GNDA: Good Neighbor Node Detection for Selfish node Identification in Mobile Ad Hoc Networks

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Abstract- **There has been a growing research activity on wireless mobile ad hoc networks (MANETs) over the past years due to their potential useful civilian and military applications. The overhead of route discovery cannot be neglected due to high mobility of nodes in mobile ad hoc networks (MANETs) which leads to frequent path failures. NCPR (Neighbor Coverage-based probabilistic Rebroadcast protocol) is used to reduce routing overhead based on neighbor coverage knowledge and rebroadcast probability. There may be a chance of node selfishness which causes data loss throughout the network and reduces the packet delivery ratio. Node failure in network tends to high end-to-end delay. GNDA is proposed for this problem to identify the good neighbour nodes based on signal strength and flow capacity. The proposed approach decreases end-to-end delay and decreases packet delivery ratio to the greater extent by identifying the selfish nodes. And improves performance of routing protocol in terms of good communication and stable route.**
Index Terms- Mobile ad hoc networks, GNDA, signal strength, flow capacity, relative position, selfishness

INTRODUCTION

Mobile ad hoc network (MANET) is an infrastructure-less multihop network where each node communicates with other nodes directly or indirectly through intermediate nodes. MANETS are self-organizing, rapidly deployable wireless networks; they are highly suitable for applications involving special outdoor events, communications in regions without wireless infrastructure, emergencies and military operations. Thus, all nodes in a MANET basically function as mobile routers participating in some routing protocol required for deciding and maintaining the routes. One of the challenges in the design of MANETs in a multi-hop environment is the design of dynamic routing protocol that can efficiently establish routes to deliver data packets between mobile nodes with minimum communication overhead while ensuring high throughput and low end-to-end delay. Various other factors make the task of secure communication in ad hoc wireless networks difficult include the mobility of the nodes, a promiscuous mode of operation, limited processing power, and limited availability of resources such as battery power, bandwidth and memory. Therefore nodes have to cooperate for the integrity of the operation of the network. Nodes may refuse to cooperate by not forwarding packets for others for selfish reasons and not want to exhaust their resources. The routing protocols proposed for MANETs are generally categorized as table-driven and on-demand driven based on

the timing of when the routes are updated. Many routing protocols, such as Ad hoc On-demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR) have been proposed for MANETs. Frequent link breakages, frequent path failures and route discoveries occurs due to node mobility in MANETs, which could increase the overhead of routing protocols and reduce the packet delivery ratio and the increasing end-to-end delay. Another problem in MANETs is reducing the routing overhead in route discovery. The traditional on-demand routing protocols uses flooding to discover a route. They broadcast a Route REQuest (RREQ) packet to the networks, the broadcasting induces excessive redundant retransmissions of PREQ packet causes the broadcast storm problem. Williams and Camp categorized broadcasting protocols into four classes: simple flooding, probability, area and neighbor knowledge methods. These broadcasting protocols, increases the number of nodes in a static network that will degrade the performance of the probability-based and area-based methods. Since limiting the number of rebroadcasts can effectively optimize the broadcasting, and compared to the area based- ones and the probability-based ones, the neighbor knowledge methods gives better results. Neighbor Coverage-based probabilistic Rebroadcast protocol was proposed in order to effectively exploit the neighbour coverage knowledge and to reduce the redundant retransmission. We propose a novel scheme to reduce the retransmission and to increase the performance of the network in terms of packet delivery ratio and end-to-end delay by identifying selfish nodes in the network using good neighbor node detection.

RELATED WORK

Broadcasting is an efficient mechanism for route discovery, especially in high dynamic networks the routing overhead associated with the broadcasting can be quite large. Neighbor coverage based good node detection for reducing routing overhead is defining the neighbor knowledge to reduce the routing overhead. But it leads to high end-to-end delay and delivery ratio. Despite the various optimizations, with flooding-based routing, many routing messages are propagated unnecessarily. That gossiping can reduce control traffic up to 35%when compared to flooding. Our protocol is simple and easy to incorporate into existing protocols. When adding gossiping to AODV, simulations show significant performance improvements in all the performance metrics, even in networks as small as 150

nodes. Local and global connectivity of a network increases when good neighbors are present throughout the network. Improved neighbor detection algorithm for AODV routing protocol is used for stable network connectivity by using concept signal to noise ratio. Hop count based routing for providing life time link stability for residual lifetime of a link. Routing protocols minimizing mobile nodes energy not only during active communication but also when they are inactive. Transmission power control and load distribution are the two approaches for minimize the active communication energy. Sleep /power-down mode is used to minimize the inactive communication energy. The protocols used in minimize active communication energy are GNDA, EERCC, COMPOW, LEAR. The protocol used in minimize inactive communication energy is PEN. Transmission power control approach represents that strong transmission power increases the transmission range and reduces the hop count to the destination, and weaker transmission power decreases the transmission range and high end-to-end delay due to a larger hop count. In this paper we will explore GNDA to increase the performance of a network by identifying selfish nodes. Besides, this approach is extended by adding extra parameters i.e. signal strength, flow capacity and relative position of a node.

PROPOSED METHOD

The overhead of route request has been reduced using several methods like neighbor coverage based probabilistic method which leads to high end-to-end delay and packet delivery ratio. The node which has enough power to transmit the packet is identified by using good neighbor node detection method. This method provides optimal solution for finding good nodes. Performance metrics in categorization of nodes are transmission range and power of node, signal strength, high packet forwarding capacity and relative position of node. Signal strength and flow capacity of the node is calculated first.
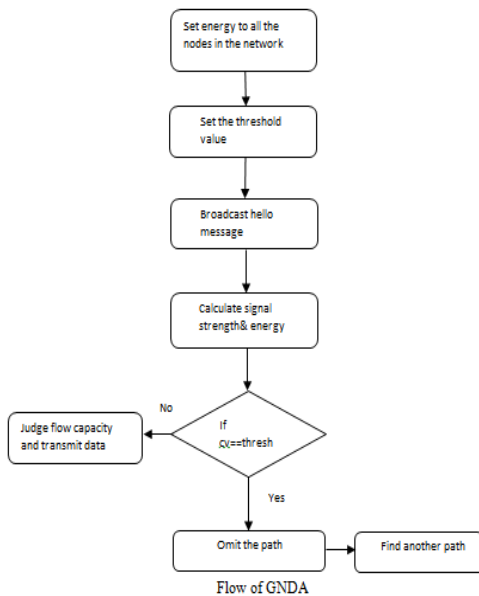

Figure 1:Flow of GNDA

SIGNAL STRENGTH

$$Transmitter_{signal\ strength}$$

$$= \begin{cases} S_H - \left\{ \dfrac{S_H - S_{threshold} * T}{e} \right\} & \text{if farther}(T > e) \\ S_H & \text{closer}(T < e) \\ S_{thresh} & \text{Otherwise} \end{cases}$$

FLOW CAPACITY

Assume a graph G (V, E). The capacity of directed edge is denoted as C_{ij}, source is denoted as s and d is destination. Flow in G is assumed as F where E belongs to edge (i, j). If for all (i, j) $\in$ E; $0 <= F_{ij} <= C_{ij}$; s.t.

$$\sum_{j:(s,j)\in E} F_{sj} - \sum_{i:(i,s)\in E} F_{is}$$

Let F_{is} and F_{sj} be the counter of amount of bytes that flowed on the link (i, j) upto time t in packets.

Suggested algorithm is an optimal solution for finding good nodes. Categorization of nodes is based on performance metrics such as transmission range and power of node, signal strength, capacity of node for high packet forwarding and relative position of node. Neighbor routing table maintains address of node for maintaining record of the entire nodes. Based on the calculation of signal strength and flow capacity, the node which has enough power to transmit the data packet is identified. The good node detection algorithm also finds the node which has selfishness in the transmission of data throughout the network. Selfishness of the node is categorised as two: full selfishness and partial selfishness.

- Full selfishness: the node which cannot be able to transmit and also to receive the data packets in the network.
- Partial selfishness: the node which has power only to receive the data packets and cannot able to transmit.

Proposed system detects the node which has partial selfishness in the network to improve the packet delivery ratio and to decrease the end-to-end delay.

IMPLEMENTATION

The proposed system is implemented using the modules such as Neighbor discovery, Route discovery, Energy calculation using GNDA, Data transmission.

A. Route Discovery
   The first step is to creating the number of nodes with specified position. By sending the route request packet the route is discovered between source node and destination node.

B. Neighbor Discovery
   The neighbor node is discovered based on neighbor coverage knowledge and probabilistic method by using the upstream coverage ratio of an RREQ packet received from the previous node to calculate the rebroadcast delay, and use the additional coverage ratio of the RREQ packet and the connectivity factor to calculate the rebroadcast probability.

C. Energy calculation
   Energy of each node is calculated. If the calculated value is equal to the threshold value then that is identified as selfish node which cannot be transmit any data packet. Then it finds the other node which has enough power to transmit.
D. Data transmission
   Data is transmitted through the good node which is detected using GNDA algorithm.

SIMULATION RESULTS

The objective of the project is to reduce the delay of transmission of data packets in mobile ad hoc networks and thereby finding node selfishness by the combined approaches of neighbor coverage knowledge and good neighbor node detection. Neighbor coverage knowledge and probability mechanism finds the nodes which are available in coverage area. Good neighbor node detection algorithm finds selfish node based on signal strength and flow capacity and thereby increases packet delivery ratio and decreases average end-to-end delay. Simulation results shows better performance in high dense network. Proposed approach for good neighbor node detection in mobile adhoc network is identified and result is compared with conventional AODV and NCPR protocol.

PERFORMANCE METRICS

- Packet delivery ratio: the ratio of number of delivered packet to the destination.
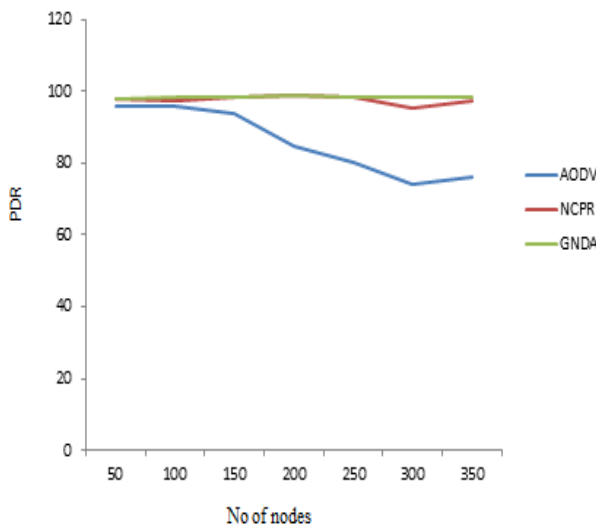
$$\sum Number\ of\ packet\ received / \sum Number\ of\ packet\ send$$

   The greater value of packet delivery ratio means the better performance of the protocol.
- Routing overhead: the ratio between number of sent packet over the number of received packets.
- Average end-to-end delay: the average time taken by a data packet to arrive in the destination.
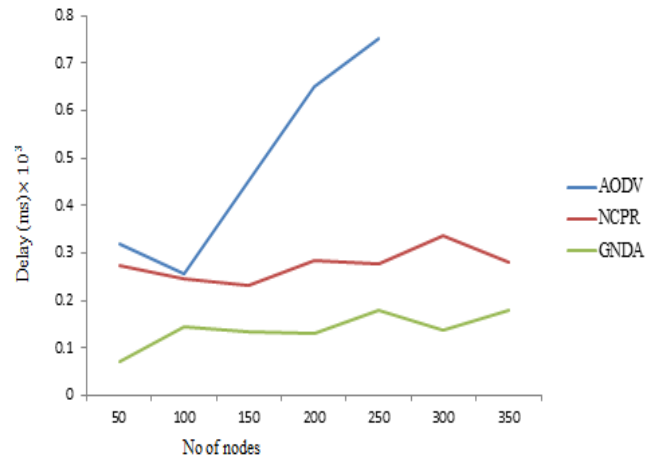
$$\sum (arrive\ time - send\ time) / \sum Number\ of\ connections$$

The performance of the protocol is inversely proportional to end-to-end delay.
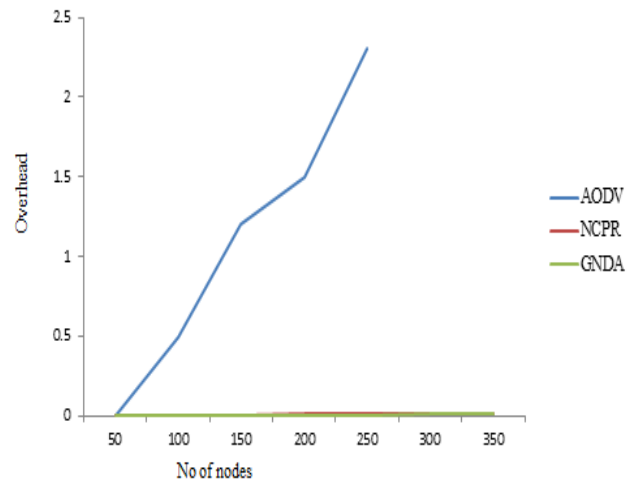

Packet delivery ratio

Packet delivery ratio is improved by about 22.2 percent compared with AODV and 1 percent when compared with NCPR.

End-to-end delay

Average end-to-end delay is reduced by about 57 percent compared with AODV and 10 percentwhen compared with NCPR.

Routing overhead

Routing overhead is reduced by about 21.8 percent compared with AODV and 2 percent compared with NCPR.

CONCLUSION

In this paper, we proposed good neighbor node detection based on signal strength and flow capacity to reduce data lose due to node selfishness in the network. This approach calculates the energy and signal strength for each node in the network. Simulation results shows that the proposed method increases the end-to-end delay and packet delivery ratio with less overhead. The simulation result also shows that the proposed approach has good performance when the network is in high density.

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