Study of Position Based Greedy Routing algorithm with Interference in the MANET

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***Abstract*—** Ad hoc network can be considered as a special type of wireless mesh networks which is a collection of mobile wireless nodes formed without any infrastructure or any standard services. A mobile ad-hoc network is a collection of mobile nodes forming an ad-hoc network. The nodes in the MANET are connected and transfer messages wirelessly. The MANETs are also having problem of interference. In this paper the interference is discussed with the position based routing protocols.

Keywords— *VANET, Malicious Node, Vehicle, DMN, RSU.*

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I. INTRODUCTION

A Mobile Ad hoc Networks (MANETs) [1] are decentralized network with mobile nodes act as router and also as host. Mobile nodes are able to transmit the packets to the nodes which are in its proximity. If a mobile node has packet to send to other mobile nodes which is out of its transmission range then the nodes within its range forwards packets to the next neighbouring hop until packets reaches to the desired destination. Thus MANETs are also called mobile multihop wireless networks.

MANETs can be setup between some nodes or can be extended by connecting to fixed network. A Mobile ad hoc network is shown in Figure 1which consists of three wireless mobile nodes A, B and C. Transmission range of a node represented by dotted circle. Mobile node A is not within the transmission range of C and vice versa. If node A wants to establish communication with node C. Node B which in the transmission range of node A and node C forwards the packets so that node A and node C are able to communicate each other successfully.

The basic difference between the fixed networks and MANET is that the computing devices in a MANET are mobile. Due to the high mobility of these nodes there are some characteristics that are only applicable to MANET.

The MANET provides the communication facility to the moving nodes. It is most widely used network. It has the following characteristics [1] -

(1) Dynamic Nature -

Nodes are free to move randomly in the network. So the network topology changes randomly and rapidly at unpredictable times. It may consist of both bidirectional and unidirectional links.

2) Bandwidth constrained –

Wireless links will continue to have significantly lower capacity than their hardwired counterparts.

3) Energy-constrained operation –

The nodes in a MANET may rely on batteries or other exhaustible means for their energy. For these nodes, the most important system design criteria for optimization may be energy conservation. The energy is one of the major issues.

4) Security problems –

Mobile wireless networks are generally more sensitive to physical security threats than are fixed-cable nets. The increased possibility of eavesdropping, spoofing, and denial-of-service attacks should be carefully considered.

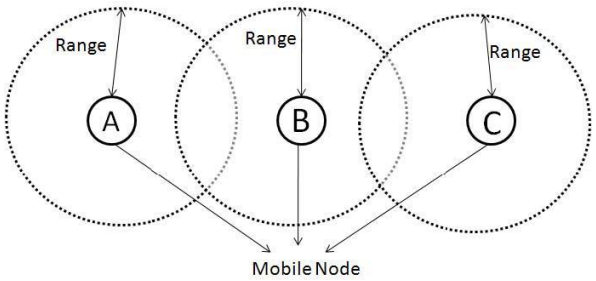

Fig. 1 Mobile Ad hoc Network [1]

This paper is divided in four sections. First section gives the introduction of the MANETs. The second section gives the description of interference in the MANET. The third section describes about position based routing algorithms, specially focused on the GBR algorithms. In section four, the conclusion is given.

II. INTERFERENCE IN MANET

Interference in MANETs is due to the possibility of a receiver node being positioned in the carrier sensing range for any other neighbourhood node, other than the previous node in the path, in the same network [2]. The neighbouring nodes create interference in the signals. The carrier sensing range for any node is the range in which a node can receive signals but cannot appropriately decode them. So in MANETs, when interference is considered, an otherwise optimized route from a source to a destination, in a specific path, may not be the optimal choice, such as the shortest path.

The communication is done wirelessly in the MANET. During the route construction process in MANETs, the neighbourhood nodes exchange messages in contention mode. This leads to heavy control message overhead and communication interference [3]. Interference affects the throughput of communication in MANETs by corrupting some of the transferred packets that are exchanged among the network mobile devices [2]. So it is important to study the

interference dependent schemes that will improve the throughput in the MANET environment.

III. Position Based Routing

In the Position-based routing, routing uses the positions of nodes to determine routes [2]. It is not necessary to maintain explicit routes, position-based routing scales well in any condition even the network is highly dynamic. This is a major advantage in mobile ad hoc networks where the topology may change frequently.

Position-based routing frequently uses one or a combination of two types of geometric based routings that are Greedy and Face based routing techniques. The greedy algorithm can be used once a node closer to the destination is found to continue discovering the path [2]. The main position based routing algorithms proposed by different authors, are as following -

A. Greedy-based Backup Routing Protocol with Conservative Neighbourhood Range (GBR-CNR)

In [4], authors proposed an approach for position-based stable routing for MANETs. Nodes are constantly in movement with different speeds and different directions, a node positioned within the transmission range of another neighbouring node at a certain time might be out of the range at another time.

In Greedy-based Backup Routing Protocol (GBR) [5], Greedy Perimeter Stateless Routing is used to construct the primary path such that each node considers the closest node to the destination within its transmission range as its next hop. To maintain the local link stability, GBR algorithm locally constructs the backup paths. Due to greedy manner of GPSR, a node may move out of transmission range before the next HELLO beacon will broadcast, resulting in no further received transmissions.

Authors modified GBR by introducing a Conservative Neighbourhood Range (CNR) which takes into account the possibility of nodes that could go out of range during the interval and subsequently avoided including them in the path leading to a significant reduction in the packets losses as well as increasing the reliability of communication. The CNR is defined by the conservative neighbourhood transmission range R_c which depends on the velocity of the node, the interval between the HELLO message broadcasts, and the actual transmission range value. The R_c is given by

$$R_c = R - (v_{max}t) \quad [2]$$

where R is the actual transmission range, v_{max} is the maximum node velocity, and t is the time interval between the HELLO message broadcast by the node. If the next hop neighbour v_{i+1} is chosen within this conservative neighbourhood range from vi then v_{i+1} will not go out of transmission range of vi during this interval, and no links in the primary path will break before the next HELLO beacon will broadcast. There will be no need to back up the primary path. This is called a Greedy-based Backup Routing Protocol with Conservative Neighbourhood Range (GBR-CNR) [2].

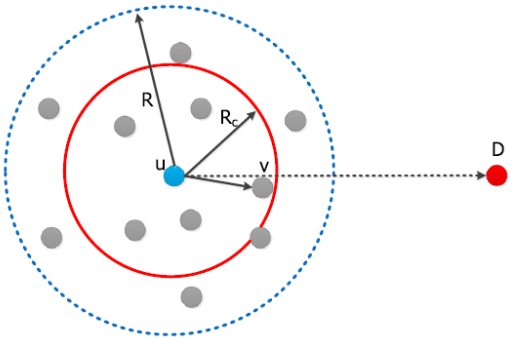

Fig. 2 Transmission range for GBR-CNR protocol [2][4]

B. GBR-CNR with less neighbours (GBR-CNR-LN)

In [2], the authors proposed new algorithm to minimizing the interference. The new algorithm is using the node with fewer neighbours. To develop a more interference-efficient variation of GBR-CNR, consider the number of neighbours in the receiving node. The basic concept is that when decreasing the number of neighbours surrounding of the receiving node, it will also decrease the probability that there will be a receiver's neighbourhood node also acting as a transmitting node in the same time slot as the sender [5,6].

The algorithm is GBR-CNR with less neighbours (GBR-CNR-LN) [7], so in the Fig. 3, where nodes are labeled A are senders, nodes B are neighbours of A, and node D is the destination. Node A will prefer, as a next hop, B2 instead of B1 because the number of neighbours of B2 is fewer than the neighbours of B1. Fewer neighbours translate into a lower probability of corrupted packets. So there is increase in network throughput [2].

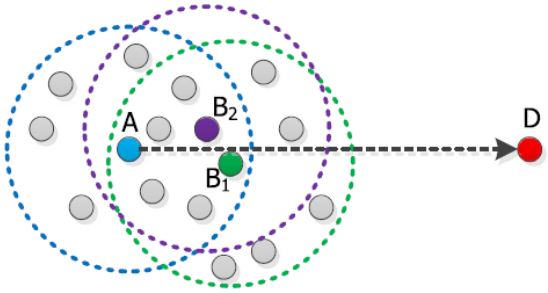

Fig. 3 GBR-CNR with less neighbours (GBR-CNR-LN) [2]

C. GBR-CNR with less neighbours used (GBR-CNR-LU)

In [2], the authors proposed new algorithm by minimizing interference using the node that is less used. Exploring another variant of the aforementioned approach to achieve more interference-efficient routing using GBR-CNR, authors consider the number of communications the receiving node is already participating in. The algorithm is GBR-CNR with the less used (GBR-CNR-LU) nodes chosen as next hops [7].

For example, in Fig. 4, where nodes labeled A are senders, nodes B are neighbours of A, and node D is the destination. We assume that there are two paths and node B1 is chosen as the next hop for node A1. So far, when our protocol will establish the second path, node A2 will prefer, for the next hop, node B2 instead of B1 since node B1 participates in more communications than node B2 even though node B1 is closer to the destination D2 than node B2. Thus, a node that participates

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in fewer communication paths is less susceptible to message corruption [2].

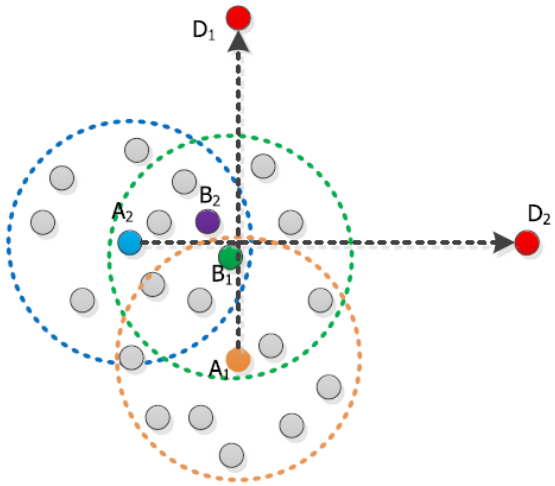

Fig. 4 C. GBR-CNR with less neighbours used (GBR-CNR-LU) [2]

IV. Conclusions

In MANETs provide the accessibility to the mobile nodes. The position based routing protocol like GBR, GBR-CNR, GBR-CNR-LU, GBR-CNR-LN etc. provide the better connectivity. Lot of work is performed by different authors. The work of authors not only increases the quality of services but also provide a secure and alternative path to the users.

References

[1] Anurag Porwal1, B.L.Pal2, Rohit Maheshwari3, Gaurav Kakhani, " Study and Design of New Reactive Routing Protocol Advance AODV for Mobile Ad hoc Networks", *International Journal of Engineering Research and Applications (IJERA)*, ISSN: 2248-9622, Vol. 2, Issue 3, May-Jun 2012, pp.3195-3204

[2] Abedalmotaleb Zadin, Thomas Fevens , "Neighborhood-based interference minimization for stable position-based routing in mobile ad hoc networks", *Future Generation Computer Systems*, 64, 2016, 88–97, Elsevier, 2016

[3] D. Andrew, J. Robert, "Link probability for ad hoc mesh networks in the presence of multiple interferers", *in: Military Communications Conference (MILCOM), IEEE*, 2010, pp. 1032–1037.

[4] A. Zadin, T. Fevens, "Stable connections using multi-paths and conservative neighborhood ranges in mobile ad hoc networks", in: 26th Annual IEEE Canadian Conference on Electrical and Computer Engineering, CCECE, 2013, pp. 1–4.

[5] W. Yang, X. Yang, S. Yang, D. Yang, "A greedy-based stable multi-path routing protocol in mobile ad hoc networks", *Ad Hoc Networks* 9, 2011, 662–674.

[6] Z. Gong, M. Haenggi, "Interference and outage in mobile random networks: Expectation, distribution, and correlation", *IEEE Trans. Mob. Comput.* 13 (2), 2014, 337–349.

[7] A. Zadin, T. Fevens, "Minimizing communication interference for stable position-based routing in mobile ad hoc networks", Procedia Comput. Sci. 52, the 6th International Conference on Ambient Systems, Networks and Technologies (ANT-2015), the 5th International Conference on Sustainable Energy Information Technology (SEIT-2015), 2015, 460–467.