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Extended buffer zone algorithm to reduce rerouting time in biotelemetry systems using sensing

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ABSTRACT
Mobile Adhoc Network (MANET) routing methods must deal with connection breakdowns caused by frequent node movement, measurement and a dynamic network topology. In these cases, the protocol must discover alternate routes. Rerouting time refers to the lag that happens during this retransmission. Researchers have proposed many ways to reduce rerouting period. One such technique is buffer zone routing (BZR), which divides a node transmission region into a safe zone adjacent to the node and a hazardous zone towards the end of the broadcast range. This technique, however, has rare gaps and restrictions, such as the ideal dimensions of the buffer zone, a rise in hop duration, network stress, and so on. This study offers a method to improve or expand buffer zone communication by grouping nodes inside the buffer zone into virtual zones based on their energy flat. When the routing decisions are made quickly, the energy consumption of the nodes is minimized. In the safe area of extended BZR, transfer time is reduced, and routing efficiency is increased. It solves issues in the present algorithm and fills holes in it, decreasing the time required for rerouting in MANET.

Section:RESEARCH PAPER

Keywords: Routing; buffer zone; measurement; rerouting time; virtual zone

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1. INTRODUCTION

A Mobile Adhoc Network (MANET) is a dynamic network made up of several nodes. An ad hoc is a self-contained system that operates without the assistance of a centralized authority. Routing is a difficult operation outstanding to the flexibility of the nodes. The ad hoc changing architecture causes frequent route breakups. Route failure has an impact on network connection. Furthermore, the nodes are reliant on the partial battery power. A lack a power in any node can lead to network apportioning [1]. Routing is the main function to guide communication across extensive networks. The basic duty of every routing is to find and preserve routes to the network destinations necessary. Ad hoc network routing protocols are distributed into two types such as reactive and proactive and. Proactive is the circumstance in which a node may send data to a certain terminus as soon as it receives it. A reactive routing protocol, on the other hand, determines a route as and when it is requested by a network node [2]. This article is about Mobile Adhoc Networks that employ a proactive routing system. Because of their dynamic topology, link breaks are a typical feature of Mobile Adhoc Networks. In such circumstances, the routing protocol must seek alternate routes [3]. The rerouting interval is the period earlier new pathways are identified, and the rerouting time is the period of the rerouting interim [4]. Stale routes exist across the broken connection during the rerouting interval. Only when the routing protocol detects that the connection is damaged can rerouting take place. In fact, detecting the connection break accounts for a considerable portion of the rerouting time [5]. In summary, the rerouting time due to connection breakdowns is resolute by the time obligatory to complete the following processes:

- Link break detection.
- Network-wide linking-state notification of new pathways
- Draining of everything stale packets from output queue.

The basic duty of every routing protocol is to find and preserve routes to the network endpoints necessary [6], [7]. Ad hoc network routing protocols are separated into two classes such as, proactive and reactive [8]. This article is about MANET environment that employ a proactive routing system. Because of their dynamic topology, link breaks are a typical feature of MANETs. In such circumstances, the routing protocol must seek alternate routes. The rerouting interval is the period earlier new pathways are identified, and the redirecting time is the rerouting break period [9]. Stale routes exist across the broken connection during the rerouting intermission. Only when the routing protocol detects that the connection is damaged can rerouting take place. In fact, detecting the connection break accounts for a considerable portion of the rerouting time [10]. In summary, the rerouting period due to connection breakdowns is determined by the time essential to complete the following processes. In research work, BZR interact and update their routing tables once the nodes are live. In addition to the neighbouring information, the virtual zone information of the node in EBZR is also efficient in the routing table. This data is then used during the choice to route. Finally, the routing could be achieved by continuously measuring the available zones, interference levels etc.

The remainder of the paper is structured as trails. Section II first provides the different linked works. Section III describes the background of the Optimized Link State Routing (OLSR), the Zone Routing Algorithm (ZRA), and link breakage and redirection time. The proposed method is obtainable in Section IV, along with a comprehensive discussion and its benefits. Simulation results are provided in Section V, with the performance comparison charts of the standard OLSR, Buffer and Virtual zone algorithm. Lastly, in Section VI, the scope for areas of future work is outlined out, with the conclusion.

2. RELATED WORK

This article is a continuation of [11] which examined Mobile Adhoc Network routing protocols and metrics. It was discovered that rerouting time is a significant enactment measure. Other authors, [12] offer an adaptive retry edge technique to decrease rerouting period. It also identifies stand in line as one of the key variables having a significant influence on rerouting time. The recommended remedy was also put into action and tested. G. Jisha and S. Dhanya [13] offer a review of different zone-based routing enhancements in Mobile Adhoc Networks. Other than the fundamental protocol implementation, this article performs a poll on ten other enhancements offered to Zone Routing Protocol (ZRP). It also analyses these enhancements and recommends apps that are best suited to them, [14]. This article implements a virtual zone-based routing enhancement technique that is described in this study. The authors present a novel zone-based routing algorithm for MANET in [15]. To discover numerous stable routes among the source and destination nodes, the proposed technique integrates the concept of a buffer zone with the OLSR procedure offer a trust-based computation method for improving the security of zone-based routing. When a lot of net nodes disobey and lose data packets, the performance of a vulnerable ZRP is tested. The OLSR is protracted in [16] to preserve node energy. In the Qualnet simulator, the presentation of the projected system is evaluated in terms of control overheads, energy ingesting, end-to-end latency, and packet delivery ratio (PDR). The author from [17] have investigates the queuing problem and proposes methods to decrease queue stagnation. The author from [18] investigates the Adaptive retry limit approach of eliminating the queueing problem in Mobile Adhoc Networks. It also proposes a solution of asynchronous invocation, where the gaps in the adaptive retry limit approach are addressed. As a result, queueing is eliminated, and the rerouting time is reduced in Mobile Adhoc Network routing. The simulation findings show that when the Buffer Zone Communication is implemented in OLSR, the rerouting time is decreased. When associated to regular OLSR, the addition of a transmission buffer zone improves throughput. The use of a buffer zone is advantageous in both traffic situations of low and high [19].

3. BACKGROUND

3.1. OLSR

The OLSR is active in nature and routes for all network destinations are accessible immediately at each node. The Open Shortest Path First is an optimisation of the pure link formal routing protocol (OSPF). This method is linked to the multi-point relay idea (MPR). A multi-point relay minimizes the control messages' size [20]. The usage of MPRs also reduces control traffic flooding. Multipoint transmits forward control memos that give the benefit of lowering the sum of transmitted broadcast control memos. The OLSR has two main features: neighbor detection and topology distribution. Each node constructs routes with these two attributes for all known destinations.

The HELLO and (Topology Control) TC are the two most significant messages in OLSR:

1) HELLO messages: Each node transmits HELLO messages on a regular basis to allow connection sensing, neighbour discovery and MPR selection signalling. The suggested HELLO messages emission intermission is 2 seconds and neighbour info time are 6 secs. A neighbour is deemed lost 6 secs after the neighbour received the last HELLO note.

2) TC messages: The link state (TC) messages are generated and transmitted via the system by every MPR, based on the information collected via HELLO messages. For TC communications, the optimum emission interval is 5 seconds and the hold duration is 15 seconds.

3.2. Zone Routing Algorithm

This method relies on the definition of nodes as safe or insecure, and whichever use as relay nodes if they are benign or avoid as relay nodes if they are insecure. In addition, if possible, traffic to hazardous nodes within the transmission region of the transmitting node should be tried through secure nodes. The signal power of the Hello packets may be used as a criterion to identify in which nodes and what zones with different mobility speeds are regarded acceptable and unsafe. To support surrounding nodes in the routing of their unsafe neighbours, each link admission in the Hello packets needs to be included in the zone status and communicated to other neighbours. A packet must not be routed to a relay node that has an unsafe neighbour as its destination. The routing table for every node is chief designed on the basis of the safety zone nodes. If this leads to dividing, it is included in the routing table to cross nodes in the dangerous zone. The buffer zone routing theory applies exclusively to the nodes in the harmless zone as realized in Figure 1. The nodes in the dangerous BZR must only be utilized to forward if complete connectivity without them is impossible.

As the neighbour defines the two-hop neighbour and topology set and no route modifications are allowed on the already specified routes. If a node is already shown as a

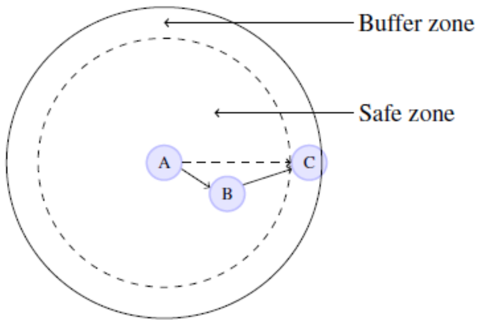

Figure 1. (A). Communication area zones of node (B) safe node (c) unsafe node.

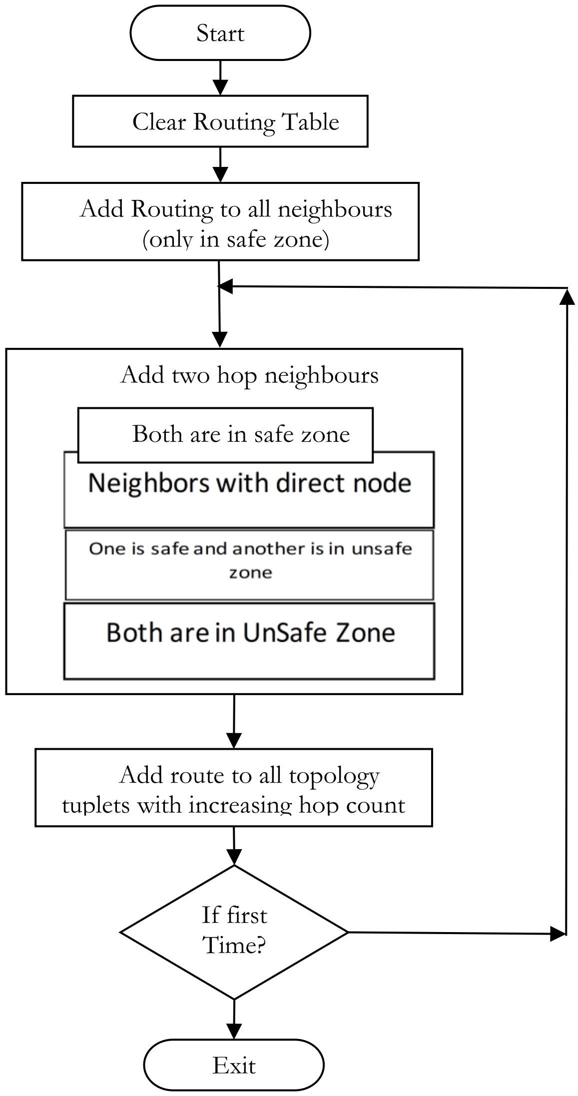

Figure 2. The Zone Routing Algorithm.

destination in the routing database, the afresh identified route to the similar destination will be ignored, even if it has fewer hops than its first route. In Figure 2 the phases of the buffer zone routing method are depicted.

3.3. Rerouting Time

One typical feature of ad hoc systems is that connections may break because of variations in radio circumstances, node mobility and other dynamic network. In these cases, the routing is meant to locate other paths. The period before novel paths is

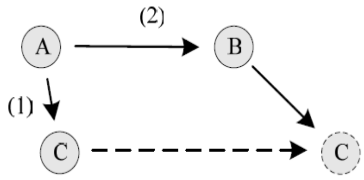

Figure 3. Rerouting Time.

discovered is termed the recirculating time, and the recirculating time is called the recirculating time. Take the experiment represented in Figure 3, i.e., the period since the disruption of the link between A and C (1) to the re-establishment of connection via the intermediary node B (2).

3.4. Queueing and Rerouting Time

Different conditions affect the timing of return in MANET. Queueing is one such scenario. The process of queuing packets in each layer is called queueing due to an enhanced transmission rate. In this circumstance, the packages are sequentially processed, which increases the redirection time. This problem has a layered solution, offering an adaptive retry limit to the MAC layer. The retry limit shall be reduced by 1, for every packet with the same MAC objective, which is lost by reaching the retry limit until every packet is transmitted once. Once a packet is transferred effectively, the trial limit is reverted to its unique value that is equivalent to the former standard.

Two parameters significantly determine the latency associated with queuing, notably the size of the tail and the retry boundary. A large transmission queue size can lead to too many waste packages with stalled routing information. Furthermore, too many waste retransmission attempts can result in a high retry number for these waste packages. The grouping of these factors could significantly extend the redirection time. Figure 4 presents an overview of each layer's protocol stack and queues.

3.5. Factors Affecting Rerouting Time

Despite so many elements such node energy levels, transmission ranges, network structure, etc., affecting retraining

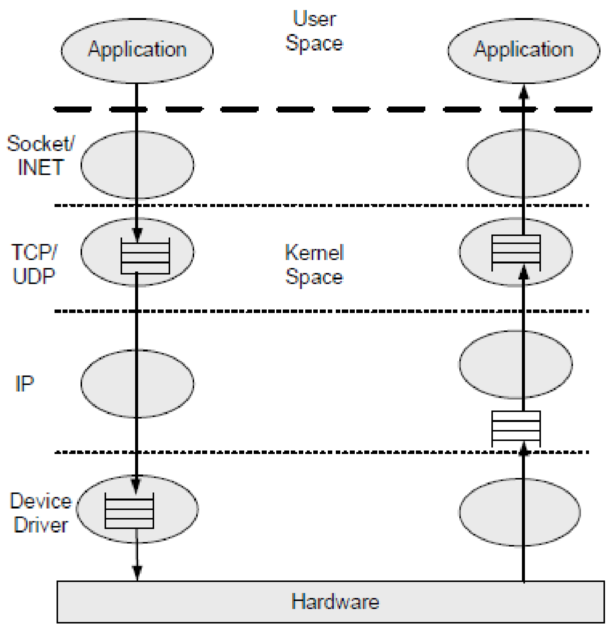

Figure 4. Linux Protocol Stack.

times, node speeds and traffic loads have a greater impact on the performance of this mobile Adhoc Network characteristic.
Node speed: Reducing the node speed minimizes the amount of link breakage. The Routing time grows as the node speed increases. With lowered speed, due to the lower node speed, the risk of a connected break due to an adjacent affecting out of the communication zone is lower. This makes it easy to adjust the threshold range higher to gain the same advantage while reducing the downside of greater track lengths. Traffic Load: if the whole network is overloaded by a huge number of unneeded broadcasts and an amplified packet loss, the successful transmission leaves a reduced part of the overall network capacity. In the event of link breakdowns, the combination of divisioning and decreased retransmissions increases the output at the lower levels. But the segmentation means that the packets will probably only reach a insufficient hops, exacerbating the injustice among the short and extended path traffic [20]. In short, the re-routing time is openly proportionate to the node speed and traffic load, which would increase the speed and traffic load of the node.

3.6. Link Breaks and Rerouting Time

Link breaks are the cause of the queueing scenario. When a node misplaces its transfer to its neighbour, the routing searches for the shortest alternative available path. In order to avoid such catastrophes, these connection disruptions have to be identified considerably sooner. The details of this preventive mechanism are outside the possibility of this paper. The standard technique to detect connection breakdowns for a routing is finished missed polling packets [21]. The OLSR Hello packets are then sent among one hop neighbours at the set time frequency to provide information about neighbourhood links and a method for detecting links. When no neighbour Hello packet is received within a specific time interval (for example, within 6 seconds, the suggested OLSR interval) the neighbour shall be deliberated inaccessible and a link to the neighbour shall be judged broken and invalid. Another technique to identify connection failures is by delegating the routing protocol in the underlying link layer to a mechanism. A link break thru the link layer must be expressly notified of the routing protocol. The drawback of this Link Layer Notification (LLN) method may be the extra application complexity. The benefits, however, are that the connection layer usually detects the connection breaks earlier. Used to detect interruptions through missing Hello packets is the buffer zone or BZA. The overall performance is vital to recognize the connection break in a timely manner because two negative impacts occur between both the physical connection breakdown and the routing protocol. Main, the packets are marked with the next unachievable hop address in the queue of the interface. This means that at this time these packets are never reached and lost. Second, these packets are sent numerous times to the MAC layer until they are castoff. This will steal packets sent from other nodes of valuable intermediate time at a legal next hop address.

4. PROPOSED SOLUTION

4.1. Analysis

There is a variance among both the buffer zone solution and regular OLSR in the average sum of hops among a source and an endpoint. With the buffer zone solution, the number of hops per way is enhanced, as it prefers nodes in the safe zone as relay nodes. The hop length increase is the biggest drawback of the buffer zone key. Chief, the hop length increases the number of transmissions required for the identical end-to-end streams and so reduces the overall capacity accessible per traffic stream.

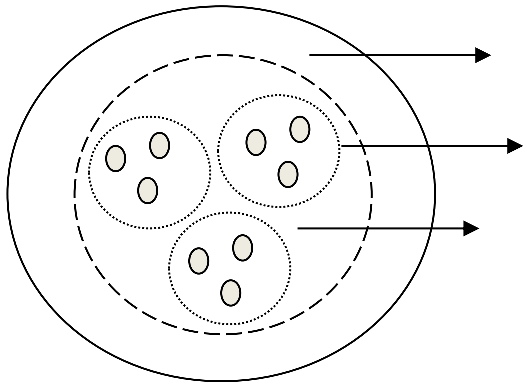

Figure 5. Nodes in Virtual safe zone.

Secondly, the danger increases as the links get longer that the topology info possessed by the transmitting nodes is incorrect. There is a greater likelihood that the ideal (both the actual and the tables presented) changes while the packet travels between both communication nodes. This increases the danger of a packet loop or a significant detour. An increased average path duration, an increase in packet reverse risk and an increased packet loop risk add to the likelihood of Time-To-Live (TTL) depletion.

However, too much of a buffer zone indication to an unnecessarily larger mean sum of hops among the MANET node pairs and a greater risk of network partitions. The BZA is also averse to finding a way to predict the ideal size of the buffer zone, according to criteria such as network load and node mobility. Finally, the buffer zone technique may be enhanced and extended to categorize a neighbour as safe or unsafe utilizing distance separate criteria [22]. These shortcomings and gaps allow the buffer zone algorithm to be enhanced or extended.

4.2. Extending Buffer Zone Algorithm

This section describes the key characteristics of the BZR mechanism. They interact and update their routing tables once the nodes are live. Then every node will know its individual neighbours, double and multiple. In addition to the neighbouring information, the virtual zone information of the node is also efficient in the routing table. This data is then used during the choice to route. Virtual zones are animatedly constructed based on node similarities. A virtual zone generation could be carried out whenever the initial topology changes or can be carried out periodically. In virtual zones, the arrangement of notion of nodes within the safe zone is presented in Figure 5. Whenever a node leaves a virtual zone, it broadcasts it via the HELLO packet to its neighbours. The neighbours then update this evidence in their routing databases. As a result, the nodes are informed of their virtual zone at any given time.

4.3. Exploring the benefits of the virtual zone algorithm

As all nodes and other info on their routing table know all the information about the virtual zone, routed is optimized within the virtual zone and thereby reduces the overall number of hops and the redirection time to a minimum. This solution associations the benefits of the area routing algorithm with the benefits of virtual area induction. The energy equal of the nodes is also assessed in this approach apart from the distance from the nodes employed in the field routing algorithm alone. The energy consumption of the nodes is also reduced as routing decisions are made quickly. This method increases routing efficiency and minimizes transfer time in the safe area. If the source and endpoint nodes are inside the similar virtual area and if both communication nodes are in a safe zone, it would be the worst scenario. If the neighbour or any of the multi-hop neighbours is in the simulated field, the source or destination would be average.

5. DISCUSSION

After comprehending the upgrade to the present buffer zone, virtual districts may also be lengthy to the insecure zone, which would cut re-routing time ultimately. There are a few reasons behind this statement. Although virtual area upsurges redirect time, it is an overhead to maintain the routing table and virtual area(s). Secondly, introducing virtual areas in the buffer zone increases network traffic. It is known that the nodes communicate using HELLO packets concerning their virtual zone location. In order to retain virtual zone information, the number of packets delivered is increased. The packet size is also enhanced as it contains virtual zone information. Given the node energy levels, the virtual zones are currently limited only to the safe zone. However, it is left open for future effort to extend them into the dangerous zone without hurting performance. Another effort would be that the creation of virtual regions eventually leads to the ZRP, which seeks to resolve proactive and reactive protocol constraints by incorporating the best features of both protocol technology and therefore can be characterised as a proactive or reactive hybrid routing protocol. The majority of communication between knots can be envisaged in a MANET. When in the zone, the packet is transmitted proactively. The projected method is simply an allowance of the remaining area routing algorithm and is limited to the shortest path and proactive routing. The improvement is to lessen the time of return solely. This differs from the ZRP, which employs reactive and proactive methods.

6. SIMULATION RESULTS

This section presents the simulation arrangement and then documents the findings. Assessment charts between OLSR standard, Buffer zone and virtual zone are presented. The parameter settings for the simulator utilized throughout the simulations are provided in Table 1. The simulations were conducted using the 2.34 version of ns-2 network simulator. The

Table 1. Parameter Situations.

Parameters	Values
Radio-propagation	TwoRayGround
Interface queue	FIFO with DropTail and PriQueue
Interface queue size	300 packets
Antenna Ideal	OmniAntenna
OLSR Hello interval	2 s
Maximum MAC retries	7
Traffic TTL	32
OLSR Hello timeout	6 s
Nominal transmission rate	2 Mbps
Basic rate	1 Mbps
Simulation period	500 s
Simulation period	Heuristic
OLSR TC interval	5 s
OLSR TC timeout	15 s

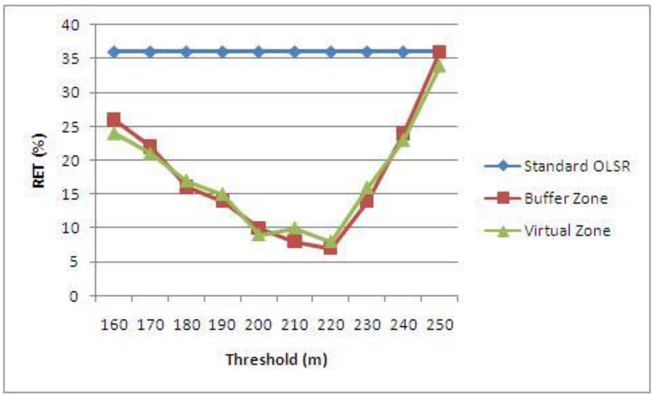

Figure 6. RET loss (Loss caused by MAC extreme retransmissions reject).

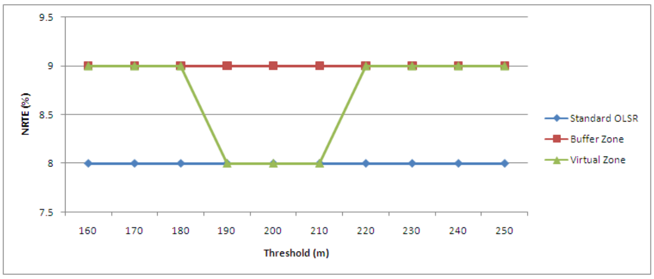

Figure 7. NRTE loss (Loss affected by lack of route).

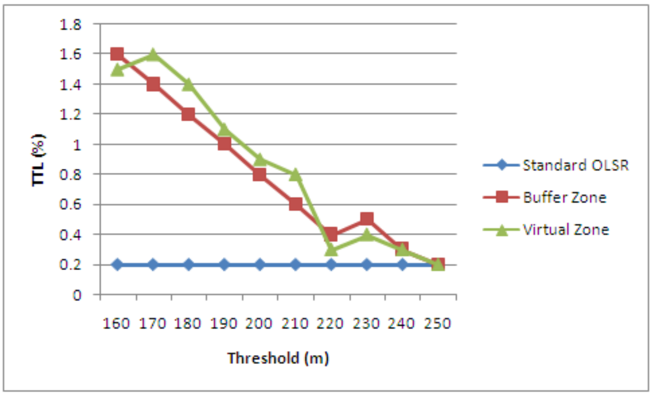

Figure 8. TTL loss (Loss affected by exhausted time to live).

Optimized Link State Routing Protocol (OLSR)[9] uses multi-hop routing with the IEEE 802.11 scheme is used as the MAC layer. Each group node relayed packets to the other group nodes. The nodes were split into two equally huge groups. The traffic category was UDP, with a constant bit rate of 64 bytes.

Figure 11 demonstrates the good performance results with a relative high node speed of 10 m/s and a little overall traffic load of 50 kbps. Compared with the results of a virtual zone procedure at thresholds of less than 250 m with that of a standard OLSR buffer zone algorithm, which equals the BZA with a threshold of 250 meters, the increase would be 84 percent − 75 percent = 9 percent on a buffer-zone algorithm at 220 m. Figure 6 shows that the main benefit of the algorithm virtual zone is that the loss of retransmission (RET) has been significantly decreased compared to the buffer zone RET loss and regular OLSR. This again leads to further packages being lost because of the missing route (NRTE loss), as shown in Figure 7. Most link breakage are then avoided because packets can still be received by nodes beyond the discard zone and reply with a recognition prior to the neighbour moving beyond a transmission radius. Thus, the RET

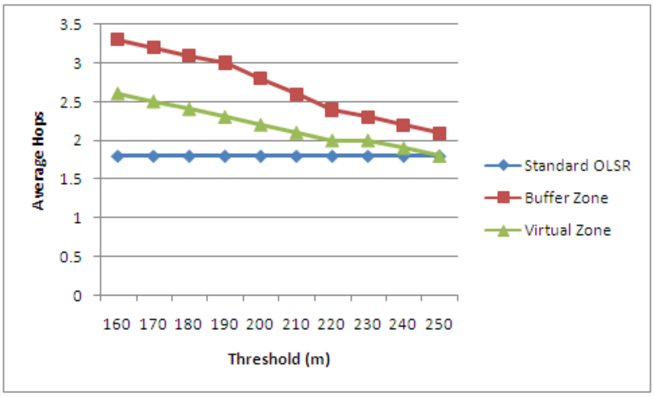

Figure 9. Average number of hops.

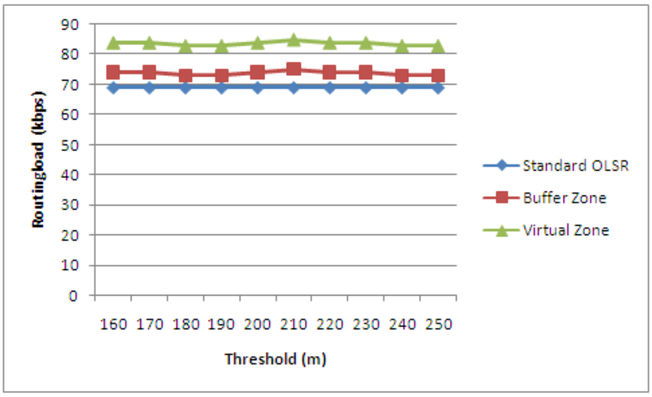

Figure 10. Routing Load.

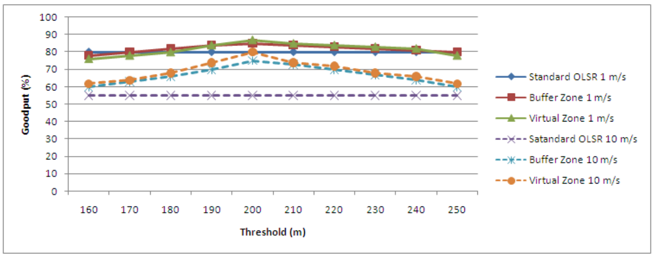

Figure 11. Goodput for 1 and 10 m/s at 50 kbps load.

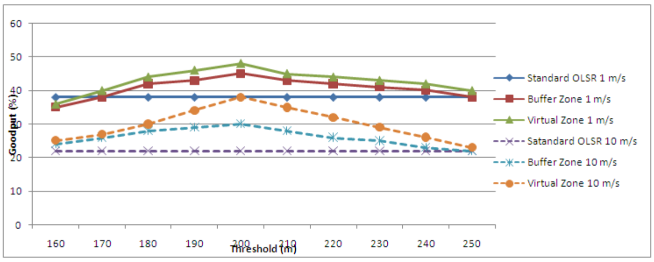

Figure 12. Goodput for 1 and 10 m/s at 500 kbps load.

loss, also for the Virtual Zone approach, is decreased as seen in Figure 6. This advantage is bigger than the advantage of a higher probability of partitioning, which results in a fully higher output than the OLSR standard and buffer zone algorithm as shown in Figure 11.

It is noteworthy to look at the cost of this approach, since the reduction in RET loss has been recognized as the key advantage of the virtual zone method. Figure 7 indicates that in terms of packets lost owing to a lack of routing, there is no transformation among the virtual area, buffer zone and normal OLSR solutions. Thus, the virtual zone algorithm is not increased compared to normal OLSR and buffer zone by the odds of network partitioning. This is predicted because, if necessary, the buffer zone algorithm builds connections with neighbours in the buffer zone. The buffer zone solution and the virtual zone differ, however, in terms of the average sum of hops among a both nodes. As illustrated in Figure 9, the sum of hops per path is augmented with the buffer zone approach, as the safety zone nodes as relay nodes are favoured. The hop longer is the biggest drawback of the buffer zone solution. This was lowered after the virtual zone was included into the safe zone.

A higher average path length, more packet detour risk, and an increased packet loop risk add to the likelihood of exhaustion from time-to-live (TTL). Indeed, because of the exhaustive Time to Live ratio (i.e., loss of TTL) of packets, the buffer zone technique is higher than the usual OLSR, as shown in Figure 8. Figure 12 indicates that the virtual area method boosts the output, even under heavy traffic loads, as compared with the Standard OLSR and buffer zone results. However, compared with the virtual and buffer zone methods, they are more or less comparable. However, for such large traffic loads, the total profit of the virtual zone solution is inevitably lower. The reason for this is that the whole network is being undermined by a great increased packet loss which leaves the successful diffusion of traffic, whether by standard OLSR traffic or traffic using a BZA, with fewer parts of the total network capacity. In addition to a reduced average distance, the cost of the solution in the virtual zone also includes a higher routing burden for a higher payload of Hello messages. This is because the virtual zone solution depends on the neighbouring nodes' Zone Status in Hello messages being published. As in Figure 10, the increase in routing load for 40 nodes at 10 m/s is about 3 kbps at a threshold of 250 m, which is rather low over the whole network capacity.

7. CONCLUSION

Entering virtual zones in the buffer zone in the OLSR improves the performance of the buffer zone alone in comparison with the OLSR. When transmission takes place within virtual zones, the retraining time is also significantly decreased. This paper discusses the rationale of confining the virtual zone within the safe zone. There is also talk of the difference among the virtual zone and the area routing protocol. The approach proposed is simulated using NS 2.34 and experimentations are undertaken to demonstrate that the performance of the virtual zones is increased. Comparison charts indicate that the redirection time is reduced when virtual zones are inducted. Extending virtual areas to the dangerous area would be a stimulating piece of work. In addition to the node criterion supplied to construct a virtual zone, further criteria for the creation of virtual zones could be introduced in future. By improving both control traffic performance and delay of proposed ZRP, the techniques can be applied to single or multiple channels of MANETs. It could also be proven that such additional criteria recover the routing presentation of the MANET. Although the routing speed with virtual areas is increased, maintaining the routing table is an upstairs due to the great mobility of the nodes. This creates the method difficult. As future work, a slight improvement in weight in the current technique is also left. The current approach merely limits the construction of the virtual zone to the safe zone of the BZA.

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