Peak Monitoring the Egotistic Nodes in MANET During Duplication Allocation

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Abstract — Mobile Ad Hoc Network is a collection of mobile hosts. The mobility nature of the MANET causes the mobile host to move freely in the network, due to that network disconnections occurs frequently and this causes frequent changes in the network topology. Data in one network cannot be accessed by the host in another network; the data accessibility from one network to another network becomes impossible, consequently data accessibility become lower in the wireless network than in the conventional fixed network. This leads to performance degradation. Many Duplication allocation methods are used to improve the data accessibility by duplicating data item on mobile hosts other than the original owner of the data. This improves the data accessibility but some of the mobile hosts in the network may act as egotistic nodes. These nodes use the services of other nodes but this does not cooperate with other nodes, this reduces the overall data accessibility. Egotistic node detection algorithm is used to detect the egotistic nodes and then the data duplication allocation method is used for data duplicationtion. The simulation result shows that the conducted egotistic node detection method and duplication allocation techniques outperforms the improvement in data accessibility and reduce the communication cost and query delay.

Keywords — Data accessibility, Degree of egotistic, Mobile Ad-hoc network, Duplication allocation

I. INTRODUCTION

Mobile Ad Hoc Network (MANET) is a collection of mobile nodes that communicate over relatively low capacity wireless links, without a centralized infrastructure i.e., without any central administration, nodes can communicate with each other, there will be no access points for communication. Each node in the MANET acts as a router and communicate with [10, 11] each other. In these networks, the mobility nature of the node and the wireless communication links may lead to dynamically changing and highly unpredictable topologies. All network functions routing, multi-hop packet delivery and mobility management have to be performed by the member nodes themselves, either individually or collectively. The network performance becomes highly dependent on collaboration of all member nodes.

A. Data Duplication Technique

In MANET, the mobile hosts move freely, disconnections occur frequently, and this causes frequent network division. Consequently, different fundamental technologies [5] from those of conventional fixed networks are needed. One whole network is divided into two or more networks due to the migrations of mobile hosts, [8] mobile hosts in one of the divided two networks cannot access data items held by mobile hosts in the other network. The data accessibility in ad hoc networks is lower than that in conventional fixed networks. In ad hoc networks, preventing deterioration of data accessibility at the point of network division is a very important issue [7]. A solution is to duplicationte the data items on mobile hosts other than the original owners.

B. Egotistic Nodes

The presence of egotistic nodes is a major issue in mobile ad-hoc network [16], it reduces the data accessibility. Data accessibility mainly involves cooperation of all nodes in the network but the presence of egotistic nodes causes the data accessibility. A non cooperative action of misbehavior is usually termed as egotisticness, notably different from malicious behavior. Egotistic nodes use the network for their own

communication, [3] but simply refuse to cooperate in forwarding packets for other nodes in order to save battery power. A egotistic node [6] would thus utilize the benefits provided by the resources of other nodes, but will not make available its own resources to help others. The behavioral states for nodes from the viewpoint of egotistic duplication allocation are of three types [14].

1) Type-1 node: The nodes are non egotistic nodes. The nodes hold duplications allocated by other nodes within the limits of their memory space.
2) Type-2 node: The nodes are partially egotistic nodes. The nodes sometimes allow the other nodes to share their memory for allocation.
3) Type-3 node: The nodes are fully egotistic nodes. This does not shares its memory with other nodes, but uses others nodes memory for their own purpose.

II. RELATED WORKS

There are several techniques used for detection of egotistic node and several data duplication allocation methods are used for improving the data accessibility. The acknowledgement based scheme [1] as the TWOACK and S-TWOACK improves the end-to-end packet delivery ratio, this can be added on to the source routing protocol such as DSR protocol, this causes the routing overhead. Time based detection schemes are used based upon the response time of the packets [13], but this failed to detect the neighboring nodes. In multi Hop ack scheme [15] NACK and CNAP schemes are used. Some techniques use the watchdog, pathrater, random feedback, distributed reputation, Mobile IDS and currency systems. These cause the overall network overhead.

Some sensors [9] are used for detection of such malicious nodes such as Activity-Based Overhearing, Iterative probing, Unambiguous-Probing, if multiple sensors are active in parallel and a egotistic node is detected by a number of these sensors. But using sensor in detecting the egotistic node becomes a tedious process. The novel algorithm [4] is used but it is failed to detect some topologies. In the reputation based scheme [12], the watchdog and path rater models are used, in the credit based scheme the packet purse model and packet trade model is used, the basic idea in this scheme is to provide incentives for nodes to faithfully perform networking functions. The data duplication allocation [2] models such as Static Access Frequency, only the data frequency to each data item is taken out. In Dynamic Access Frequency and Neighborhood, the access frequency to each item and neighborhood among mobile hosts is taken and in the Dynamic Connectivity based grouping, the whole network topology is taken into account. In all these models the periodic updating of data item is not considered [15].

III. PROPOSED WORK

In this paper, the formula is used to detect the egotistic nodes in the network. The data duplication allocation technique is used to improve the data accessibility.

A. Detection of Egotistic Nodes

The Credit Risk (CR) value is calculated for each node in the network shown in the equation (1), each node calculates the CR score to each of its connected node [17].

Credit risk = Expected risk / Expected value (1)

The node estimates the degree of egotisticness for all of its connected nodes based on the score. The egotistic feature is described first, that may lead to the egotistic duplication allocation problem to determine both expected value and expected risk. The two categories of egotistic features are node-specific and query processing-specific. Node-specific features can be explained by considering the following case: A egotistic node may share part of its own memory space, or a small number of data items like the type-3 node. The size of shared memory space or the number of shared data items can be used to represent the degree of egotisticness, the size of N_k's shared memory space, denoted as SS^k_i, and the number of N_k's shared data items, denoted as ND^k_i, observed by a node N_i, are used as node--*.

The query processing-specific feature is the ratio of egotisticness alarm of N_k on N_i, denoted as P^k_i, is the ratio of Ni's data request being not served by the expected node N^k due to N^k's egotisticness in its memory space.

The query processing-specific feature can represent the expected risk of a node. The P_i^k gets larger, node N_i will treat Nk as a risky node because a large P^k_i means that N_k cannot serve Ni's requests due to egotisticness in its memory usage. N_i should know the status of other nodes' memory space to effectively identify the expected nodes memory space.

$$Cr_i^k = P_i^k / (\alpha * SS_i^k + (1-\alpha) * ND_i^k) \quad (2)$$

The system parameter, α, is used to adjust the relative importance of SS^k_i and ND^k_i. Node N_i updates CR^k_i at every query processing and looks it up for the connected node Nk at every relocation period, each node has its own threshold α, of CR^k_i. The measured CR^k_i shown in the equation (2), exceeds α node N_k will be detected as a egotistic node by N_i. The value of P^k_i is updated at every query processing of some item that Ni allocates to other node or nodes during the duplication allocation phase. The effect of parameters SS^k_i and ND^k_i on CR^k i can be weighted by taking into consideration the size of memory space at node N_i, S_i, and the total number of data items accessed by N_i.

B. Duplication Allocation methods

The Three proposed new duplication allocation methods are the extensions of the previous duplication allocation methods [2] and to reduce the network traffic and periodic update of data in the mobile hosts. The three extended methods are as follows:

1) Extended Static Access Frequency (E-SAF) method
2) Extended Dynamic Access Frequency Neighborhood (E-DAFN) method
3) Extended Dynamic Connectivity based Grouping (EDCG) method.

The PT value can be calculated as shown in the equation (3):

$$pij \cdot \tau j = pij \cdot (Tj - tj) \quad (3)$$

Dj from mobile host Mi is issued at a unit of time, that is the access frequency, τj is the time remaining until Dj is updated next, Tj denotes the update period of Dj, tj denotes the time that has passed, Dj has been updated at the most recent update period. The PT value represents the average number of access requests that are issued for Dj until it is updated next, and it takes the maximum value pij. By allocating duplications with high PT values at a relocation period, the data accessibility is expected to be higher. These three methods are proposed by mainly changing their algorithms to use PT values instead of access frequencies [16].

1) E-SAF method:

The memory space for the duplication is temporarily filled with one of the duplications that have been allocated the previous relocation period but are not currently selected for allocation.[16] This temporarily allocated duplication is chosen from among the possible duplications according to that have the highest PT value. The memory space remains free, if there is no duplication that can be temporarily allocated. The data access to the data item the duplication should be allocated succeeds, the memory space is filled with the valid duplication.

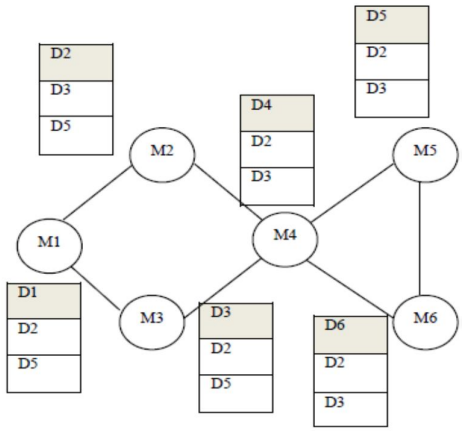

Fig.1 An example for E-SAF method

The Fig 1 shows the example diagram of E-SAF method. The mobile hosts do not need to exchange information with each other for duplication allocation in the ESAF method; duplication allocation can be done with low overhead and low traffic. On the other hand, the each mobile host allocates duplications based on the PT values to the data items, mobile hosts with the same access characteristics allocate the same duplications. A mobile host can access data items or duplications held by other connected mobile hosts, it is more effective to share many kinds of duplications among them.

2) E-DAFN method:

The E-DAFN solves the problem with the E-SAF method, this method eliminates duplication duplication among neighboring mobile hosts.[16] There exists a duplication duplication of a data item between two neighboring mobile hosts, the mobile host with lower PT value to the data item replaces the duplication with another duplication. The Fig 2 shows the example diagram of E-DAFN method.

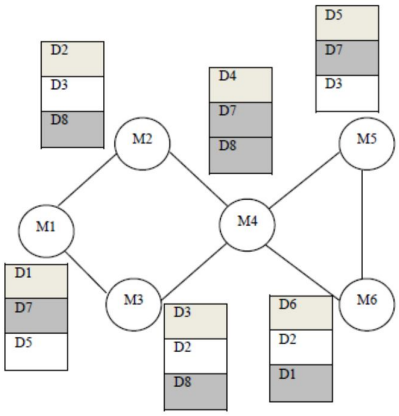

Fig. 2 An example for E-DAFN method

The algorithm of E-DAFN method is,

Step 1: At a relocation period, each mobile host broadcast its host identifier and information on access frequencies to data items. After all mobile hosts complete their broadcasts, from the received host identifiers, every host knows its connected mobile hosts.

Step 2: Each mobile host determines the preliminary allocation of duplications based on the E-SAF method.

Step 3: In each set of mobile hosts that are connected to each other, starting from the mobile host with the lowest suffix i of host identifier Mi, the following procedure is repeated in the order of the breadth first search. There exists a duplication of a data item between two neighboring mobile hosts, and if one of them is the original, the host that holds the duplication replaces it with duplication. The host having PT value to the data item is lower replaces the duplication with another duplication, if both of them are duplications.

At a relocation period, a mobile host might not connect to another mobile host that has an original or a duplication of a data item that the host should allocate. In ESAF method, the memory space for the duplication is temporarily filled with duplication, and is later filled with the valid duplication during data access to the data item succeeds.

3) E-DCG method:

The E-DCG method shares duplications in each larger group of mobile hosts than the E-DAFN method that shares duplications among neighboring hosts. [16] In order to share duplications effectively, each group should be stable, i.e., not easily divided due to changes in network topology. The E-DCG method creates groups of mobile hosts that are biconnected components in a network. A biconnected component denotes a maximum partial graph is connected if an arbitrary node in the graph is deleted. By grouping mobile hosts as biconnected components, the group is not divided even if one mobile host dis appears from the network or one link is disconnected in the group and it is considered that the group has high stability. The Fig.3 is the example diagram of E-DCG method.

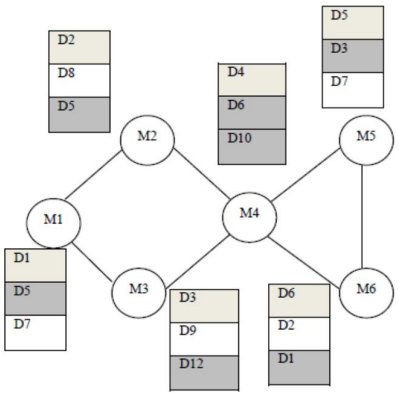

Fig.3 An example for E-DCG method

The algorithm of E-DCG method is,

Step 1: At a relocation period, each mobile host broadcast sits host identifier and information on access frequencies to data items. After all mobile hosts complete their broadcasts, every host knows its connected mobile hosts

Step 2: In each set of mobile hosts that are connected to each other, starting from the mobile host with the lowest suffix of host identifier (Mi), an algorithm to find biconnected components is executed. Each biconnected component is put in a group.

Step 3: In each group, a group access frequency to each data item is calculated as a summation of access frequencies of mobile hosts in the group to the item. The PT value of the group to each item is calculated. These calculations are done by the mobile host with the lowest suffix of host identifier in the group.

Step 4: In descending order of PT values in each group, duplications are allocated until the memory space of all mobile hosts in the group becomes full. The duplications of data items that are held as originals by mobile hosts in the group are not allocated. Each duplication is allocated at a mobile host having the PT value to the data item is the highest among hosts that have free memory space to create it.

Step 5: After allocating duplications of all data items that have no original in the group, the free memory space still exists, each duplication is allocated at a mobile host the PT value to the data item is the highest among hosts that have free memory space to create it and do not hold a duplication or the original of the item. The duplication is not allocated if there is no such mobile host

IV. RESULTS AND DISCUSSION

The proposed technique is done using Network Simulator, this technique improves the data accessibility by detecting the egotistic nodes , the egotistic node detection is done using formulae.

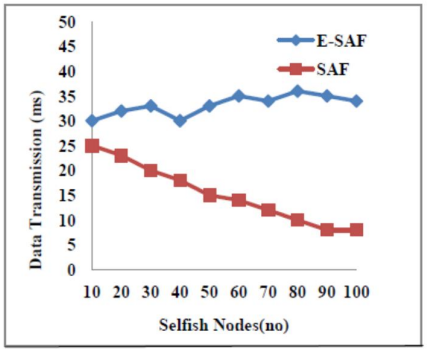

Fig.4 Comparison of E-SAF and SAF method

The data duplication allocation technique is used to improve the data transmission between the nodes. The Fig. 4 shows the data transmission comparison between the SAF and E-SAF method. In the presence of egotistic nodes.in E-SAF method the data transmission is constant but in the SAF method it becomes low. Next the Fig. 5 shows the data transmission comparison between the EDAFN and DAFN method. The E-DAFN method transmits at constant rate than the DAFN method.

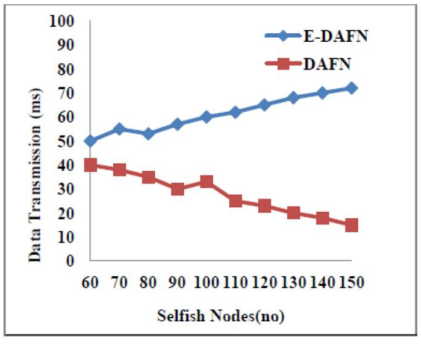

Fig.5 Comparison of E-DAFN and DAFN method

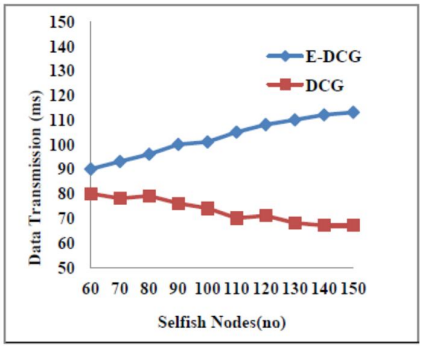

Fig.6 Comparison of E-DCG and DCG method

The Fig 6 shows the comparision between EDCG and DCG methods. Comparing to previous E-SAF and E-DAFN method, the data transmission is higher in the E-DCG method. Among the three methods the EDCG method transmits data at high rate in the presence of egotistic nodes.

V. CONCLUSION

In the mobile ad hoc network, each data item is periodically updated and the proposed three duplication allocation methods are used to improve the data accessibility. In the E-SAF method, a mobile host allocates duplications with high PT values. In the E-DAFN method, from duplication allocation based on the E-SAF method, duplication duplication is eliminated among neighboring mobile hosts. In the E-DCG method, duplications are shared in each stable group of mobile hosts. In the proposed three methods, the E-DCG method gives the highest accessibility and the ESAF method gives the lowest traffic. The mobile hosts are connected by unstable radio links that are likely to be disconnected after a short time, it is inefficient to allocate different duplications on them because the mobile hosts cannot share the duplications after disconnections, and it is suitable for only stable link mobile hosts, the further extension is to allocate the duplications in unstable links.

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