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Multiple Transceivers for IEEE802.16 Mesh Network to Avoid Confusion Routing and Scheduling

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Abstract- **The speed of data transfer and the amount of space within the communication service, taking into account the cost, security, capacity, and specifications of WiMAX is highly important in communications. There are varies difficulties for routing in WiMAX, for example, delay, long scheduling, interference and progressively stringent Quality of Service (QoS) backing and burden parity. This paper proposes a multi-transceiver and multi-channel centralized routing and scheduling algorithm to avoid the impact of packet collision with neighbor nodes. The proposed algorithm looks for a short path from the subscriber station (SS) node to Base station (BS), while the optimal path is achieved when the whole path has the lowest (energy bit minimum routing (EBMR)). After the route is fixed, and the traffic demanded at each node is known, the total traffic arriving at a node is centrally scheduled in order to avoid the transmission interferences. The results from the multi and nearest multi-transceiver systems showed that the proposed algorithm has effectively minimize the length of scheduling in the in multi \ nearest multi -transceiver system. Moreover, the channel utilization ratio (CUR) is found to be improved over the implementation of the proposed system.**

Keywords: **WiMAX, IEEE802.16, optimization, EMBR.**

I. INTRODUCTION

WiMAX has some excellent characteristics such as Quality of Service (QoS), high capacity, high security, scalable infrastructure, ensuring coverage to the last level, promoting broad range mobility, quick rollout and low cost. Thus WiMAX is ideal for carving a vast area as Metropolitan Area Networks (MANs)[1]. The broadband wireless connectivity has increased an extended interest in the past years due to the high data storage efficiency, adaptable portability and QoS requirement in the remote arrival system. WiMAX, which is based on the IEEE 802.16 standard [2]. The WiMAX determines two unique methods for the network depend on the link mechanism for the nodes :Point 2 Multipoint (P2MP) and mesh mode. In the P2MP fashion, traffic is coordinated from the Base Station (BS) to Subscriber Stations (SSs), or on the other hand the other way around. In this manner, the SSs should be inside the transmission direction and view Line Of Sight (LOS) of the BS. In the mesh, mode not all SS units must be directly linked with BS [3, 4]. The SS can connect with another SS directly without a need of the BS, from the source to destination. In WiMAX the MAC support two sort scheduling: centralized and destitution. The BS is responsible for characterizing the timetable of transport in the whole system, and whole bundles ought to be shipped through the BS scheduling centralized mode [1, 5]. In scheduling destitution, increasing SS goes after the channel uses a pseudo-irregular estimation of control decisions based on the two-jump neighbours' results. Information sub-frames are distributed dependent on demand award affirm three-path handshaking among the hubs. That, scheduling would be more able to secure request for QoS [6]. Nevertheless, backhaul transmitting capacity is a real constraint for increasing QoS in multi-jump single-channel work systems. To take care of the issue, various channels are provided between BS and SS to extend the connections' transmission power. In WiMAX function systems multichannel fashion delivery has greater fashion efficiency than one-channel communication. A multi-channel MAC functionality is performed as a multi-channel multi-transceiver or multi-channel one- transceiver [5, 7, 8]. Although multi-channel multi-handset can prompt superior efficiency, it might increment drastically the expense and the equipment multifaceted nature. For multi-channel WiMAX work systems for streamlined planning, the multi-channel single - transceiver frame is better suited. In Han [9] using the system signal-channel, and depend on the algorithm for routing to the selected the PN with the lower least ID number which does not improve the scheduling routing number which does not improve the scheduling routing . Subsequently, this system will suffer from interference. Additionally, Peng [8] used the system multi-channel, single-transceiver whereas each node is

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tuned for varies channels, when the node changes between the different channels it needs the time for changing causing delay for in the response system. In this paper, we present the streamlining of directing and scheduling planning calculations in the IEEE 802.16 have become significant research drifts in the WiMAX work systems, give QOS, reduce interference, get a shorter scheduling length, improve system performance, equity and balanced load by choosing the optimal path, and build routing tree scheduling tree. which depending on the algorithm it used. The WiMAX mesh topology used to centralize scheduling and boost the output method by finding the best route by using the EBMR algorithm to centralize mesh network; afterwards, increase latency, CUR and the scheduling of distances. So stop interfering. Multi-transceiver network used to prevent primary interference and multi-channel network used to stop secondary interference. The main intervention is identified when we ask Node to send and receive two instructions concurrently at the same time, for example. And secondary interference exists when the transmission of one channel may be affected by opposing connection interference.

Besides the measurement of the Energy Bit Minimum Routing EBMR-CS1 and EBMR-CS2 takes into account opening reuse, simultaneous transfer, amount of bounces, reasonableness and the optimized method to achieve the best output method; IEEE 802.16 efficiency.

I. NETWORK MODEL

The BS is the key station that links the network through Backhaul Network to other networks. The other stations are usually called SSs. There are no downlink or uplink concepts within the mesh networks. The mesh network is similar to P2MP but in the mesh the connection is between nodes without reference to BS [7, 10].The Mesh BS allows the assets. This alternative named brought together routing as shown in fig.1.

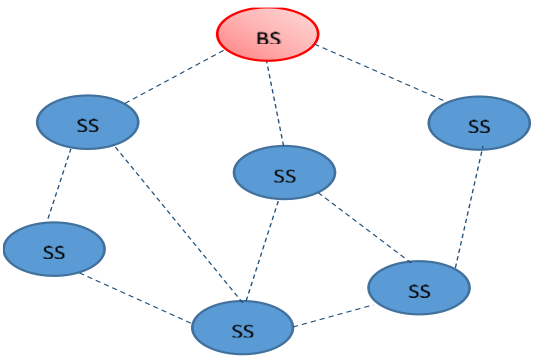

Fig. 1. 10 Nodes mesh topology network

In the wireless communication, the transmission signal suffered from the attenuation; one of type this attenuation is path losses, which depend on the range (R) between two nodes and effect on the quality of the signal. Can determine the value of the path losses by using the NLOS equation [1].

$$\text{Path losses} = 122.5 + 26.5 * \log(D) \quad (1)$$

When two nodes one of them sending and the second one receiving the transmitting and the receiving process is done successfully if and only if [2]:

$$PT_x - 10log_{10}(BW) + GT_x + GR_x - Path\ losses - 10log_{10}(KT_0) + Noise\ figure > (SNR)_{threshold} \quad (2)$$

When represents the power of the antenna, BW the perfectly bandwidth, are the transmitting and receiving gain at the receiving and transmitting antenna, respectively. The amount minimum of SNR threshold as shown in the table below must be the amount of SNR for the link between two nodes bigger than SNR threshold according to the type of the modulation to connect.

By using direct graph G(V, E) method to build the mesh topology; depending on the amount of the SNR threshold according to sort of modulation for example; when used QPSK ½ must all the amount SNR (listed in table I) for all links bigger than the 9.4 (SNR>9.4). To fulfil the connection between the two nodes.

TABLE I: SNR THRESHOLD

No.	Modulation types	Coding rate	SNR threshold (dB)
1	BPSK	1/2	6.4
2	QPSK	½ ¾	9.4 11.4
3	16-QAM	½ ¾	16.4 18.2
4	64-QAM	2/3 ¾	22.7 24.4

III. EBMR-CS ALGORITHM

The directing or routing tree assumes a significant job to lessen the connection obstruction, improve load balance obtain QoS. routing will have an immense effect on the framework's display and will usually select the start to finish.

The way of a data stream comprising of numerous connections and assessing the general execution of the course sensibly to pick the best courses is likewise an open issue. The objective of this study is to survey several

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directing calculations suggest by different creators for IEEE 802.16 work systems [12, 13]. The routing technique is utilized to move traffic from a hub to the BS to figure out which way is achievable. Starting at the BS, the hubs of SSs are individually included in the list. After the network diagram is acquired the guiding tree created. Since the EbM design reduces the vitality used per bit send for the BS job, the general use of vitality reminds a base of the amount of bounces not being considered. In Wireless MAN/HIPERMAN frameworks, this capacity dealt with by the Mesh Networks Configuration (MSH-NCFG) message. The estimate energy bit (n) = energy bit (n, PN(n)) is the dissipation energy per unit information byte got via the parent hub PN(n) from hub n [12, 14].

$$EB(i) = \sum_{v \in path(i)} e_b(v) \qquad (3)$$

To register the energy metric Eb(i) dissipation for all path the directing way from hub to Mesh BS [15], as shown in figure (2). The BS picked as the modern routing tree's root hub. For every one of the applicant supporter hub prospective node, n is the hub at neighbours in the directing tree however as at present not in the tree themselves from now on, the direction of BS function is decided by selecting the path to the smallest energy (E) and its parent hub PN (n) is chosen accordingly [15, 16].

$$PN(n) = argmin\{E_b(i) + e_b(n.i)\} \qquad (4)$$

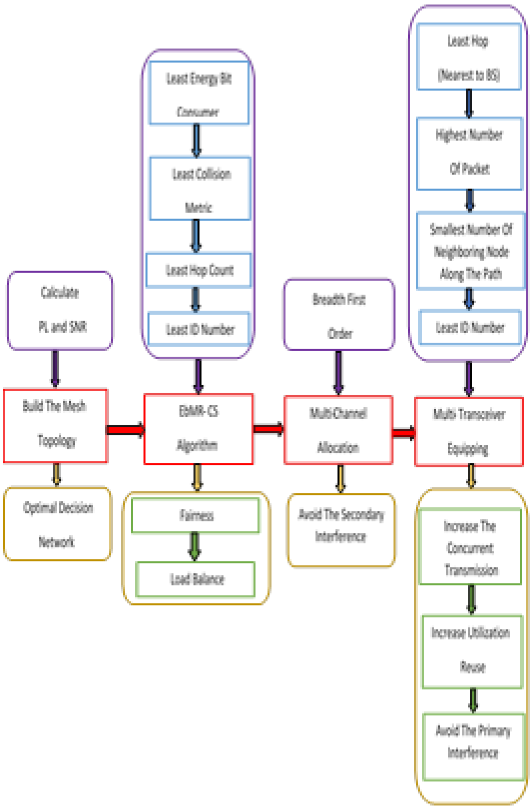

Fig. 2. Main structure of the EMB scheme

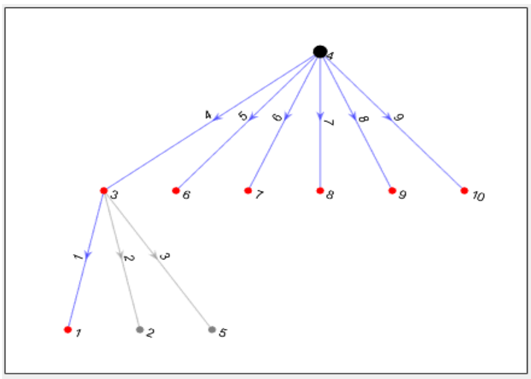

Fig. 3. Shortest path smallest id EMB_CS algorithm

Usually, this method submits a hop up count to hit the BS. This result assign shorter hops at higher complexity in modulation. To comprehend this technique as seen in figure (3). However, the routing algorithm using Peng [8] depends on the smallest number node of the ID to select the timing for tiebreaking .

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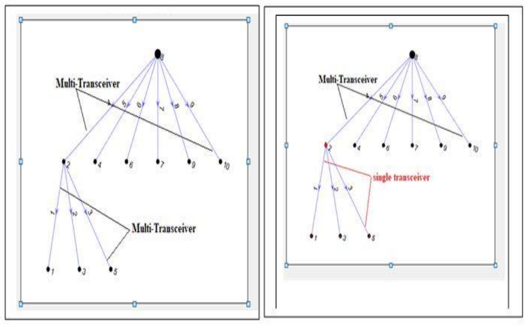
Obviously, from figure (3), firstly determine what is the BS, the BS is the node has the greatest energy and much more connection in the first mesh topology graph. Then applying the EBM-CS algorithm would arrangements the shortest distances based upon the minima energy and the smallest hop number and less Id number.

IV. MULTI-TRANSCEIVER SCHEDULING ALGORITHM

Multi-Transceiver system is use to eliminate primary interference. This system operates per the assumption the WiMAX standard. Which Assume each transceiver tuned at the one channel; any two-shop pair of nodes with different channels it is not considered an interference; the contact range of each node is only adequate to cover the adjacent one-hop; Concurrent contact without interference on a variant channel is possible. The main programming is to use timeslot and simultaneous communications to generally use a timeslot and to achieve maximum computer performance. To this end, simultaneous transmissions must be optimized, although network interference removal is also required. The traffic conditions of the various SSs network should therefore be considered. The first is the multi-transceiver systems that allow posting and reception at any node simultaneously [17, 18]. two central algorithm scenarios of distribution mechanism for the multi-transceiver where used. Second scenario: the nearest dual transceiver network (two transceivers have just the closest nodes to the BS). Only the nodes closest from BS will simultaneously pass and receive. The Hop count, the depend model, node ID, reuse time slot, competitor transmittance and equity (fairness constraints to avoid hunger from nodes further from BS) are considered in both the centralized schedule algorithm scenarios. To construct the centralized scheduling mechanism is to awareness all interfering nodes in the forward connection and to permit the simultaneous transmission of without interfering nodes for optimal bandwidth usage. This means the algorithm considers four essential metrics; these are the closest node to pass the system bottleneck (mind hop count for BS), traffic number (package number) to ensure parity between node numbers, interfering node number, and simultaneously to optimize the timeslot for reuse [13, 19] finally to break the tie among nodes, the Node ID number is Used. Multi-channel multi-transceivers result in shorter schedules, higher system performance, improvement of CUR and free channel access for collision. In contrast to the single transceiver system, it can therefore have a better ranking. The proposed structure has excellence performance and it used in mesh networks fundamental of WiMAX. However, better system efficiency was achieved in WMNs [14].



(a) (b)

Fig. 5. Transceiver topology: (a) PN with multi-transceiver and the edge SS have single-transceiver (applying EBM_CS1); (b) PN edged without transceiver but the edge SS has a single transceiver with PN (here node 2, applying EMB_CS2).

V. Simulation Setup and Results

Right now, the efficient measurement for EBMR-CS was generated at the point where the optimal routing and scheduling system was collected, which was tested through simulation. The introduction for the EBMR-CS in the simulation under survey using MATLABR2019a. A recreated configuration collected and arrived at the midpoint contains up-interface flow. The different jump from the SS. The n of bundles where selected for parcels with the inclusion of 5 nodes.

Tree routing is based on the EBM algorithm. The multitranscever nodal distribution will depend on two scenarios, the SC1 will supplement two transceivers while CS2 will provide the nearest two nodes only. The CUR will then be calculated based on which scenario was used [15].

$$CUR = \left(\sum_{k=1}^{K} \frac{active\ links}{(K * edges)} \right) \quad (5)$$

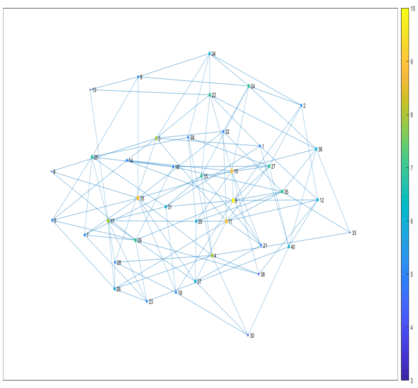


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Fig. 6a . Mesh topology colour energy bar with the highest energy assign as BS

Now, we defined the throughput time as following [15]:

$$T_r = \frac{\sum_{i=1}^{N} D(i)}{\sum_{i=1}^{N}(d(i) * h(i))} \qquad (6)$$

Where the shortest distance from BS, to the all PN and SS. h(i) traffic from/to Mesh Subscriber Station (MSS) i to be relayed slot times. Typically speaking, the first step in the simulation results is precisely the node-based BS nodes with the most connections and the highest degree of energy as seen in figure (6a), then find the routing tree during the EMB-CS algorithm based upon the smallest distance and id number as shown figure (6b).

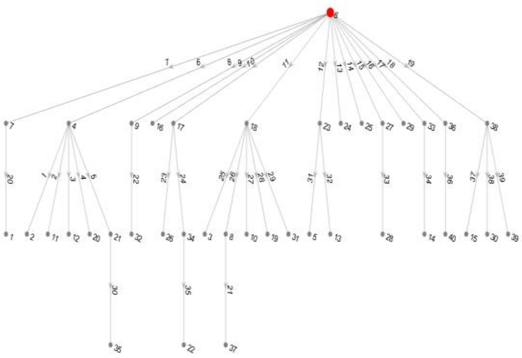

Fig. 6b. Routing Tree with priority weight Id

There are two cases considered for comparison in this paper with Peng [8] study:

Case 1: We consider the packet number for each node to be one packet, and then calculate the scheduling longitude, CUR, and finally the results, respectively through figures (7) to figure (9).

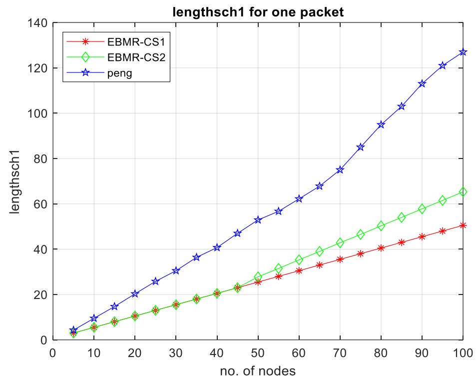

Fig. 7. Length of scheduling for one packet

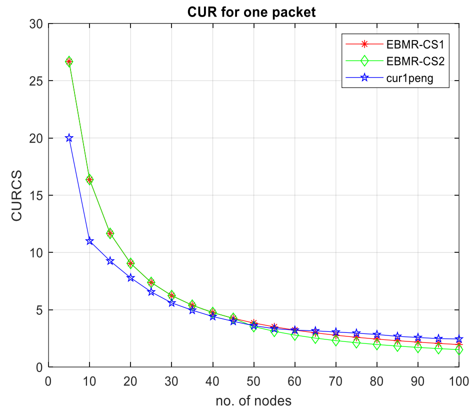

Fig. 8. CUR for the one packet, using two EMB algorithms

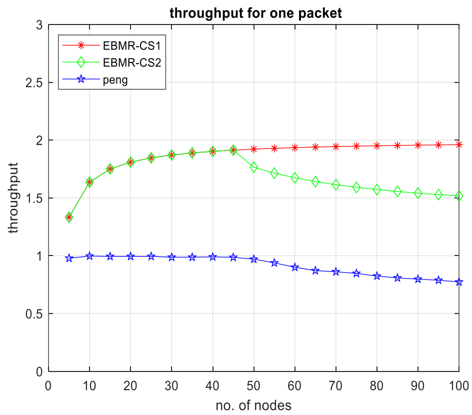

Fig. 9. Throughput for one packet case

Case 2: For each node, adding the two schemes by supposition is one to three packets. Figure (10) displays the test results of Figure (12), respectively.


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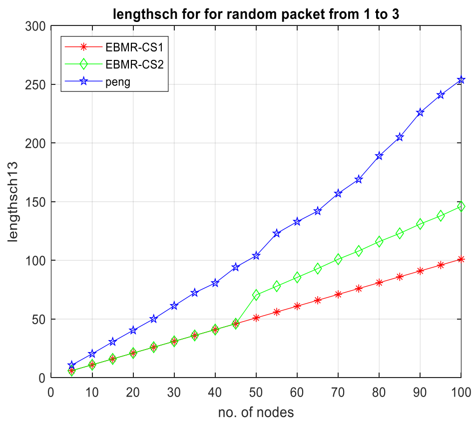

Fig. 10. Length of scheduling for 1 to 3 packet for each node

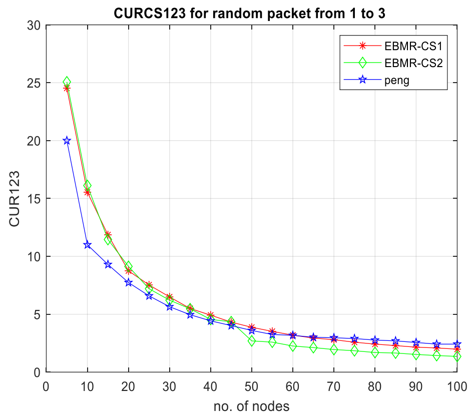

Fig. 11. CUR for one to 3 packet, two EMB-CS schemes

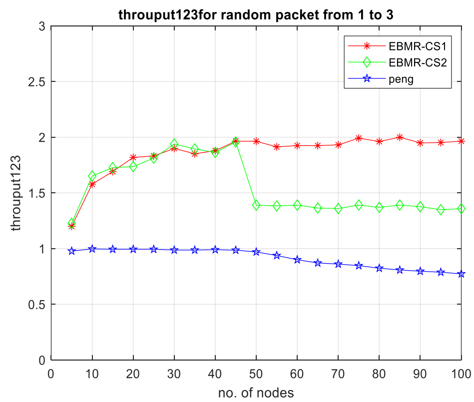

Fig. 12. Throughput for 1 to 3 packet

Obviously, as the number nodes of the network are increased, the CUR will decline from figures (9) to (12); the amount of interruption SSs when the additional consumer in the network increases the level of network interruption; therefore, the simultaneous communication decreases. Additionally, the rise in packet numbers will lead to an increase in CUR. And the performance of the EBM-CS1 is much better than the EBM-CS2 and Peng [8]. Basically have demonstrated the effectiveness of the EBM algorithms.

VI. CONCLUSION

In this paper, routing and scheduling in WiMAX are active areas of research, in which EbMR scheme have been proposed in an attempt to increase the system throughput, minimize length of scheduling, increase channel utilization ratio and provide more robustness over the wireless channel. Algorithms suitable for avoiding collision and traffic scheduling mechanisms have also been discussed. Furthermore, both the routing and scheduling algorithms for the proposed structural design were studied. In particular, the EbMR routing and centralized scheduling for the multi-transceiver and nearst multi-transceiver by considering different aspects which include spatial reuse, concurrent transmission, as well as the number of hops, fairness and balanced network, have extensively been investigated. The MATLAB simulator was used to evaluate the performance.

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