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Modified Qualified Stateless Multicast Routing Protocol

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ABSTRACT: The multicasting routing protocols maintains their state information at the forwarding nodes to keep updated routing structure. The stateless protocols do not require the routing information to be kept at forwarding nodes. QSMRP is a stateless approach, in which the routing of the packets and splitting of the packets to multiple routes depends upon the information of the location of the destination nodes. QSMRP is an efficient protocol still end to end delay of the QSMRP is large. The QSMRP is modified to reduce the end 2 end delay by sending the RREQ to a node that is farthest from the transmitting node but within the transmitting range of the node. This procedure uses the farthest node instead of nearest neighbor. The simulation results show that the performance of the proposed protocol is better than the existing protocol. The E2Edelay gets decreased and it results in enhanced throughput. The PDR of the proposed protocol is also better than the existing protocol.

KEYWORDS: Stateless routing, Multicast, QSMRP, e2edelay, PDR.

1. INTRODUCTION

A Mobile Ad-Hoc Network (MANET) is a self-configuring network in which nodes are connected through wireless link. It is an infrastructure less network. The wireless network topology may change rapidly [1]. Each node in the network act as router and it communicate other nodes. There is no centralized administration. Nodes in ad-hoc networks are differentiated by their limited resources like power, memory and mobility [2]. Due to the limited transmission range of the nodes, multiple hops may be needed for a node to send data to any other node in the network. Thus each node acts as a host and router. If a node needs to communicate with another that is outside its transmission range, an intermediate node acts as a router to relay or forward packets from the source to the destination. For this purpose a routing protocol is needed. Routing protocol design is an important and essential issue for Ad-Hoc networks due to dynamism of the network [3]. One interesting research area in MANET is routing. Routing in the MANETs is a challenging task and has received a tremendous amount of attention from researches [4]. Guaranteeing delivery and the capability to handle dynamic connectivity are the most important issues for routing protocols in wireless mobile ad hoc networks. If the connectivity of any two nodes changes and routes are affected by this change, the routing protocol should be able to recover if an alternate path exists [5]. QSMRP stands for qualified stateless multicast routing protocol is a stateless protocol. The multicasting routing protocols maintains their state information at the forwarding nodes. It helps to keep updated routing structure. While the stateless protocols do not require the routing information to be kept at forwarding nodes [6] . QSMRP is a stateless approach, in which the routing of the packets and splitting of the packets to multiple routes depends upon the information of the location of the destination nodes. The necessary information required for the routing the packet is inserted in to the packet header. This information may include the location list of the nodes, checksum, and TTL [7]. This protocol works on the concept of ‘multicast regions’ and ‘virtual nodes’ to forward the packets form source to the destination. When a node gets a packet, then it divides the network into regions. The regions can be either 4 quadrant of each 90 degree or 3 regions each of 120 degree etc. It calculates the virtual nodes by using the location of the multicast members. The virtual nodes are assigned imaginary destination nodes for each region as routing table is not maintained at the intermediate nodes. The routing packet is replicated to all regions and virtual nodes are used for transmitting the packet to the destination nodes. Then finally the whole packet from all regions are collected to be queued into MAC and broadcasted to the neighborhood. This procedure for transmitting packet is explained by following algorithm 1.

Algorithm 1: Send

1: Group list say GL= get group list from Header
2: for each node in GL say node repeat

3: for each region in network say reg repeat
4: if node is in reg then
5: add node to reg list. End if
6: end for; end for
7: Create new packet say p
8: Add header to p that consists of reg list, checksum, TTL.
9: Insert p to MAC queue
10: Repeat the steps 8 & 9 for each region

When any node receives the packet, then it checks the checksum to determine whether error exists or not. If error exists then node drops the packet. Then the node matches its id with the list of destination nodes available in the header. If the id matches then the node removes itself from the list and passes it to the upper layer of the protocol stack. If the TTL field value of the packet is less than zero then protocol drops the packet. The process is repeated until any of the destination nodes left in the list. The procedure is elaborated in algorithm 2.

Algorithm 2: Receive

1: Calculate checksum.
2. if error exists
3. Then Drop packet
4. End if
5:for each element in the destination list say Dl from packet header
6: if node == dl.node then
7: Remove node from Dl & Pass the packet to upper layer
8: end if
9: if TTL <= 0 **then**
10: Drop the packet
11: end if
12: add each region destination to the Dl.
13: Create new packet say p
14: Add header (r.list, checksum, TTL-1) to p
15: Insert p to MAC queue
16: Repeat steps 14 & 15 for each region.

The conceptual flow diagram of QSMRP that shows the complete working of the QSMRP is depicted in figure 1.

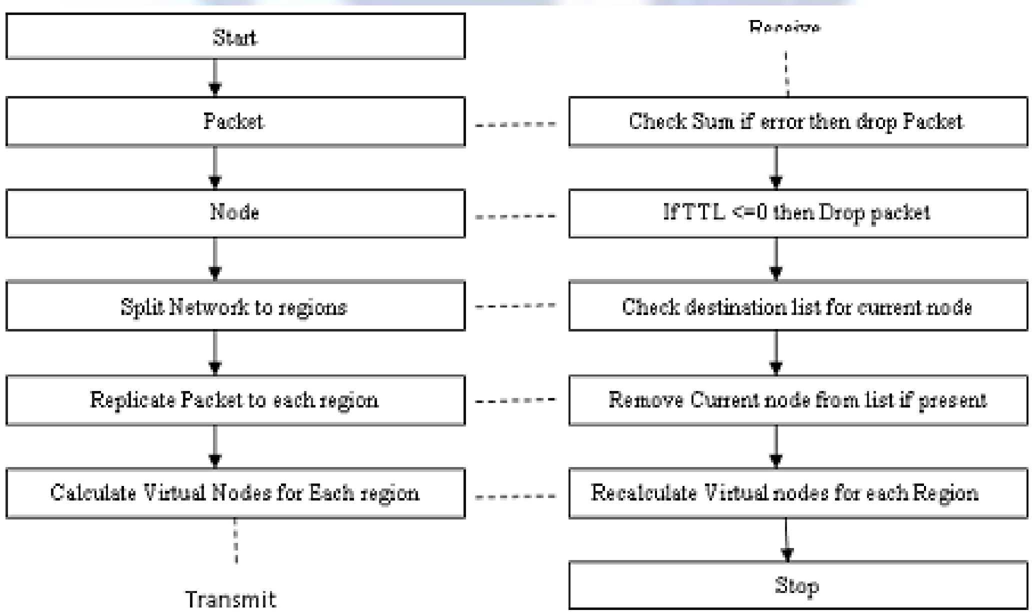


Figure 1: Flow Diagram of QSMRP

The protocol extends the service life of node in the dynamic topology. This protocol maximizes the life time through life time prediction routing. This is stated as,

$$\underset{pa}{\mathrm{Max}}\,T_{pa}(t) = \underset{i \in pa}{\mathrm{Min}}(T_i(t))$$

Where $T_{pa}(t)$: life time of path pa and $T_i(t)$: predicted life time of node i from path pa.

The intermediate nodes on receiving a RREQ packet assign the Min-lifetime for that packet in the header. If any other RREQ is arrived for same destination then minimum of two cost is used to forward the RREQ. The route with minimum cost enhances the lifetime of the network.

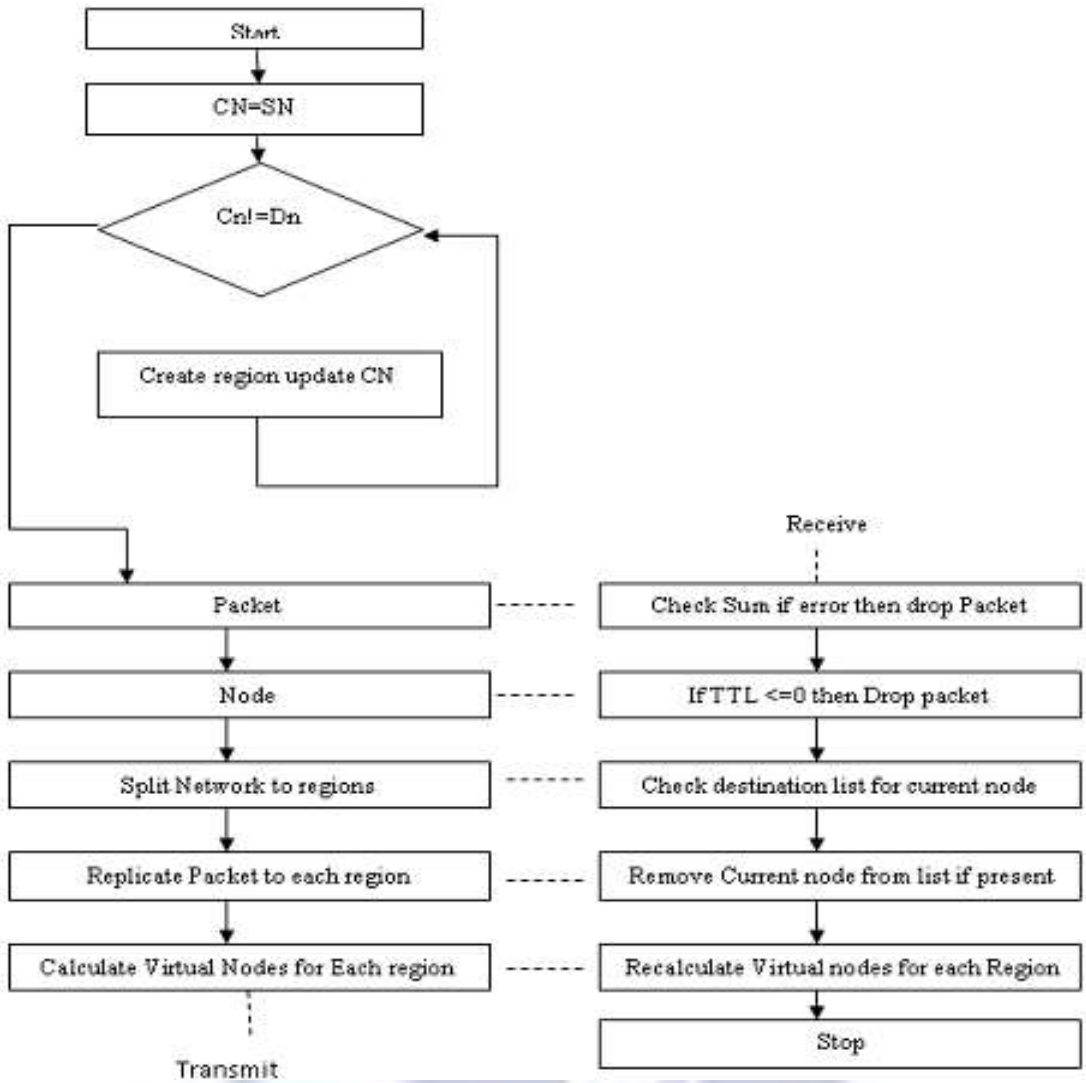
2. THE PROPOSED MODIFIED QUALIFIED STATELESS MULTICAST ROUTING PROTOCOL (MQSMRP)

MQSMRP stands for the modified qualified stateless routing protocol. This protocol supports all the features of the QSMRP protocol resulting enhance lifetime and less overhead. The QSMRP is modified to reduce the end 2 end delay. To reduce the delay the RREQ is sent to a node that is farthest from the transmitting node but within the transmitting range of the node. This procedure uses the farthest node instead of nearest neighbor. It results in increased size of the region i.e. less number of regions. The less number of regions will result in less number of the virtual nodes. Overall, less number of hops to transmit the packet from source to destination resulting less delay. The whole process can be explained by following algorithm:

PROPOSED MQSMRP Algorithm:

1. Start
2. Set Current node=Source Node
3. Num=1;
4. While current node != destination node
5. Reg[num]=select radius range of current node as region.
6. Current_node=Select node in the direction of destination node with farthest distance from current node within the reg[num].
7. Num=num+1;
8. End while.
9. Group list say GL= get group list from Header
10. for each node in GL say node repeat
11. for each region in reg repeat
12. if node is in reg then
13. add node to reg list. End if
14. end for; end for
15. Create new packet say p
16. Add header to p that consists of reg list, checksum, TTL.
17. Insert p to MAC queue
18. Repeat the steps 15 & 16 for each region
19. Transmit the packet. Follow steps 19 to 28 at receiver end.
20. Calculate checksum. if error exists Then Drop packet End if
21. for each element in the destination list say Dl from packet header
22. if node == dl.node then
23. Remove node from Dl & Pass the packet to upper layer end if
24. if TTL <= 0 **then** Drop the packet end if
25. add each region destination to the Dl.
26. Create new packet say p
27. Add header (r.list, checksum, TTL-1) to p
28. Insert p to MAC queue
29. Repeat steps 26 & 27 for each region.
30. stop

This algorithm is also elaborated by flow chart.



3. IMPLEMENTATION

The paper implements the proposed protocol by using NS2.35. When we run the TCL file then it creates the TR file. The following figures represent the snapshot generated by the TCL files.
The AWK scripts are used to evaluate various parameter .The AWK script use the TR file to get result. The parameter evaluated by running AWK scripts on the TR file generated by TCL file.

3.1 Parameter Analysed

Packet Delivery Ratio (PDR): The number of delivered data packet ratio to the destination and this also illustrates the level of delivered data to the destination.
∑ Number of packet receive / ∑ Number of packet send

End-to-end Delay: The average time taken by a data packet to arrive in the destination and it also includes the delay caused by route discovery process and the queue in data packet transmission and only successfully data packets that delivered to destinations that counted.
∑ (arrive time – send time) / ∑ Number of connections

Throughput: Throughput or network throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network 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.

Table 1: Performance Analysis of Existing Algorithm

Number of nodes	PDR	E2edelay	Throughput
10	98.9047	12.1756	170.56
20	95.7022	12.2859	164.68
30	90.8932	12.3323	163.98
40	89.6346	12.2377	163.57

Table 2: Performance Analysis Of Proposed Algorithm

Number of nodes	PDR	E2edelay	Throughput
10	99.6916	11.9841	170.86
20	99.6913	11.9883	170.69
30	99.691	11.9911	170.57
40	99.6842	11.9984	170.41

In next section the above parameters are shown graphically. These are as follows: figure 3 shows the Packet Delivery Ratio between the existing and proposed algorithm. Next graph figure 4 shows the e2e delay and figure 5 shows the throughput between existing and proposed.

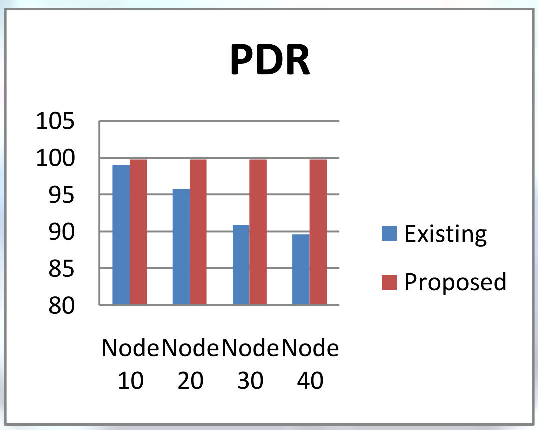


Figure 3: Comparison of PDR between Existing And Proposed

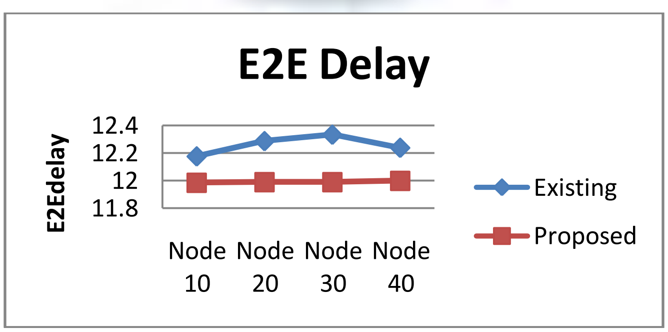


Figure 4: Comparison of E2E Delay between Existing And Proposed

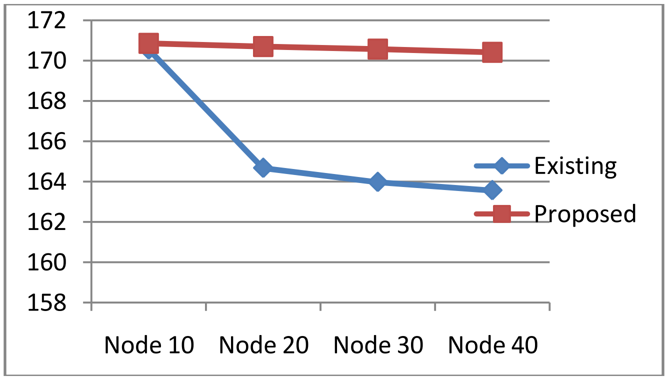


Figure 5: Comparison of Throughput between Existing and Proposed

4. CONCLUSION

The paper modifies QSMRP to reduce the end 2 end delay. The reduced delay must increase the throughput. The graphical and the tabular analysis show that the performance of the proposed protocol is better than the existing protocol. The E2Edelay gets decreased and it results in enhanced throughput. The decreased delay and enhanced throughput confirms the better performance of the proposed protocol. The better performance is verified by the packet delivery ratio of the proposed protocol. The PDR of the proposed protocol is also better than the existing protocol. In future**,** The MQSMRP can be compared with existing hybrid routing protocols like ZRP etc and the protocol can be enhanced in terms of security.

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