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USING NS-2 COMPARISON OF GEOGRAPHICAL AND TOPOLOGICAL MULTICAST ROUTING PROTOCOLS ON WIRELESS AD HOC NETWORKS

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Abstract. Performance evaluation of geographical and topological multicast routing algorithms for cellular Wi-Fi ad-hoc networks is offered. Flooding and On-call for Multicast Routing Protocol (ODMRP) are simulated and in comparison with novels protocols: Topological Multicast Routing (ToMuRo) and Geographical Multicast Routing (GeMuRo) in pedestrian and vehicular situations. The situations evaluated recollect one multicast transmitter and one, two and three multicast receivers under numerous mobility and transmission levels. The conduct of 150 nodes is evaluated in terms of cease to end postpone (EED), jitter, packet delivery ratio, and overhead. Consequences display that ToMuRo is suitable for pedestrian eventualities because of its tree-based structure and GeMuRo is right for vehicular situations because its miles based on a mesh topology.

Keyword. NS-2; Adhoc Networks; Multicast Routing.

INTRODUCTION

Multicast routing algorithms have come to be more and more crucial within the area of Wi-Fi ad-hoc networks because they correctly communicate and coordinate units of nodes. Multicast routing algorithm, as an example, plays better than a couple of unicast routing strategies in advert-hoc environments, wherein bandwidth assets are at a top rate. Multicast affords a more green routing strategy for multimedia packages in mobile environments (e.g. cellular studying, audio/video broadcasting, and so forth.) with big numbers of simultaneous receivers. The predominant obstacle, therefore, is those nodes in multicast networks pass Omni-directionally, causing common and unpredictable topological changes. In a traditional ad-hoc surroundings, network hosts work in pairs to accomplish a given assignment. Multicast community algorithms, but, should transmit facts packets to numerous hosts simultaneously, which then need to figure if their role is to acquire or ahead the packets. despite the fact that multicast network algorithms are proper in lots of situations, their forwarding mechanism and network useful resource consumption cause them to substantially less efficient than unicast routing algorithms. Packet delivery ratio, jitter and quit-to-stop put off are the predominant overall performance variables taken into account whilst considering QoS packages and community useful resource management.

Multicast Protocols evolved for static networks, which include Distance Vector Multicast Routing Protocol (DVMRP) [1, 2], Multicast Open Shortest path First (MOSPF) [3], middle primarily based bushes (CBT) [3], and Protocol unbiased Multicast (PIM) [4], do not function very well in advert-hoc network environments because of their non-stop dynamic changes. The one essential downside of the above-stated multicast protocols is they own an inherently unstable tree shape. This unstable tree structure obliges this type of networks to continuously replace their link repute in response to topology changes. Additionally, normal multicast bushes normally require a link state or distance vector international routing substructure which can result in extensive packet loss. Furthermore, non-stop topology modifications as a result of the frequent trade of routing vectors or link country tables also can result in immoderate channel and processing overhead that may appreciably boom community congestion. As a result, constraints associated with bandwidth sources, power consumption, and host mobility makes multicast protocol layout in particular tough. In reaction to these difficulties, several multicast routing protocols have been proposed for use in wireless ad-hoc networks, such as ad-hoc Multicast Routing Protocol (AMRoute) [6], On-demand Multicast Routing Protocol (ODMRP) [7], advert-hoc Multicast Routing protocol using increasing identity-numbers (AMRIS) [8], center- Assisted Mesh Protocol (CAMP) [9], Multicast ad-hoc On-demand Distance Vector (MAODV) [10], and Adaptive demand-pushed Multicast Routing protocol (ADMR) [11]. But the essential disadvantage of those topological multicast routing algorithms is that their statistics shipping strategies do no longer assure efficient transmission in fairly cellular environments including vehicular ad-hoc networks (VANET´s). This deficiency exactly has resulted within the development of geographical routing algorithms, together with: a singular place-based totally Multicast Protocol for ad-hoc Networks [12], a singular function primarily based reliable Unicast and Multicast Routing approach using colored Petri Nets [13], A strength-aware Multicast Routing Protocol for cell ad-Hoc with Mobility Prediction

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[14]. This work presents a performance analysis of topological and geographical multicast routing algorithms for cellular Wi-Fi ad-hoc networks. Flooding and ODMRP are simulated and in comparison with the Topological Multicast Routing Protocol (ToMuRo) and Geographical Multicast Routing Protocol (GeMuRo) in pedestrian and vehicular scenarios.

The rest of this paper is prepared as follows: phase 2 affords simulation info of ODMRP, ToMuRo and GeMuRo. Section 3 offers a dialogue of the eventualities simulated and results obtained. In the end, phase 4 summarizes our work and proposes future research.

DEMAND MULTICAST ROUTING PROTOCOL (ODMRP)

In ODMRP, institution membership and multicast routes are mounted and up to date by using the supply on demand. Similar to on-call for unicast routing protocols, ODMRP has both a request segment and a reply phase. When a multicast source sends packets, it makes use of a flooding strategy to transmit a member advertising and marketing packet to all the individuals of the group. This packet, referred to as JOIN_DATA, which additionally consists of the payload, is periodically broadcast to the entire community to refresh the membership statistics and replace the routes. When a node receives non-replica JOIN_ facts, it stores the upstream node identification into the routing desk and rebroadcasts the packet. When the JOIN_DATA packet reaches a multicast receiver, the receiver creates and broadcasts a JOIN_TABLE to its neighbors. Whilst a node gets a JOIN_TABLE, it verifies that the subsequent node id of one of the entries matches its very own identification. If it does, the node realizes that it's far positioned at an intermediate factor among the supply and receiver and recognizes that it must ahead the packet. It then units the FG_FLAG (Forwarding group Flag) and declares it's personal JOIN_TABLE based on matched entries. The JOIN_TABLE is as a consequence propagated by way of each forwarding organization member until it reaches the multicast supply via the shortest path. This system constructs (or updates) the routes from assets to receivers and builds a mesh of nodes [6].

TOPOLOGICAL MULTICAST ROUTING PROTOCOL (TOMURO)

ToMuRo applies on-call for routing mechanisms to avoid channel overhead and enhance scalability. It makes use of the concept of "multicast relay", a hard and fast of nodes designated for forwarding multicast facts on shortest paths between any multicast transmitter- multicast receiver pair to construct a forwarding tree for each multicast institution.

GEOGRAPHICAL MULTICAST ROUTING PROTOCOL (GEMURO)

GeMuRo establishes and updates the receiver's multicast routes on demand much like ToMuRo, a multicast request is initiated with the aid of the receiver and a respond phase is dispatched lower back with the aid of a not sure node this is receiving multicast statistics packets from the transmitter. The reply phase is finished the usage of the grasping strategy, in which man or woman nodes choose the acquaintances closest to the receiver.

PERFORMANCE EVALUATION

Flooding, ODMRP, ToMuRo and GeMuRo were simulated using OPNET Modeler [20]. OPNET Modeler is an important network simulator that can be used to design and study communication networks, devices, protocols, and applications.

SCENARIOS MODELED

Our simulations version 150 node wireless in two special scenarios. The primary state of affairs evaluates wireless nodes uniformly allotted within a 1200m x 1200m location. The node moves are based totally at the random-waypoint version (RWP). The IEEE 802.11b MAC protocol was used with an eleven Mbps channel capacity and a simulation time of one hundred seconds. A pause time of one 2nd become also applied inside the RWP model. This scenario considers one multicast transmitter and one, two, and three multicast receivers under various mobility and transmission levels. Inside the simulation, node speeds of zero, five, 10, 15, and 20 meters in line with second have been chosen, and a consistent bit fee (CBR) for facts go with the flow and a uniform payload length of 512 bytes was also selected. The simulation parameters for the state of affairs 1 are listed in table 1.

A second situation, primarily based on a microscopic site visitors model and evolved in OPNET, was used to simulate 150 cell nodes travelling on a 6,283 m round dual carriageway (Figure.1). The round scenario is a suitable illustration of highway visitors because real-existence avenue curvature is normally much less mentioned, allowing cars to maintain a greater steady pace. A non-causal version changed into additionally hired that prohibited motors from coming into or exiting the gadget, as well as an arbitrary vehicular velocity of 42 m/s (ninety five miles/hour) turned into established. The IEEE 802.11b allotted Coordination feature (DCF) turned into used as the medium get admission to control protocol. The simulation parameters for scenario 2 are listed in table 2.

Table 1. Simulation parameter for ToMoRo.

Parameter	Value
Simulation Area	1200 m x 1200 m
Total nodes	150
Movement models	Random-waypoint model
Channel capacity	11 Mbps
Maximum speed	0,5,10,15 m/sec
Pause time	1 second
MAC protocol	IEEE 802.11b
Packet flow	Constant bit rat(CRB)
Packet payload	512 bytes

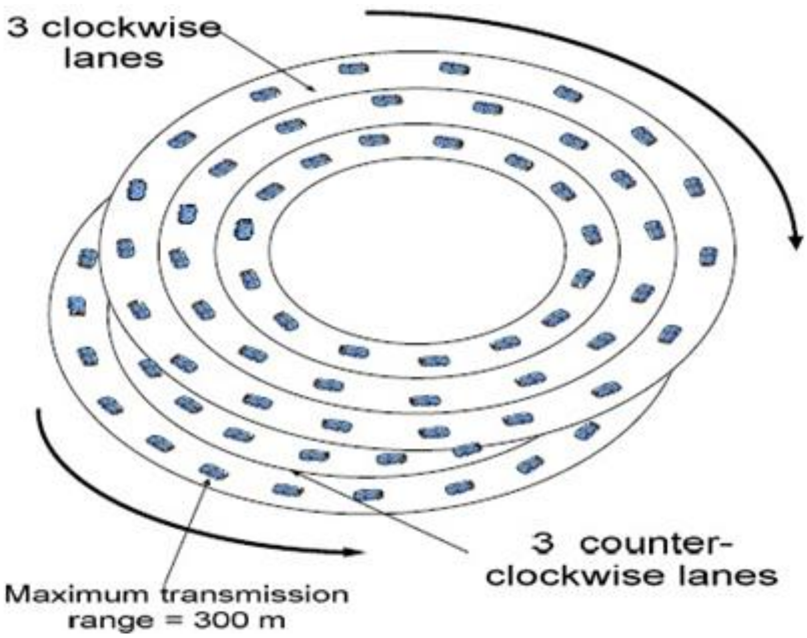

Figure 1. Representation of second scenario

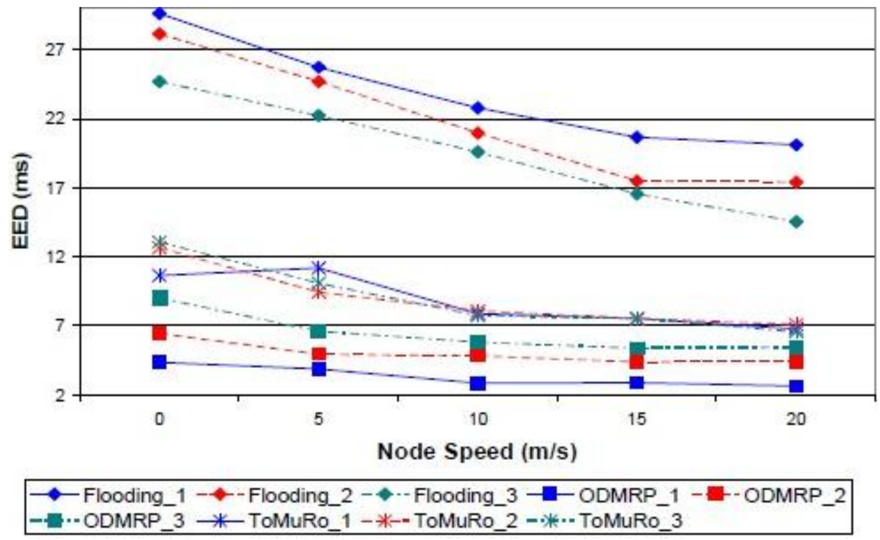

Figure 2. End-to-End delay for ToMuRo

Figure. 2 represents the End-to-End Delay (EED) for the first scenario; the horizontal line indicates the node speed in m/s and the label numbers under the graph (Flooding_1, Flooding_2, etc.) represent the number of receivers under simulated conditions. In general, flooding creates more End-to-End Delay (EED) due to its lack of a control mechanism. ToMuRo shows a slightly more EED than ODMRP, but its performance is more constant with one, two, and three receivers.

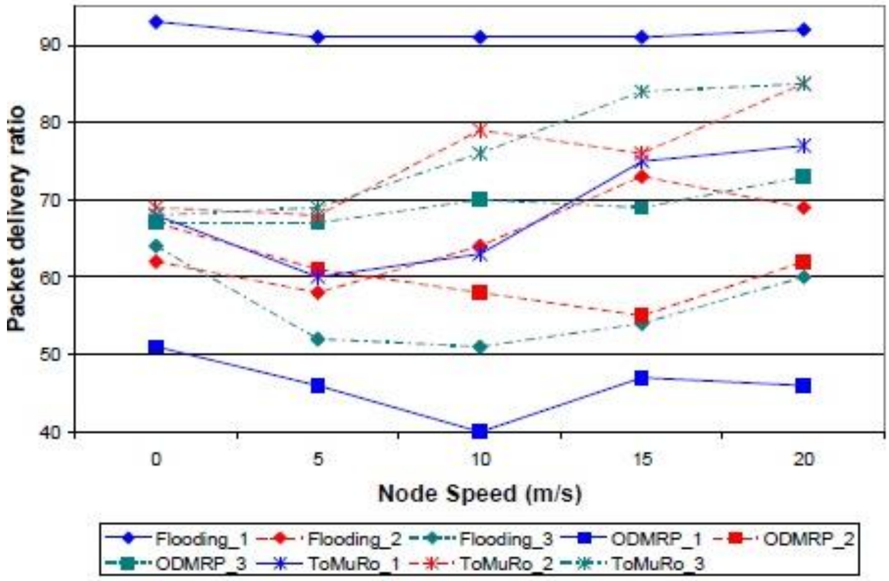

Figure 3. Packet delivery for ToMuRo

Figure. 3 represents the packet delivery ratio. In contrast to the previous figures, flooding performs poorly as the number of receiver increases. However, although, ODMRP improves its behavior as the number of receivers increase, it still does not perform as well as ToMuRo. The performance of ToMuRo remains satisfactory when the number of receivers increases.

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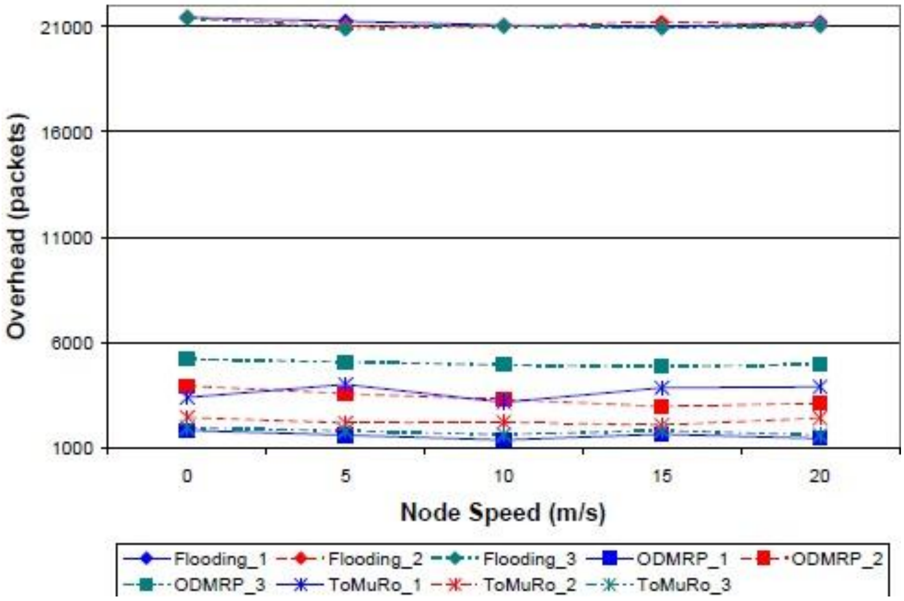

Figure 4. Overhead for the ToMuRo

Figure. 4 represents the overhead. This metric shows the efficiency of the algorithm in retransmitting data packets throughout the network. Flooding shows the worst behavior of the three algorithms because of its data packet retransmission mechanism. ToMuRo and ODMRP have similar behavior for one receiver, but for two and three receivers, ODMRP performs slightly lower than ToMuRo.

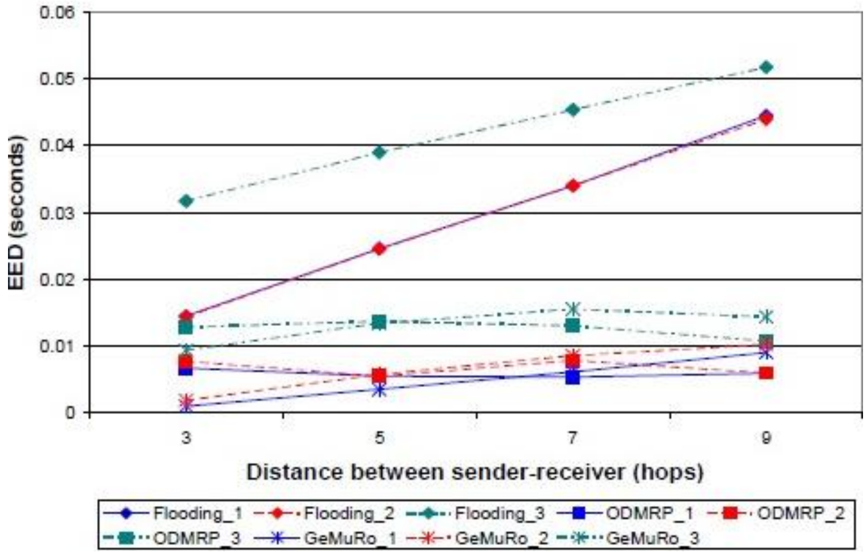

Figure 5. End-to-End Delay (EED) for GeMuRo

Figure. 5 represents the End-to-End Delay (EED) for the second scenario. Flooding creates more End-to-End Delay due to the retransmissions of all the network nodes. GeMuRo and ODMRP show similar behavior in general, however, there is one significant difference for distances of fewer than three hops between the transmitter-receiver pair, GeMuRo has a better EED. Importantly, however, after three hops GeMuRo increases its EED because of its location-based strategy.

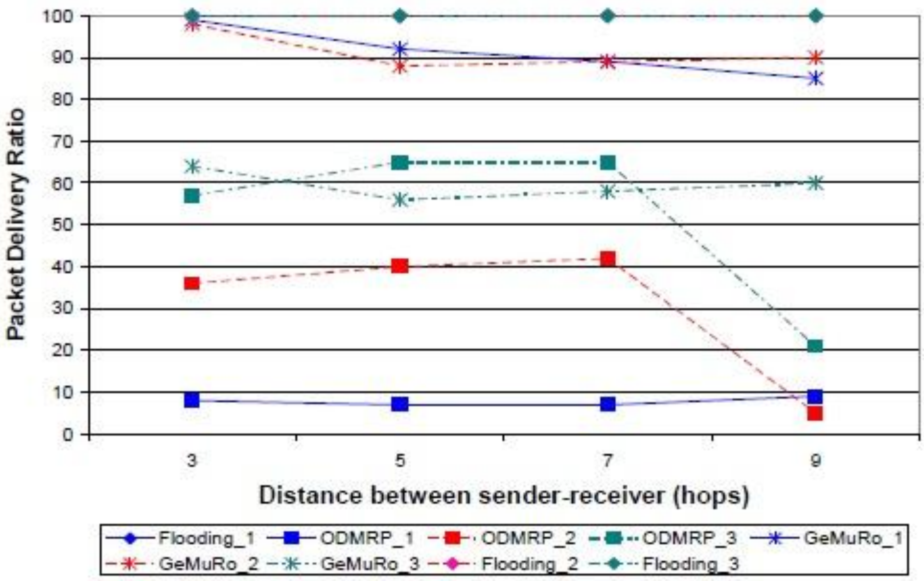

Figure6. Packet delivery for GeMuRo

Figure. 6 shows the packet delivery ratio of the three multicast routing algorithms. Flooding has the best performance compared to GeMuRo and ODMRP. GeMuRo reacts very well with one and two receivers, but with three receivers its performance significantly deteriorates. ODMRP performs poorly because of its lack of location information.

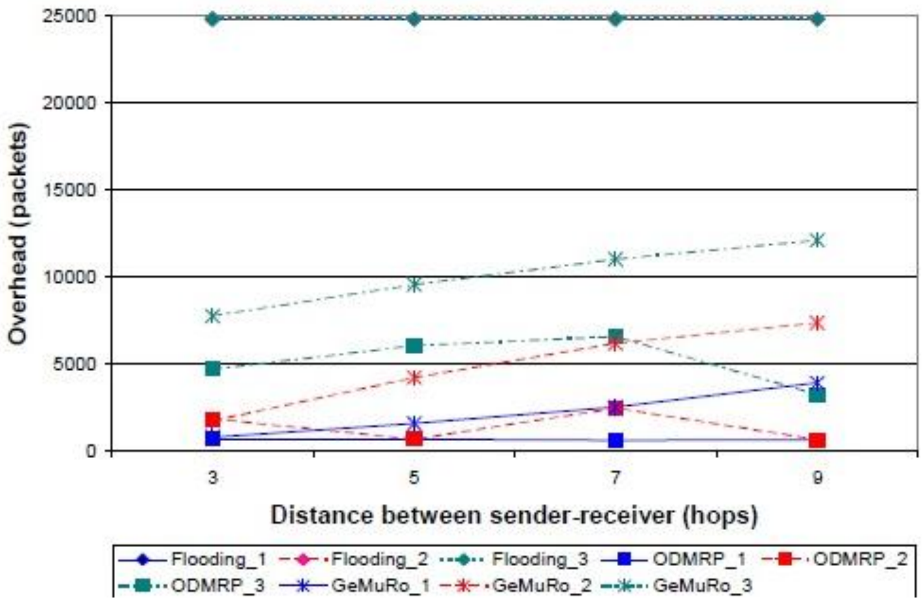

Figure7. Overhead for GeMuRo

Figure.7. represents the data sent throughout the network during the simulation period. Flooding performs the worst of the three algorithms because of its data packet retransmission mechanism, which is characterized by considerable redundancy. GeMuRo on the other hand has a higher probability of receiving data because it transmits a greater number of data packets.

CONCLUSION

ToMuRo, a topological multicast routing protocol and GeMuRo, a geographical multicast routing protocol were presented in this paper. ToMuRo has been compared with Flooding and ODMRP in a pedestrian scenario. On the other hand, GeMuRo has been compared with Flooding and ODMRP, but in a vehicular scenario. Significantly, simulation results of the pedestrian scenario show that the ToMuRo algorithm performs better than the ODMRP algorithm in terms of packet delivery ratio. The performance of ToMuRo, when compared with ODMRP, improves as node speed and the number of receivers increases. On the other hand, simulation results of the vehicular scenario show that the GeMuRo algorithm performs better than ODMRP in terms of jitter and packet delivery ratio. In terms of EED, GeMuRo and ODMRP perform similarly. However, Flooding shows significantly better performance in term of packet delivery ratio. Results show that Flooding might provide a viable option for vehicular ad-hoc networks with high mobility and density. Our future work will implement and compare ToMuRo and flooding in a tested.

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