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A Incentive Based Scheme to Detect Selfish Nodes in MANET

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Abstract: ***MANET (Mobile Ad-Hoc Network) is self-directed and infrastructure less network. MANETs contains mobile nodes that are free to move in the network. Nodes can be the devices like mobile phones, PDA, MP3 players and personal computers which are participating in network. MANET has the dynamic topology due to the node movement. Transmissions of the packet between the mobile devices are overcome by the Routing Protocol. Selfish node is a major problem in MANET. Selfish nodes are nodes that do not participate in forwarding process. An incentive based scheme is proposed to detect the selfish node in MANET. Proposed scheme is implemented on ONE Simulator.***

Keywords: MANET, routing protocols, selfish node, incentive ONE (Opportunistic Network Environment).

I. INTRODUCTION

A mobile ad hoc network is an independent arrangement of mobile nodes linked by wireless associations. These networks are very flexible and suitable for a number of types of applications, as they allow the concern of temporary communication with no any pre installed infrastructure. Due to the limited communication range of the wireless interfaces, communication has to be relayed intermediary nodes. Ad hoc networks allow devices to produce a network on demand not including prior management. This requires the nodes in a MANET to be implicated in routing and forwarding information among the neighbors. The designing of routing protocol plays an important role in the implementation of the mobile network. The misbehavior of selfish node is a major problem in the MANET. The selfish nodes do not participate in the routing process. Selfish node is delay and drops the packet. Selfish nodes do not participate in the forwarding process. These misbehavior nodes will impact energy, efficiency and reliability. The selfish node utilizes the resource for its own purpose. The selfish node neglect to share the resources like battery power, CPU time to forward the data packet of different node [1][2][3][4].

The main features of the selfish node are as follows:

- Non participating routing
- No transmission or reply
- Data packet delay and dropping

II. RELATED WORK

This section deals with the exit solutions for the managing and detecting the misbehavior in MANET.

Lien et al. [5] implements a threshold based method in MANET. In this analysis, an empirical and effective approach was proposed threshold value to determine whether a node is selfish or not. If the detected number of misbehavior of this node is more than or equal the threshold value, this node will be identified to the selfish node.

Ze Li et al. [6] implements a game theory analysis of cooperation incentive strategy in MANET. In this analysis, the game theory analyze the cooperation incentive provided by two system (reputation based and price based system) and by the system with no cooperation strategies. Game theory can be classified into the cooperative game models and non cooperative game models. In cooperative game, the node agrees on their strategies and cannot change their strategies later on. In non cooperative game, node can change their strategies any time to maximize their benefit.

Enrique et al. [7] implements the selfish node detection using the collaborative watchdog. Watchdogs are used to detect the selfish dog in the computer networks. If one node has previously detected the selfish node using its watchdog it can spread this information to other nodes when a contact occurs. We say that a node has a *positive* if it knows as the selfish node. The detection of contacts between the nodes is straight forward using the node's watchdog. In this examination, proposed a collaborative watchdog based on contact dissemination of detected selfish node.

Rubana et al. [8] implements the selfish node detection and deletion. A selfish node is a node whose objective is to maximize its own benefit. Selfish node gets the benefit when it participates in routing process. There are different motives that insist some nodes to drop a packet rather than sending a packet. In this paper, a new distributed and cooperative approach was proposed which insist every participating node to detect the selfish node.

S. Roselyn Mary et al. [9] implements the early detection of DOS (Denial-of-service) attack using attacked packet detection algorithm (APDA). Vehicles can send messages to the router road side unit (RSU) through the APDA mechanism. It is to detect the certain position of the messaged vehicles. After detecting the position of vehicles information it is stored in the certain RSU. DOS attack can be done by the network insiders and outsiders. APDA can be

applied, before verification time and to increase the capacity. In this analysis, an APDA was proposed which is used to detect the DOS (Denial-of Service) attacks before verification time.

A. Nadeem et al. [10] evaluate network layer selfish behavior and a method to detect and mitigate its effect in MANET. In these method nodes monitor its neighbor's behavior when they forward using promiscuous monitoring. During the monitoring period, if a node detects suspicious behavior of its neighbor, then its request all other neighbors nodes to monitor this node monitor for a predetermined time period. They analyze the statistics collected from neighbors to detect selfish nodes and punish them by isolating it from the rest of a network for a predetermined time period. In this analysis, a proactive mechanism that first detects nodes that are exhibiting selfish behavior and mitigate its effect on network performance.

III. EXISTING TECHNIQUES TO DETECT THE SELFISH NODE

Threshold based method: In this algorithm, we initialize the selfish degree to each node. Selfish degree is a number by which we represent the selfishness of node. In this, if selfish degree is 0 then node is not selfish otherwise node is selfish. After initializing the selfish degree, we generate a threshold by using the random n umber. The range of random number lies between -1 to 1. After generating the random number, we check that our node is selfish or not. If the node selfish degree is less than equal to threshold then node is not selfish otherwise node is selfish[5].

Game theory: In game theory, game theory model can be classified into cooperative game models and non-cooperative game models. In cooperative game model, each node earns its maximum benefit only when the nodes from a grand association, in which all nodes in system are cooperative. In non-cooperative game, investigate the best strategy for each node to maximize its benefit. Game theory is used for packet forwarding in MANETs[6].

Collaborative watchdog: A way to reduce the detection time of selfish (or non-cooperative) nodes in a network is the collaborative watchdog. If one node has previously detected a selfish node using its watchdog it can spread this information to other nodes when a contact occurs. The detection of the contacts between nodes is straight forward using the node's watchdog. In this examination, proposed an efficient approach to reduce the detection time of selfish node[7].

Credit based: In this, we reduce the selfishness of node. If the node delay or drop the packet, then this node is known as selfish node and to remove the selfish node we give the credit to selfish node then selfish node does not drop or delay the packet and node take the participate in routing process and then node send the data to next node[11].

IV. PROPOSED WORK

It is desirable that various researchers proposed different schemes to deal with Selfish nodes and their behaviors in MANETs. Various schemes have been developed to distribute incentives to Selfish nodes to remove Selfish behavior but no optimal scheme is provided for a secure and energy efficient operation. The present research work focused on the credit based distribution scheme to remove selfishness from MANETs. Many approaches have been proposed for detection of selfish nodes but no one has an optimal solutions. We have further explored the approach incentive based scheme to remove identified and selfishness from the network.

PROPOSED ALGORITHMS

Algorithm to Detect the Selfish Node

```
Initialize selfish degree to each node from 0-100.
Selfish degree/Drop rate = Number of packets received by node- Number of packets forwarded by node
Generate a Th (Threshold).
Th=0;
For (k=0; k<n; k++)
{
If drop rate =100%
{
Then
Node is Selfish;
Else
Node is Normal;
}
}
For (i=0; i<n; i++)
{
Check if node selfish degree <=0
{
Then    node status normal;
Else
Node status partially selfish;
If node selfish degree=100
{
Node status fully selfish;
}
}
}
```


V. DESCRIPTION OF ALGORITHM

In this algorithm we first initialize n number of nodes and calculate their drop rate. Drop rate is the amount of packets dropped by a node. Drop rate is calculated by Number of packets received by node- Number of packets forwarded by node. If drop rate of node is 100% then node is selfish else node is normal. Using drop rate selfish degree of each node is calculated. If selfish degree is less than or equal to zero then node is normal else if degree is between 0-100 node is partially selfish else if selfish degree is 100 then node is fully selfish.

Algorithm to Distribute Incentive

```
Check the node status using algorithm 1.
2. If node status is selfish
     {
Then   Incentive is not given to node
            Else
 Incentive is given to node
     }
3. End.
```

Description of algorithm

When we detect selfish node and normal node then we assign an incentive to the nodes who successfully deliver the message else no incentive is given to the node. Incentive is in the form of energy, battery etc.

VI. SIMULATION RESULTS AND ANALYSIS

Simulation Environment

The One (Opportunistic Network Environment) simulator has been used for simulation purpose. ONE is a Java based simulator targeted for research in Delay Tolerant Networks (DTNs). Apart from letting a user to simulate different scenarios quickly and in a flexible way, it also provides an easy technique to generate statistics from the simulation performed. The ONE simulator can be run on Linux, Windows, or any other platform supporting Java. The simulator is written in Java (1.6).

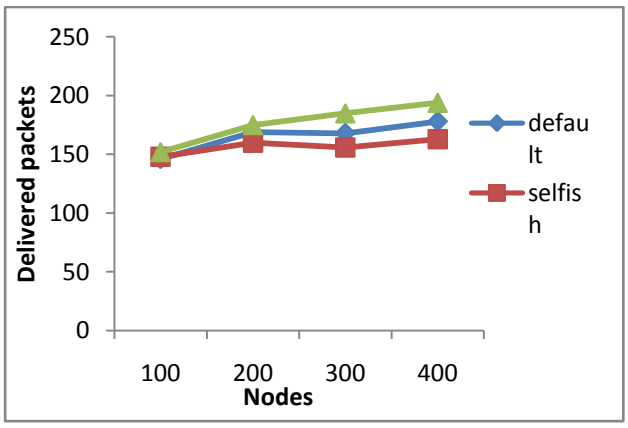

Fig 1: Delivered packets v/s Nodes

Fig1. Shows that when we run simulation with default routing then delivered packets is normal when selfish nodes are present in network then delivered rate is low and in proposed incentive scheme delivered rate is increases.

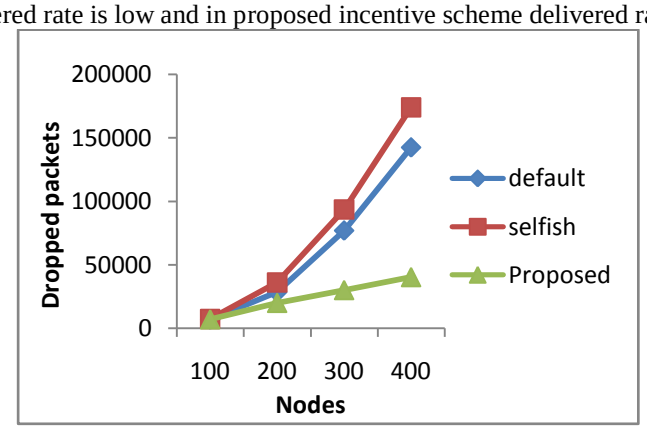

Fig. 2 dropped packets v/s Nodes

Fig2. Shows that when we run simulation with default routing then dropped packets is normal when selfish nodes are present in network then dropped rate is high and in proposed incentive scheme dropped rate is decreases.

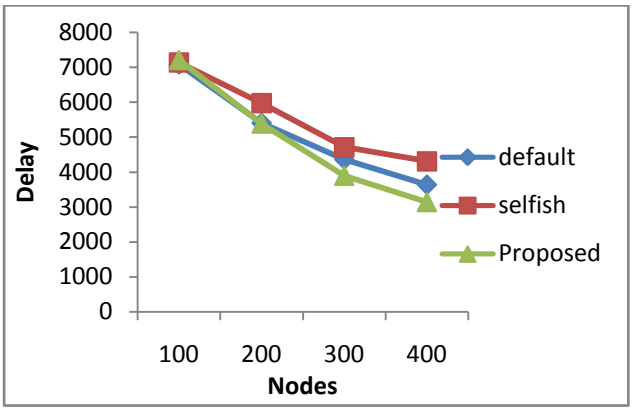

Fig 3 Message delay v/s Nodes

Fig 3. Shows that in proposed scheme message delay is low while when selfish nodes are present then message delay is high

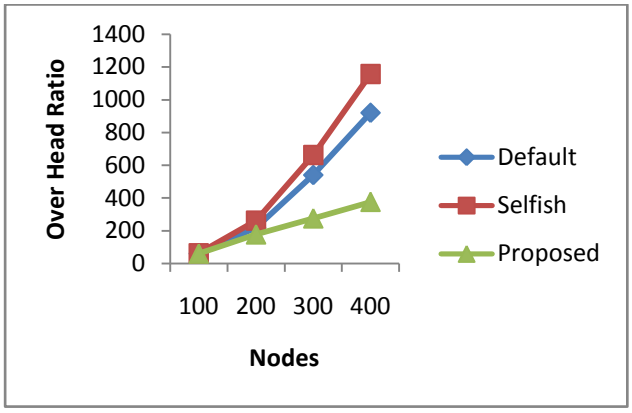

Fig4. Overhead ratio V/s Nodes

Fig4. In proposed scheme overhead ratio is low. When selfish nodes are present in network then overhead ratio is increases.

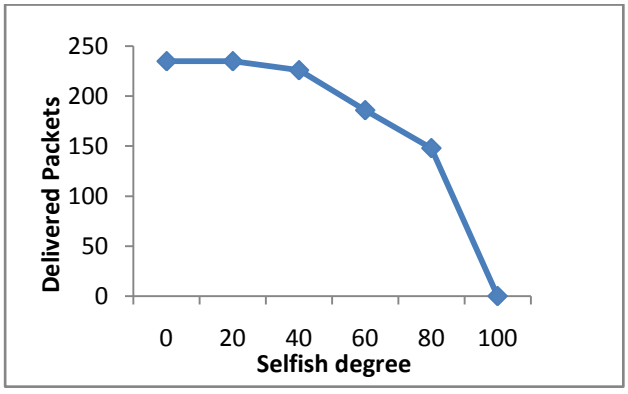

Fig 5 Delivered packets v/s Selfish degree

Fig 5 shows that as we increases selfish degree then delivered packets are constantly decreases. When selfish degree is 100 then no packet is delivered.

VII. CONCLUSION

In this paper, an incentive based scheme to detect the selfish node and remove the selfishness is proposed. Simulation result illustrates that the proposed scheme reduces dropped rate, message delay, overhead ratio and increase the delivered rate. But on the other hand delivered packets are decreased to increase the selfish degree. In future, it is intended to continue working on it and improve it with the help of formation of the clustering. Next step will be to propose more efficient policies for distribution of credits to participating nodes.

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