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Eliminating Selfishness to Improve Replica Allocation over MANET's

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Abstract— Mobile ad hoc networks are formed dynamically due to autonomous system of mobile nodes that are connected through wireless links without using an existing infrastructure or centralized administration. We have explored the impression of selfish nodes in a MANET from the perspective of replica allocation and developed selfish node detection algorithm that considers the partial selfish node and fully selfish node as selfish replica allocation. Some mobile nodes decided not to cooperate with other mobile nodes and simply aim to save its resources to the maximum while using the network to forward its own packets, these types of mobile nodes are called "Selfish Nodes" this misleading is very common in ad hoc network because of its configuration setup. These nodes could be detected and excluded from the cooperative portion of the network, as they only consume resources but don't contribute to the infrastructure. In existing methods, there are no steps to handle false alarms and efficient detection of selfish nodes. In this paper, a new mechanism that minimizes the problem of selfish nodes with the help of Credit risk and Brain trapping function Model. Including Degree of selfishness in allocating replicas will considerably reduce communication cost and produce high data accessibility.

Keywords— Selfishness, Replica allocation, MANET, Mobility, Nodes.

I. INTRODUCTION

A MANET (Mobile Ad-hoc Network) is a type of ad hoc network that can change locations and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission. Some MANETs are restricted to a local area of wireless devices (such as a group of laptop computers), while others may be connected to the Internet. Mobile Ad hoc Networks do not rely on extraneous fixed infrastructure and can be installed without base station and dedicated routers. This makes the nodes as ideal candidate nodes for rescue and emergency operations. The nodes in these networks have limitations in battery power and bandwidth, and each node needs the assistance from other nodes to forward their packets. The selfish nodes are reluctant to spend their resources such as battery power, CPU memory and CPU time for others but they are not malicious nodes.

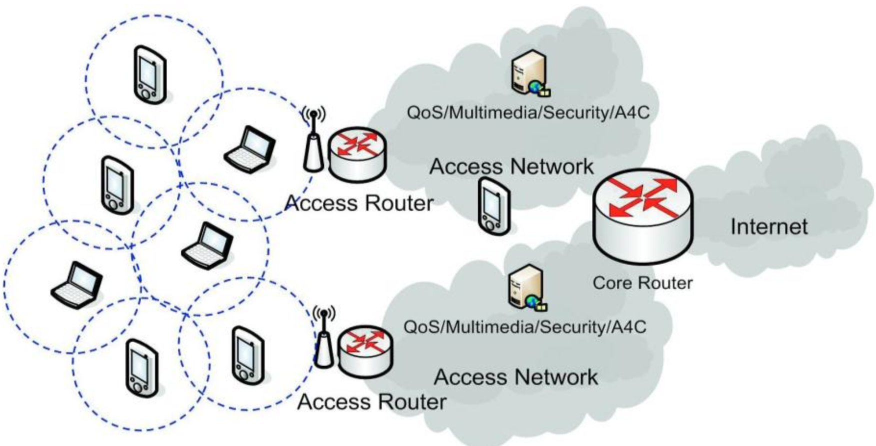

Figure 1. MANET

Especially the problem is critical when with the passage of time the nodes have little residual power and for their own purpose they want to conserve it. Thus in MANET environment there is a strong chance to a node to become selfish. A mobile node may be able to communicate with other nodes far away with the combination of intermediate nodes, transforming the packets to the destination. In this multi hop communication, each mobile node performs as both host and router. Routing protocols of ad hoc network such as DSR[3]. Selfish replica allocation is a another notation refers to a mobile node's non cooperative act, means the node refuses to participate fully in sharing its memory space with other mobile nodes in the network. It considers replica allocation techniques with the developed selfish node detection method.

They are based on the concept of a self-centered friendship tree (SCF-tree) [1] and its aim is to achieve high data accessibility with low communication cost in the presence of malicious nodes. The SCF-tree is divine by human friendship handling in the world. In this paper, a model to detect and prevent selfish nodes that decline to cooperate but at the same time still utilize the network for their own benefits. Actually this model is also helped to find any misbehaving node attack in ad hoc network but in this paper the focus on replica allocation with the presence of selfish nodes.

II. METHODS

Three replica allocation methods were proposed belongs to the access frequency and network topology [1].

a. SAF (Static Access Frequency) [3] The mobile host stores the original data with the highest access frequency and replicas with the descending order of their access frequencies.
b. DAFN (Dynamic Access Frequency and Neighborhood) [2]The mobile host allocates replicas based on SAF. And the replica duplications among neighbors are eliminated as much as possible.
c. c. DCG (Dynamic Connectivity based Grouping)[3] The mobile hosts are organized into groups using bi-connected components.

III. PREPARATORY

1. Node Behavior Model

- Type-1 node: The nodes are nonselfish nodes[1]. The nodes hold replicas allocated by other nodes within the limits of their memory space.
- Type-2 node: The nodes are fully selfish nodes[1]. The nodes do not hold replicas allocated by other nodes, but allocate replicas to other nodes for their accessibility.
- Type-3 node: The nodes are partially selfish nodes[1]. The nodes use their memory space partially for allocated replicas by other nodes. Their memory space may be divided logically into two parts: selfish and public area. These nodes allocate replicas to other nodes for their accessibility. The detection of the type-3 nodes is complex, because they are not always selfish.

2. System Model To focus on the selfish replica allocation, it will not consider selfishness in data forwarding throughout this paper [12].

- Each node in a MANET has a unique identifier[1]. All nodes that are placed in a MANET are denoted by N= {N1,N2,…Nm}, where m is the total number of nodes.
- All data items are of equal size, and each data item is held by a particular node as its original node. Each data item has a unique identifier, and the set of all data items is denoted by D= {D1, D2,…Dn} where n is the total number of data items.
- Each node Ni has its own access frequency to data item. The access frequency does not change.
- Each node moves freely within the maximum velocity.

IV. PROPOSED STRATEGY

The strategy consists of three parts:

1) Detection and prevention of selfish nodes : It made plan on the real case that everyone want to live and exertion for its existence if anyone is sure that he will not going to die because of scarcity of resources then it will be more chances that it will not cheat others for resources. Here it consider the notion of credit risk (CR)[1] from bank management to detect selfish nodes. Credit Risk (CR) = Expected risk/ Expected value (1) each mobile node computes a CR score for each of the nodes to which it is connected. Each node shall calculate the “degree of selfishness” for all of its connected nodes according to the score.

2) SCF-tree with cooperative monitoring system : The SCF-tree[1] based replica allocation methods are divine by human friendship handling in the world, where each person makes their own friends forming a web and forming friendship by himself/herself. He/she does not have to communicate these with others to insist the friendship. Then define Gins as the undirected graph Gins =(INins,ILins) which consists of a finite set of non selfish nodes detected by Ni, INins and a finite set of communication links among nodes INins , ILins is derived by a smooth[1] over operation in graph theory.

2.1 Implementing Collaborative Monitoring within SCF Tree: If one node has previously detected a selfish node using credit risk value, it can spread this information to other nodes when a contact begins. It implies that a node has a positive if it knows the selfish node. The node is overhearing the packets of the neighborhood. Thus, when it starts receiving packets from a new node it is considered to be a new contact. Then, the node transmits one message including all known positives it knows to this new contacted node. The number of messages required for this task is the overhead of this method. A collaborative node can have a positive when a contact occurs between the connected nodes. In the model one of the nodes is the selfish node. Then, the collaborative monitoring node can identify it using its monitoring and have a positive about this selfish node. Even so, a contact does not always simply detection. To model this fact, it introduce a probability of detection (pd).This probability depends on the effectiveness of the monitoring system and the type of contact (for example if the contact time is very low, the node does not have enough information to evaluate if the node is selfish or not). A node has two states: NOINFO, when the node doesn‟t know about the malicious node and POSITIVE when the node has information about the selfish nodes. All nodes have an initial state of NOINFO and they can update their initial state when a contact occurs. Using a contact

3) Allocating replica regarding Degree of selfishness : This technique takes into consider the degree of selfishness[1] in allocating replica. Less selfish nodes should be visited first at the same SCF-tree level. This one makes more frequently accessed data items rest on less selfish nodes. Consider that a node can use some part of its memory space selfishly[1], so divide memory space Mi for replica logically into two parts:

- Selfish area (Ms)
- Public area (Mp)

Each node may use its own memory space Mi freely as Ms and Mp. In each mobile node, Ms will be used for data of local interest to produce average query delay and Mp for public data is set to hold data for other nodes to improve data accessibility. Consequently, each mobile node allocates replicas in descending order of its own access frequency. Each node Ni executes the replica allocation algorithm at every relocation period after construct its SCF-tree. At first, a mobile node determines the priority for allocating replicas. The priority is based on Degree of selfishness. A mobile node allocates a replica to the expected node in its SCF-tree once during a single relocation phase; a node has at most one expected node for each replica. If its own Ms is not full, Ni allocates replica to its Ms first. If its own Ms becomes full, the node requests replica allocation to nodes in its SCF according to degree of selfishness of each node.

The ultimate aim of the SCF-tree-based replica allocation techniques is that it minimize the communication cost and achieving high data accessibility.

V. CONCLUSIONS

The selfish replica allocation could reduce the overall data accessibility in a MANET and does not handle false alarms. The proposed strategies are inspired by the real-world reflection from economics in terms of credit risk and in human friendship management in terms of selecting friends completely at its own discretion. The applied notion of credit risk and the collaborative monitoring method to detect selfish nodes outperforms the existing detection methods and every node in a MANET calculates credit risk information on other connected nodes individually to measure the degree of selfishness. The collaborative monitoring method is used to reduce the detection time & cost of the each node. Since existing replica allocation techniques failed to consider selfish nodes and also proposed novel replica allocation techniques. The research is currently going on the impact of different mobility patterns. The proposed strategies improves the data accessibility, reduces communication cost, and average query delay and also to reduce the detection time of the selfish nodes.

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