Designing Route Algorithm for WiMAX Centralized Scheduling Mesh Topology to Prevent Interference

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ABSTRACT — **The (BS) is a decision maker in WiMAX unified scheduling mesh topology for scheduling the whole network including packet distribution between the (SSs) in the network through the BS. Hence the device, which particularly affects the nodes close BS through interference. A unified network routing algorithm called Mesh Topology (EBMR) was developed, This algorithm use to maximize route chosen, and equipped all nodes with a multi-channel and planned two scenarios: the first scenario named the Multi-transceiver equipped all (SSs) with a multi-transceiver except at the brink. While the second scenario called closest, multi-transceiver system, in this scenario only the closest (BS) was fitted with the (SSs) by multi-transceiver that is known to be 35 per cent of the overall network nodes. Both scenarios can increase network performance, throughput, scheduling range, and usage ratio of channels (CUR).**

Keywords— **WiMAX, (EBMR) algorithm, the Multi-transceiver system, Nearest Multi-transceiver system, Optimization.**

I. INTRODUCTION

WiMAX has some excellent characteristics such as QoS (Quality of Service), 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 the vast area as Metropolitan Area Networks (MANs). WiMAX has a topology of two sorts: P2MP and Mesh. In the (P2MP) the passage information is just between the (BS) and (SSs), but in mesh topology the passage packet directly from the (SS) to another [1, 2]. The (MAC) used the (TDMA) technique for allotment the time slot on the frame and in WiMAX the (MAC) support for two sorts scheduling centralized and destitution; The BS is tasked with designation the scheduling for whole network and all packet posting during the BS but in the distribution scheduling be between only the (SSs) without return to BS. In mesh centralize scheduling the BS collection the all demand from the (SSs) subsequently. The BS get up allocation the required amount for every (SS) ; for this possessing used (MSH-CSCH)message. It is grant broadcast from the BS to all SS; for spread the nodes, link and scheduling tree configuration information to all (SS) in the mesh network the Mesh Centralized Scheduling Configuration (MSH-CSCF) signal is propagation by the Mesh BS and then re-propagated by intermediate (SSs) [3, 4].The author [5] using the system signal-channel and signal-transceiver subsequently this system will suffer from the primary and secondary interference. In [6] using the system multi-channel ,signal-transceiver ;in this system each node tuned for varies channel ,when the node change between the different channel it need the time for switching, thus will be delay. In [7] design the system multi-channel and equipped the (SSs) only 30% nearest from (BS) by multi-transceiver , and for scheduling depend only ID number to tiebreaker ,it is don't effect the scheduling.

For this article, the WiMAX mesh topology used to centralize scheduling and boost the output method by finding the best route by using the (EBMR) 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.
The rest of the paper is organized as: in section 2 presents the method of mesh network construction, the minimum energy bit optimal algorithm presents in section 3. Chanel allocation and multi transceivers techniques explained in section 4 and section 5, respectively. Finally, section 6 is the simulation results that demonstrated the proposed algorithm and section 7 is the remakes of conclusion.

II. CONSTRUCT THE MESH NETWORK

In wireless communication, one of the most critical factors affecting the quality of communication is attenuation, and one attenuation type is path losses for NLOS and depends on the range between the nodes (R) by the equation:

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

Therefore, the SNR value is calculated based on the path losses value and the connection between two nodes is achieved only if the SNR value is higher than the threshold limit SNR values and the threshold for SNR value varies depending on the modulation type used in the network according to the equation below[8].

$$SNR = PTX - 10log_{10}(BW) + GTX + GRX - Path\ losses - 10log_{10}(KTo) + noise\ figuer \quad .... (2)$$

Connecting only two nodes achieves this condition:

$$SNR > SNRthershold \quad ..... \quad (3)$$

Nodes are randomly distributed to create the mesh network. There is a selected relation between two nodes. This relation is determined by the path losses and SNR. The relation is linked if the SNR is found to be bigger than the SNR threshold. The relation fails otherwise. It is repeated until all nodes choose their neighbors. The path losses and the SNR are used in this way to minimize the number of ties to make optimal decisions for selecting their parents by using the routing algorithm. Choosing the BS as the highest energy node in the mesh would be effective directly on the design of the connection and avoidance the interference in future. Figure 1 shown the different between choosing the BS always as the node 1 and choosing the BS as the highest energy

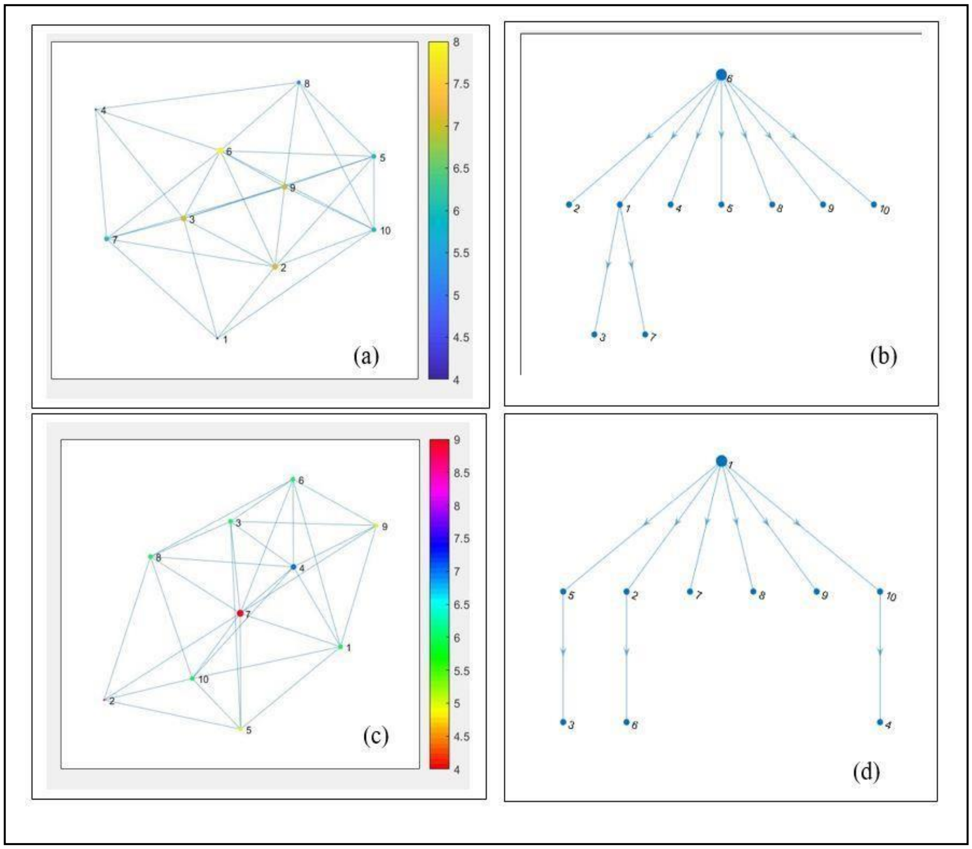

Figure 1: Mesh topology of the network with 10 nodes: (a) Choosing BS as the highest degree energy; (b) the scheduling tree for a; (c) Choosing BS always node 1; (d) Scheduling tree for (c).

III. DESIGN THE EBMR ALGORITHM

The routing strategy is used to transfer traffic from a node to the BS in order to decide the potential path. As such, this paper only takes account of static paths. Start with the BS. After the connectivity graph is obtained the routing tree is constructed. As the EbM model reduces per-bit energy used to the mesh BS, overall power consumption without regard to the number of hops shall be kept at least. The Mesh Network Configuration (NCFG) messages are used in the wireless MAN / HIPERMAN systems. Ebit(n)= ebit(n, PN(n)) energy value is the energy dissipation for each unit byte of the data obtained from node n by the parent node PN(n)[9]. Therefore, by selecting the path with the least energy (E) and parent node PN (n), the BS mesh route assumed; only 30% of the total number of the network nodes is assumed PN. And to tiebreaker select the less collision matric, less hop count, smallest ID number respectively, figure 2 illustrated the EMBR algorithm working by moving from BS to the edge.

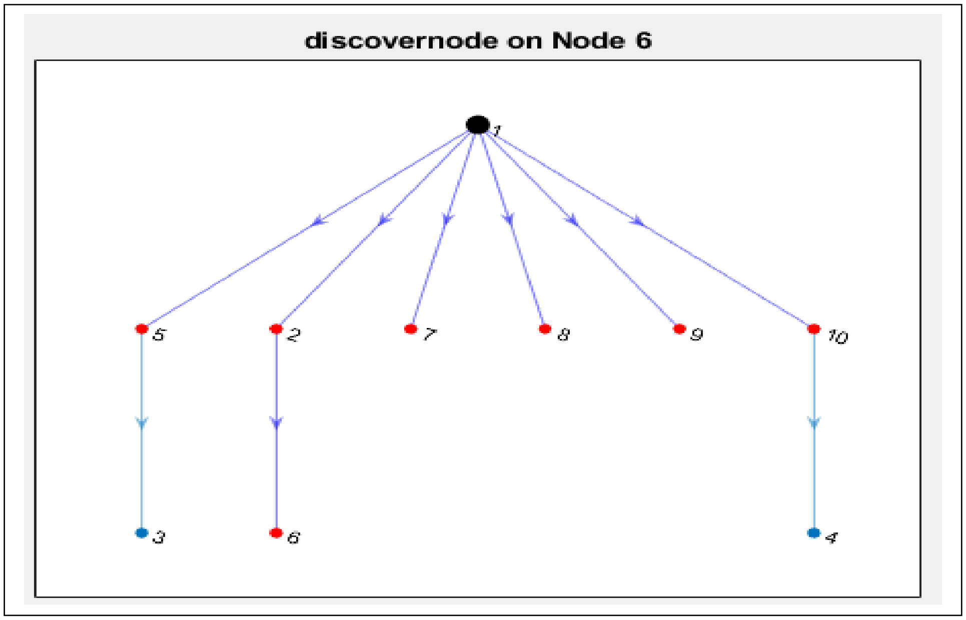

Figure 2: EMBCS discovering edge.

IV. CHANNEL ALLOCATION

by using Breadth First Order identify which network nodes will identify as BS and are chosen based on the node that has the most connection, therefore determine which of the SSs is closest to BS have one hope, then assigning the SSs with a BS the number of jump is larger than one. In addition, the edge's designation. To assigning the channel at first to select the node have the primary and secondary interference, then allocated the different channel for (PN) by choosing the nearest and smallest ID number node; if these nodes do not suffer from the primary and Secondary interference will be delegated to this node by the similar channel but if this node suffer the interference assigning the new channel.

V. MULTI-TRANSCEIVER

Using Multi-Transceiver system for eliminate primary interference. The operation of this system as 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 it be optimized, although network interference denial 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, [10-13]. Used two central algorithm scenarios of distribution mechanism for the multi-transceiver. 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 [14-18]. Used finally to tiebreaker among nodes is the Node ID number. 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, [19].

VI. SIMULATION MODE AND SIMULATION RESULTS

In this paper, The effective EbMR-CS programing it is design to find the optimum routing and scheduling to be determined by simulation. The efficiency of the EbMR-CS system is evaluate in the simulation (MATLAB R2019a)[20]. First, we build the Mesh network and assign any nodes that have the most link to appoint them as BS. We then convert the mesh topology to the Routing Tree by setting any nodes that represent the PN that is closer to the BS which have a single jump with the condition that the number of PN does not exceed 30% Of the whole of the network; Therefore, the farthest nodes that separate from the BS are determined more than one jump. the nodes on the end of the tree that nodes are the edges according to the EBMR logarithm, which is applied to the two scenarios. Then, distribution the multi-transceiver for all nodes in the network except on the edges this scenario represent the EMBR-CS1 algorithm which it is multi-transceiver. And the second scenario equipped only the nearest nodes from the BS by multi-transceiver, it is represent the EMBR-CS2 algorithm .We took into consideration the cost in the second system EMBR-CS2 so we have limited the number of transceiver by equipped only nodes near the BS by Multi transceiver. Both the EMB-CS1 and EMBR-CS2 find the scheduling length, CUR, and throughput, then compared this result with the result obtained by Wang in [6]. The result obtained from simulation for scheduling length as illustrate in figure 3; These results are imposed each node sent one packet only. We also note that scheduling length is directly proportional to the number of network subscribers. It is clearly from curves the EBMR-CS1 have shorter scheduling length if compare with EBMR-CS2 and the Wang[6].

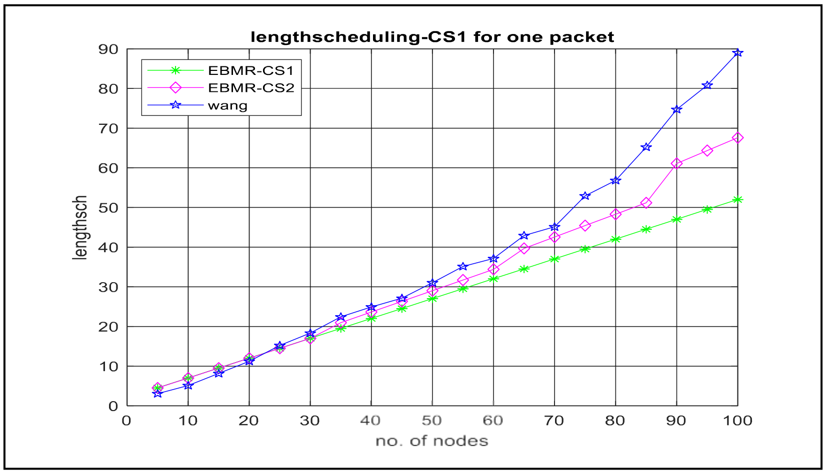

Figure 3 : Length of scheduling for one packet**.**

The results for the scheduling length with a random packet number generated from one to three appear in figure 4. Moreover, one packet each time slot should be sent to the transmitter. This situation is also less long in EBMR-CS1 for scheduling the EBMR-CS2 and Wang[6].

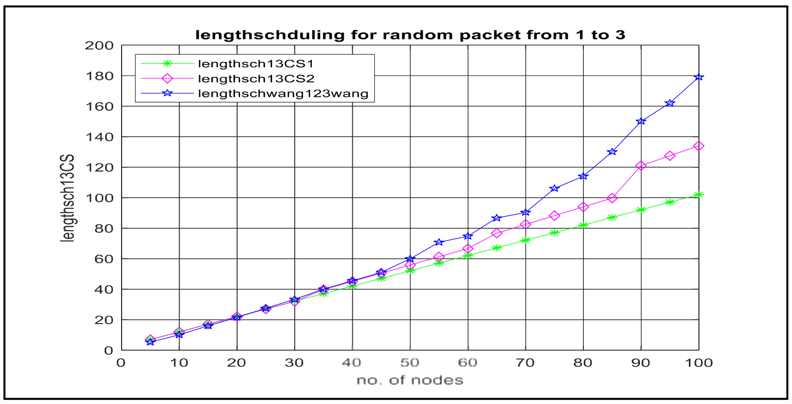

Figure 4: Length scheduling for random packet between1 to3.

For the CUR, the results of one packets at figure5 and for the number generated in figure 6 are randomly 1 to 3. Calculate the CUR according to the scheduling length it previously got. We note when increasing the number of CUR nodes that decreases the rate of interference SSs as the additional nodes in the network raise the frequency for network interference; consequently, the simultaneous transmission decreases. Furthermore, the rise in packet numbers would lead to an increase in CUR. The CUR for EBMR-CS1 and EBMR-CS2 best from Wang [6] are reported in figure 5 and figure 6.

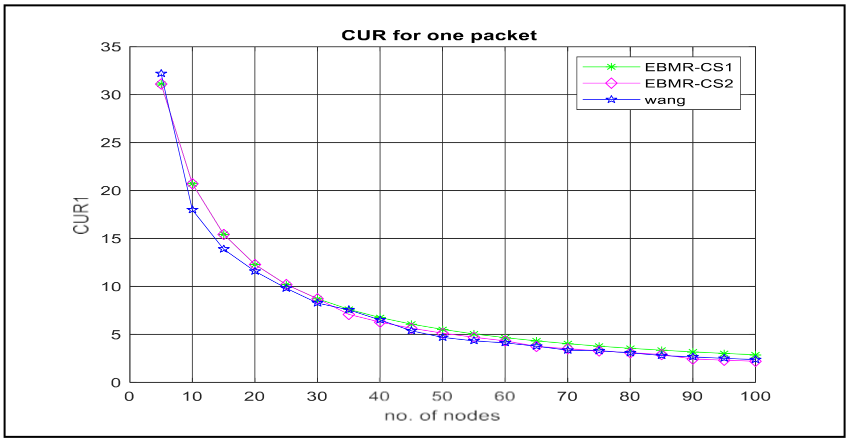

Figure 5: CUR for the one packet.

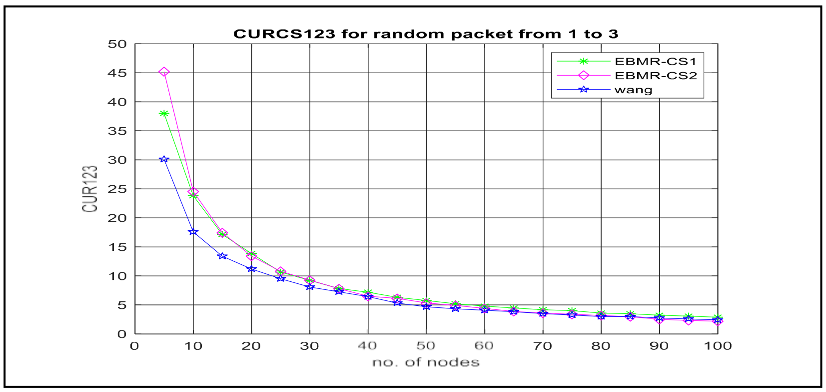

Figure6: CUR random packet from 1 to 3.

In Figure 7 and figure 8 show the simulation result for throughput; can be noted the performance of EBMR-CS1 is best from EBMR-CS2 and Wang [6]; because in this system equipped all node by the multi-transceiver except on edge; But the EBMR-CS2 system is reasonable, given that it is lower costly.

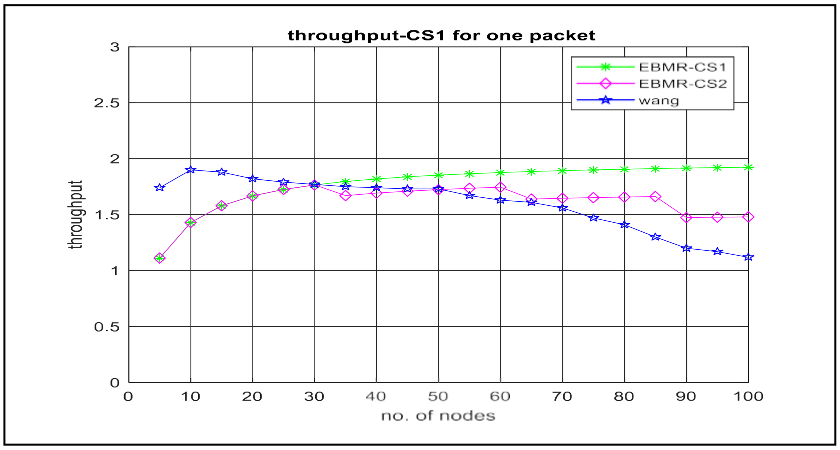

Figure7: throughput for one packet

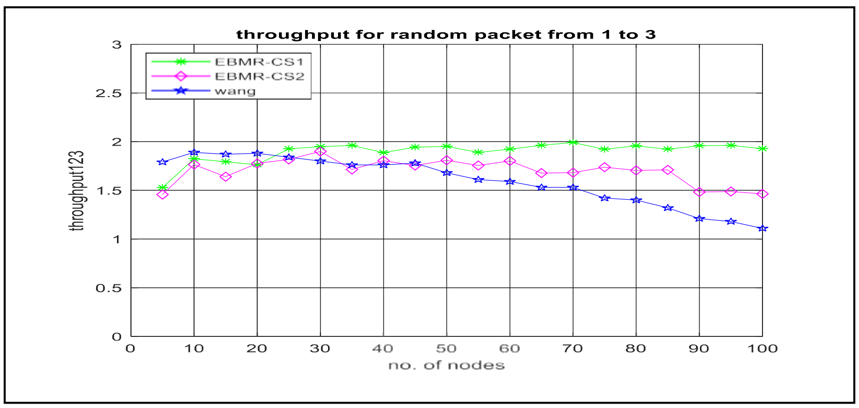

Figure 8: Throughput for random packet from 1 to 3.

VII. CONCLUSIONS

WiMAX routing and scheduling are important research fields where several algorithms are proposed to boost system performance, minimize scheduling time, increase CUR and enhance wireless channel robustness. The related routing and timing issues with WiMAX still leave many testing concerns unanswered. Interference affects WiMAX-focused networks very strongly. In this paper EbMR-CS1 and EbMR-CS2 are proposed to improve network capacity by unified WiMAX scheduling. The EbMR-CS1 and EbMR-CS2 especially use multi-transceiver and multi-channel systems. This would completely remove interferences. The simulation result shows that the suggested schemes have reached shorter scheduling distances, a higher CUR and a higher machine efficiency than Wang[6]. Around the same time, in the centralize mesh networks configured on WiMAX, it ensures fairness and greater loading, particularly when the nodes are increased. In addition, the algorithms expand time slots for reuse and simultaneous transition, Allowing the simultaneous transition of non-interfering connections. In addition, the proposed EbMR-CS can prevent packet loss and allow for collision-free operations; work in this article can be extended in several ways. Subsequently, as there are several tracks available, traffic flow can be more increased. Secondly, SS mobility is introduced to equate the performance with IEEE 802.16d and IEEE 802.16e.

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