connections of multicast as well as for management operations. Before it enter into mode of sleep a request is sent by MS to its Base Station which requested it to enter into a mode of sleep and once a message is to grant the request has been received the MS will enter into a mode of sleep. A sleep mode is comprised of all sleep cycle consist of interval in sleep (T) as well as listening (L), interval in a Mobile station checks whether there is packet transmission to determine whether to keep sleep or to wake up, while in a sleep interval, an MS closes communication reduce power usage.

After first sleep interval, the mobile station enters into listening interval monitoring broadcast messages from the base station to determine whether there have been messages destined to MS in last sleep interval. Mobile station returns to wake mode after this listening interval, if there have been messages. Otherwise, it enters into the next sleep cycle awaiting received by MS which indicates the communication on the Listening interval (Ln) which show there is a transmission of packet beginning with BS at the infinity cycle of sleep. In the entire process of sleep, the MS periodically alternates in between the mode of sleep and mode of awoken.

II. RELATED WORKS

Many current explorations have found out that the energy problem usage in different mode of sleep and various power saving classes.

A Power saving schedule for one mobile station with multi UGS connections is proposes by Wen- Chuan Huang (2014) [1] uses a bucket checker algorithm.

Sunggeun Jin et al (2011) [2] projected a SMM (Sleep Mode Management) system that It minimizes power utilization by MS and limits delay of packets.

For each packet flow has set a minimum fair allocation is done by R.Murali Prasad et al. (2010) [3], here only the real-time connection is considered.

JianbinXue et al (2010) [4] proposed a system called time scheme of time to transit from the mode of awake to a mode of sleep and a sleep window sleep to another sleep window. It uses the power and circle the time gap required value.

Wen-Hwa Liao et al (2011) [5] Network will avoid interference in potential between the MSSs.

Arun M Bhaskaran (2013) [6] proposed a system that adjusts the sleep interval stated to the packet rate of arrival of the base station serving and to reduce the

power source the use of serving BS sources. The Authors concentrate on using WiMAX we can do scalable video streams and video quality while minimizing mobiles energy usage of mobile receivers in (2011) [7]. The two operations of SM and IM are done by evaluating the joint performance in WiMAX network (2012) [8].

The Sunggeun Jin et al. (2010) [9] examine numerically a presentation of mode of sleep operation IEEE 802.16m both serving non-real point and traffic of real instance simultaneously. Here (2011) [10] a system that with passion change a sleep of interval T happening on the traffic based time of service helping is introduced to reduce the transmitted overheads between MS and BS.

Harald Burchardt et al. (2012) [11] effectively control the uplink interference by minimizing the power of transmitting the interfering MS to denigrate the compromise in between the capacity of a system and efficiency of energy.

Georgios Paschos (2012) [12] Capture the action of single mode of sleep algorithm and provide an exact estimation for the case of hybrid using a combination of Hybrid mode of sleep algorithms.

YY chu et al (2014) [13] proposed an algorithm called uplink scheduling for saving energy uses centric method for a wireless broadband network admission.

arun M Bhaskaran et al (2013) [14] given an adaptive mode of sleep mechanism for 3G networks of WiMAX.

OAODV-Optimizing the Time to Leave (TTL) value based on priority for route discovery process of AODV protocol in MANETs R.Senthil Kumar (2018) [15] AODV protocol needs to establish the connection, first to route discovery process of route finding to a discovery process in network. A node source sends a message called Route Request (RREQ), spending an optimal TTL for route discovery value process and range propagation of process of route discovery.

Ankur Ashok Acharya et al (2017) [16] have concentrated on two main attacks in DDoS which looks to be simple but causes heavy damage on the network. The raw data which is captured is investigated whether the size of raw data is according to the size of standard. If the captured data is not according to the size of standard then it could be called as the packet malformed or a malicious.

III. INFERENCE FROM RELATED WORKS

In related works many researchers have proposed numerous technologies to optimize the power utilization on the WiMAX network; we have mentioned those techniques in the above survey.

IV. WIMAX METHODS ON ENERGY

From the study made on the existing systems, it is clear that there are many systems for sleep management. But the best system is to schedule the uplink traffic by the base station for efficient sleep management. This paper focuses on the sleep management. In order to identify a better radio source consumption in heuristic manner, the energy saving centric uplink scheduling applies the SBT concept of Energy Saving Centric Scheduling (ESCS) method is used which properly manages the QoS for uplink scheduling. In this manner, for better sleep arrangement BS will schedule the traffic when BR receive from MS for finer efficiency of sleep and to decrease shift between the awake mode and the mode of sleep, connections of both (non-real time and real-time) are examined in the scheme of scheduling. ESCS will apply "Sleep before Transmission" (SBT) will succeed in best radio usage in heuristic manner. This system provides user satisfaction and better energy saving as shown in below table I.

TABLE I
RANGES OF MOBILITIES

	Fixed access	Limited mobility	Full mobility
Dominating Standard	802.16-2004 IEEE	802.16e IEEE	
Services	choice to T1,dsl, wire backhaul for cellular & Wi-Fi	bonus: voip, QoS application based; enterprise networking	benefit: handoffs have mobile access(data),some roaming and interworking
Form factor CPE	External---CPE Desktop---CPE PCMCIA---Client built in		
price tag CPE	\$500-\$300		\$100
Markets residential	areas which are Underserved	Deployment is initially in aggressive markets	Underserved and competitive markets, mobile users
industry markets	areas which are Underserved	Underserved and competitive areas	Underserved and competitive markets, mobile users

To achieve broadband wireless access, WiMAX will use OFDMA technique for radio resources uplink process, insertion to allocating the resource of radio for the traffic downlink. Traditionally and a good way is efficient energy consuming and to arrange in uplink order in the time period of transmitting and receiving which is shown in the below table II.

TABLE II
REQUIREMENTS FOR 802.16m

Necessities	Advanced-IMT	SRD 802.16m
Efficiency of Peak spectral	UL:6.75(2*4) DL:15 (4*4)	DL:8.0/15.0 (2*2/4*4) UL:2.8/6.75 (1*2/2*4)
Efficiency of Cell spectral (Hz/b/s/sector)	UL (2*4)=1.4 DL (4*2)=2.2 (urban Base coverage)	UL (1*2)=1.3 DL (2*2)=2.6 (Mobility varied)
Cell edge user spectral efficiency (b/s/Hz)	UL (2*4)=0.03 DL (4*2)=0.06 (urban Base coverage)	UL (1*2)=0.05 DL (2*2)=0.09 (Mobility mixed)
Latency	U-plane: 10ms C-plane: 100ms (at rest to active)	plane-U: 10ms plane-C:100ms (at rest to active)
Mobility b/s/Hz at kilometer/h	0.55 at 120 km/h 0.25 at 350 km/h	Best performance of upto ten kmh "Graceful degradation" upto 120 km/h "Connectivity" upto 350 km/h upto 500 km/h depends on top of frequency operation
Interruption time Handover (ms)	Frequency Inter: 40 (with in group) 60 (among the groups) Frequency Intra: 27.5	Frequency Inter: 40 (within a group) 60 (among the groups) Frequency Intra: 27.5
Capacity of VoIP (users Active/MHz/sector)	40 (4*2 & 2*4) (urban Base coverage)	60 (DL 2*2 & UL 1*2)

A. WiMAX modules to save energy

Two major algorithms focused by the system model it shows the bandwidth allocation and sleep cycle decision. Uplink will generate and waits for time slot. MS will give BR message to the BS resources for transmission when MS will have to wait for traffic. BS will be assigned to the time period for MS for proper algorithm allocation. Farthest frame

Will allocate for nearest and it begins by BS, on the basis of concept of reserving. Then Base Station in anticipation of a frame with bandwidth reserved arrives notifies the mobile station to be asleep, if BS will reserve the bandwidths for MS in the frames in further. Compared to traditional scheme, the reservation based approach allows sleeping time and still maintains the QoS requirement. The unallocated bandwidth will be remembered by the BS for earlier BR given and the present BR is an essential bandwidth for the traffic which is newly generated and when the Base Station receives an aggregated bandwidth request. The incremental BS approach assumes that when the MS has to wakes from the period of sleep. The traffic will generate in sleep period and hence a more number of bandwidth may require for MS than mentioned previously in the BR. The bandwidth of BR comprised in the MS bandwidth and originally MS will transmit the time slot traffic when it starts and prescheduled has to take by the bandwidth of previous BR. Since the MS remains same for prescheduled transmission frames which are reserved. Therefore, the bandwidth availability to a reserved frames initially allocated by BS is extended. For a long sleep time, if the received bandwidth is not satisfy as per the frames. The BS primarily allocates the bandwidths residual for the III frames which are prescheduled. After that the allocated information to BS at the further frames informs MS to be in sleep mode. The resource allocation bases provisioning only when the threshold is more because the sleeping time of BS will never give a chance for MS to sleep. Tolerable delay will appear in the request of MS to sleep entry. The scheme decides the fastest frame which can be allocating for issuing BR without spoiling the QoS desire. The major nrtPS connections parameter is MRTR and the delay tolerance is critical for the connections of rtPS when efficient resource utilization is taken care and hence accepted fastest frames.

B. Pooling to save energy in WiMAX

In radio resources for MS the reservation based allocation will be used to make the most of the time of sleep and to reduce inactive time. The radio resources will not been allocated in the MS and we will not the required residual bandwidth of the BS as well as MS.

C. System architecture for saving energy

Two types of system architecture were present in WiMAX, as shown in Fig. 1. Too many RSs were connected to the upper WiMAX tier multiple APs are connected in the lower WiFi tier. RS & AP is like parent and child related wire line connection. Not in necessarily overlapped APs are adjacently covered in wireless. WiMAX network will cover the complete wireless service but it's not been covered by WiFi technology. We should understand that both WiMAX and WiFi are related for same service. Dual 802.16b/g & 802.16e are the dual equipped MD for interfacing method.

Synchronized Power Saving Mechanism Management will reduce the MSSs mitigate energy used timings and exchanged the messages. We first need discuss the working condition of uplink (UL-MAP) and down link (DL-map) messages and it is very important in QoS services. Configuration describes the power consuming algorithm. DL-map & UL-map these two are the listening windows of synchronization. MSS has to wake in the entire algorithm and this is the common window in all the network algorithms and its common idea for less the power usage, in the manner of data reception and transmission functions.

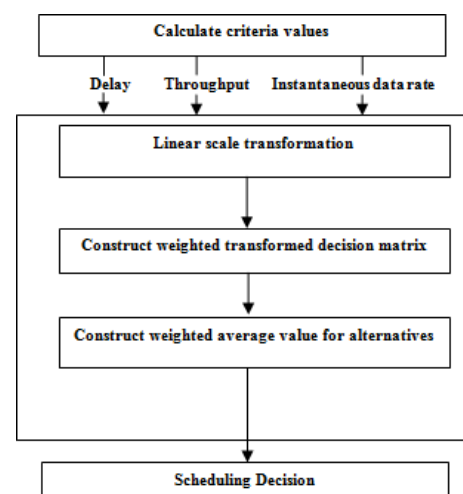


Fig. 1. System flow chart

V. PROPOSED METHODOLOGY

The message MOB TRF IND, these are the following messages we used in MSSs downlink (DL) and by this method we can assume the data. By

synchronization method of downlink and uplink we can consume more energy source, and it boosts the power saving performance the BS can deliver the current WiMAX frame to generate burst downlink when the messages delivering status. Under the certain condition we inform for related MSS. sleep mode or awoken mode condition will take place in MSS window but its reverse in the listening window. Fig 3 shows the listening window and downlink synchronization (DL-MAP) and to speed the delivery time we use uplink (UL-MAP) this improves energy level of the messages. All algorithms will not get synced with uplink and downlink in advanced power saving scheme and in sleep mode technique also. When downlink map bursts then uplink will have the capabilities of handling the burst signals. In the current WiMAX frame MSS will miss to get authorized. It has to wait until of getting next frame message the sleep mode of MSS window and as well as synchronization of WiMAX signal will always make high in the delivery time.

TABLE III
EFFECTS ON FREQUENCY

EFFECT PROPERTIES	HIGHER FREQUENCY	LOWER FREQUENCY
Authentication	High	Low
Antenna	Smaller Antenna	Larger Antenna
Weather Effect	More Effected	Less Effected
Bandwidth	High	Low (less)
Data rate	High	Low rates
Frequency Reuse	Allow more frequency reuse	Low frequency reuse
Mobility	Poor mobility	Below 10 GHz Good mobility

The table III describes the effects on frequency on wireless networks where WiMAX can provide High data rates with highest coverage area.

VI. EXPERIMENTAL RESULTS

Here, by increasing the ranges of the base station will improve the energy of a wireless access network in WiMAX. Thus the larger area can be covered by only one Base station. Through this the power consumption increases only 2 to 3 percent, which results in higher energy efficiency.

The experimental results show the placements of the nodes in the area or in the cell in order to use the frequency efficiently.

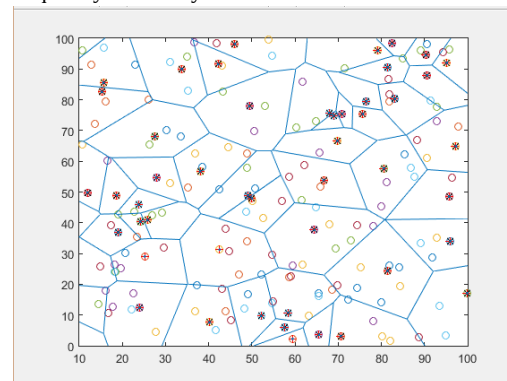


Fig. 2. Field Dimensions for the nodes

The figure 2 shows the pattern for efficient usage of frequency in a cluster of cells where in this simulation we have taken random numbers of nodes along through X and Y axis.

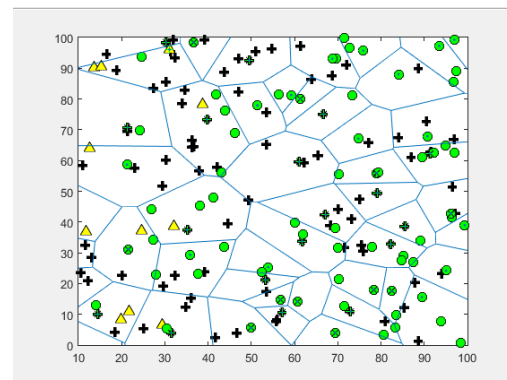


Fig. 3. An election of optimal for possibility of a node to turn into a head of the cluster.

In the figure 3 we have considered the possibility of a node to become a head of the clusters using optimal election algorithm.

TABLE IV
COMPARISON OF POWER UTILIZATION

Number of Nodes	Average energy utilization in joules	Average Power Consumption in joules	
		Existing Method	Proposed Method
50	10.35	14.05	11.15
100	17.72	20.05	18.55
150	23.16	27.10	24.05
200	38.58	42.92	39.87

The above table IV assumptions are done to simplify the calculation and when the packets are transmitted to the mobile station there is no delay occurred and neglecting the energy utilized by other system operations which are relevant to the OS.

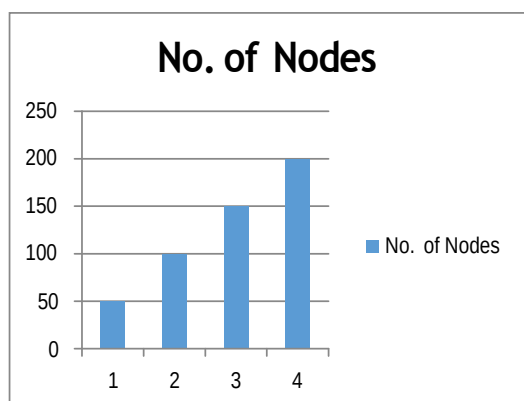


Fig. 4. Total number of nodes considered for simulation with respective iterations

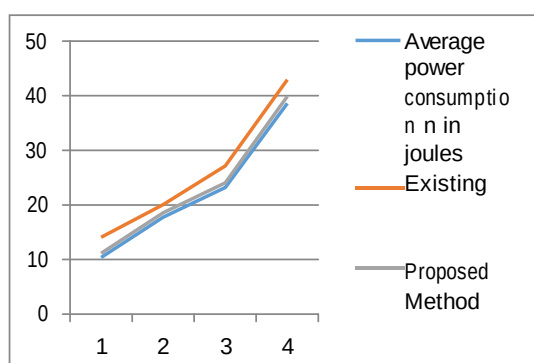


Fig. 5. Comparison graph b/w existing and proposed method

VII. EQUATIONS

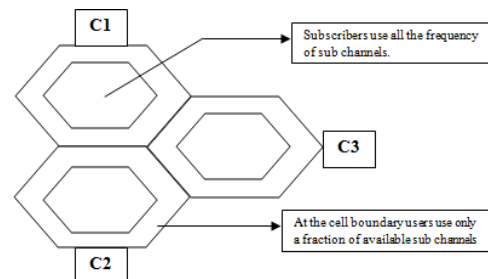


Fig. 6. Usage of frequency of sub channels in a cell

$$E = C * S * F \quad (1)$$

The above equation (1): E defines the efficient use of frequency by the subscriber in a cell, C is the number of cell per cluster, S is the number of sector in a cell and F stands for number of frequency allocations per cell.

In the results we have shown the nodes in the area uses the pattern for efficient usage of frequencies.

VI. CONCLUSION AND FUTURE WORK

The number of nodes inside a cell is fast increasing, and these users request for increasing bit rates thus we proposed an efficient use of frequencies in order to reduce the energy consumption of these nodes. Operational modern smart-phones most important performance is filling up the accumulator and this is new device for customer and this is the most use full in the field of battery usage & design it has been performed for system optimization in regards of energy consumption. How to reduce the battery power in the sending and reception end and it analyze the spent data in the battery usage saving protocols new energy has been emerged to know different factors detail knowledge in impacting energy. Form analytic model measurement results have been derived for energy calculation has been submitted to per bit, these can be incorporated in level of system simulators for the estimation of the efficiency of energy which is recently emerged protocol.

In our further work, the same method we are applying with different modulation techniques in WiMAX we effort on the way of switching mechanism, which includes polling the loads of nodes in a network, using the Adaptive modulation and Enhanced coding, we also consider enhanced energy optimizing parameters, 802.16s IIoT concept and reducing the consumption of power in a network.

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