Performance Evaluation in Energy consumption of Mobile Ad-Hoc Network to increase the Network Lifetime

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***Abstract*—** MANET is self configuring network. It has many design issues like scalability, energy consumption etc.In this paper, an overview of the Distributed mutual exclusion algorithm & various enhanced variations done on distributed mutual exclusion. In DME Permission-based algorithm is used for discovering clusters of the nodes. The initial point selection effects on the results of the algorithm, in the number of clusters found and their cluster headers. Methods to enhance the Permission-based clustering algorithm are discussed. With the help of these methods increase the concurrency between the nodes, decrease the synchronization delay and decrease response time. Some enhanced variations improve the efficiency and accuracy of algorithm. Basically in all the methods the main aim is to increase the life of each node in the network or increase the battery power which will decrease the computational time. Various enhancements done on DME are collected, so by using these enhancements one can build a new hybrid algorithm which will be more efficient, accurate and less time consuming than the previous work.

Keywords- *DME, Energy consumption, Token Based, clusters, mutual exclusion, Distributed System.*

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I. INTRODUCTION

Over sometime the problem of mutual exclusion in distributed system received significant consideration and many algorithms were introduced to achieve mutual exclusion in distributed systems [3, 4, 5, 6, 7, 8]. MANET is a group of mobiles that are connected together to form a network which is independent of any infrastructure. It means there is no base station required in MANET. So the nodes can communicate with other nodes which are in the range of network only. MANET is a kind of wireless ad hoc network that has a routable networking environment on the top of a link layer .Here each node in a network can act as a router at the same time, and these nodes are independent to move freely [2]. "Flooding" is used to forward the data from one node to another. So cause of this change the topology changes often and rapidly. MANET, the data should be routed via intermediate nodes, and these intermediate nodes will act as a router. Each node can be switched ON/OFF without identify other nodes. For communication single hoping and multi-hopping is used. MANET is a self-configuring infrastructure. Each device in a MANET is free to move alone in any path or direction, and cause of which it links to other devices in the network repeatedly. Each node must forward traffic distinct to its own use, and therefore be a router [9, 14. The mobile nodes that are in radio range of each other can directly communicate, while others need the support of intermediate nodes to route their packets. [1]

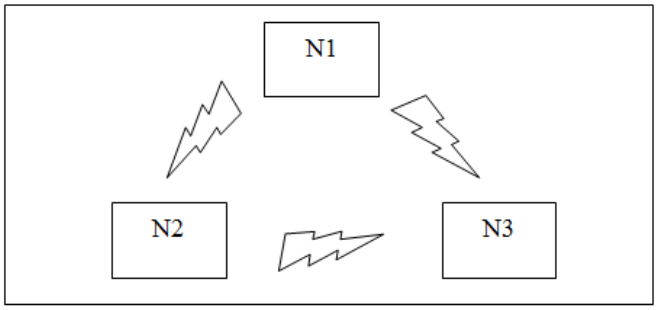

Fig.1.1 MANET All categorized routing protocols of Mobile Ad-hoc Network:

One of the most important and a difficult method to maintain in ad hoc networking is the routing mechanism. An ad hoc routing protocol is a concurrence between nodes or devices as to how they control routing of packets in between themselves [9]. The nodes in an ad hoc network discover routes as they do not have any previous knowledge about the network topology. Routing protocols in MANETs are classified into three different categories [10, 15].

1. Reactive protocols: It is On Demand routing protocol. Route only create when it required. If a node needs to transmit a packet to another node first check route through on demand and after that create the connection between the nodes. The source node initiates the route discovery segment. There are mainly two stages in reactive routing mechanism after the node needs to send data to the destination. The source node broadcasts Route Request messages and is extend across the complete network [9, 14]. Routes are added to the list one time the Route Reply packets derive from the destination reach the

source using different forwarders. Example: DSR, AODV, TORA.

2. Proactive Protocols: - It preserves the route data when it is needed. It uses an already existing route. These protocols maintain routes to all possible destinations even while a few of the routes may not be required. Every node in the network maintains tables of routes and when the network topology changes, updates are sending across the network. These protocols require nodes to send control packets sometimes to maintain the routes [10]. To maintain all possible routes in a network is difficult because the control packets for route preservation use a lot of bandwidth on links where there is no need of data transfers. These protocols encourage a lot of routing overhead. There are some really good advantages of proactive protocols. Types are DSDV, OLSR.

3. Hybrid protocols: It is association of proactive and of reactive routing .ZRP sand TORA.

II. REVIEW OF LITERATURE

In paper [1] defines the GME problem. In this problem, same type of processes can request the critical section and can execute CS concurrently. Basically, the different type of processes can request their critical sections and executes in mutually exclusive manner. The distributed algorithm is used for group ME problem. Token based algorithm is used, process that can found a token enter a CS. Message complexity is decrease. When a process request a message, it use coterie as communication structure. A coterie is an established by quorums. Any two quorums assign at minimum one process and process act as gateway between the two quorums. The proposed algorithm can reach high concurrency, measure the performance of processes that enter in CS. of performance for number of processes that can be in critical. In paper [2] they describe the cluster merging method. Clustering is generally used approach in various problems like routing and resource management in MANET. Clustering approach is ease to implement, that merging the clusters to form advanced level by rise their level. They show operation of algorithm and examine its time, message complexity. The algorithm planned is accessible. It has a lesser time and message complexity. In paper [9] they described PBMUTEX in MANET. Author explained about the resource allocation in MANET. They proposed a new approach for ME in MANET which is based on clustering and concept of weight throwing. Algorithm is based on cluster hierarchal method which is help to decrease the message complexity. In paper [10] their problem. DME is provided that to access the shared CS resources to different nodes. The paper use the new message called 'HOLD' message to make sure that which node is currently execute in CS. In **paper [11]** they create based on the RTS/CTS which will switch off NIC dynamically when idle i.e. neither sending nor receiving any data? DSR, DSDV, AODV, TORA algorithms used in research paper. These Algorithm provide security, reduce the network overhead, rate of topology change is less or medium. In this paper [9,14] they describe the DMUTEX based on token exchange between the nodes. The algorithm is based on the logical ring. In TMUTEX two families of algorithm is used like token asking and circulating token.

III. ENERGY CONSUMPTION IN MANETS

In MANET, each node has batteries attached to it, which is inspired during the process of transmission i.e. during transmission, reception and overhearing and many other reasons. It is very difficult to replace batteries or to re-charge them. So to increase the long life of the network; the available battery power must be sensibly used. There is need to reduce the energy consumption and handle the available energy for a long network connection [1]. If power goes down, network connection will not be present, and will influence our transmission also. So there is requirement of different strategies to reduce the wastage of energy consumption at different levels.

Token Based Algorithm in MANET:

The group mutual exclusion (GME) problem is a generalization of the mutual exclusion problem. **Group mutual exclusion**: only processes in the same group can enter a critical section (CS) simultaneously. In other words, no two sites can perform communication at the same time [12].
Critical section is a part of program that accesses shared resources.
In **token based mutual exclusion algorithms**, a unique token is shared among the hosts and if a host possesses the token than it is allowed to enter the critical section.
Whereas in **Permission based mutual exclusion algorithms**, the node that wants to enter in critical section (CS) must first obtain permission from rest of the nodes by exchanging messages.
In **quorum based mutual exclusion algorithms**, each node obtains permission from a subset of nodes referred as quorum for executing critical section. Any two quorums contain a common host.

Distributed Mutual Exclusion (DME) algorithms must satisfy following properties:

Safety: No two processes, requesting for a different group can be in their critical sections concurrently.

Freedom from deadlocks: Two or more hosts should not continuously wait for messages that will never arrive.

Freedom from starvation: A host must not wait endlessly to execute the critical section while other hosts are frequently executing the critical section.

Fairness: The requests for entering critical section are executed in order of their arrival in the system. [17]
Look-ahead technique is used. All nodes including arbitrator will use this technique.

Designing of look-ahead algorithm mutual exclusion involves two issues [11]:

1. First is identifying sites which are concurrently competing for CS.
2. Second is enforcing mutual exclusion among these sites.

Advantages of choosing Look-Ahead Mutual Exclusion (i) This algorithm is more efficient as it removes the unnecessary communications between sites and on the other hand Message exchange is prepositional to the number of sites active at a time. (ii) Look-Ahead Algorithm also introduced another dimension to dynamic distributed algorithms [11].

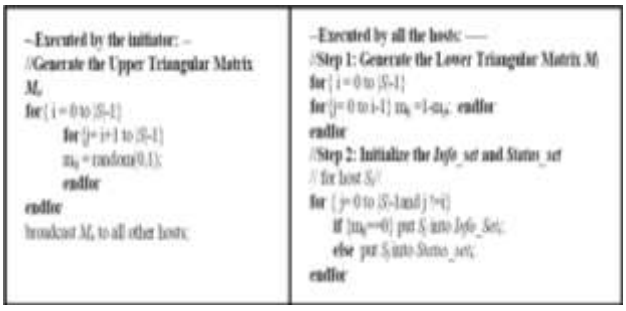

Fig. 1.2 Algorithm for Initialization

Here, Info_set of i means it contains all those nodes to which i node sends request message.

In our case, each node and arbitrator node has Info_seteg: Info_set of node 1 contains { node 2, node 3, arbitrator}
Status_setof i contains those sites from which i receives request message. Eg: Status_Set of 1 contains { node 4, node 5}
This whole process means node 1 sends request message only to node 2 , node 3 and arbitrator. Node 1 receives request message only from nodes 4 and 5.
Node 2 contains in its status_set { node 1 } and not in its info_set.

Disadvantage of Permission based cluster:

1. Message complexity increases. Message complexity graph is not shown [13].
2. Waiting time of node increases due to ring topology as node takes more time for entering in CS.
3. Response time and synchronization delay increases.

IV. PROPOSED METHODLOGY

MANET is a group of mobiles that are connected together to form a network which is independent of any infrastructure. It means there is no BS required in MANET. So the nodes can communicate with other nodes which are in the range of network only. Here each node in a network can act as a router at the same time, and these nodes are independent to move freely. But each node in MANET required efficient amount of energy. To increase the battery power of the node different methods are developed. We have used PBMUTEX algorithm used to overcome the problem. The proposed algorithm will help to increase the concurrency of the nodes, decrease response time and decrease synchronization delay. Nodes will divided into different clusters and then elect the cluster head for each cluster. Proposed algorithm will also reduce the message complexity. The outcome of the proposed algorithm will compared with existing algorithm then compares their performances. Existing algorithm is basically used token based algorithm and use Quorums. Between two Quorums one node acts as gateway. Through the gateway nodes present in the quorums can communicate with each other.

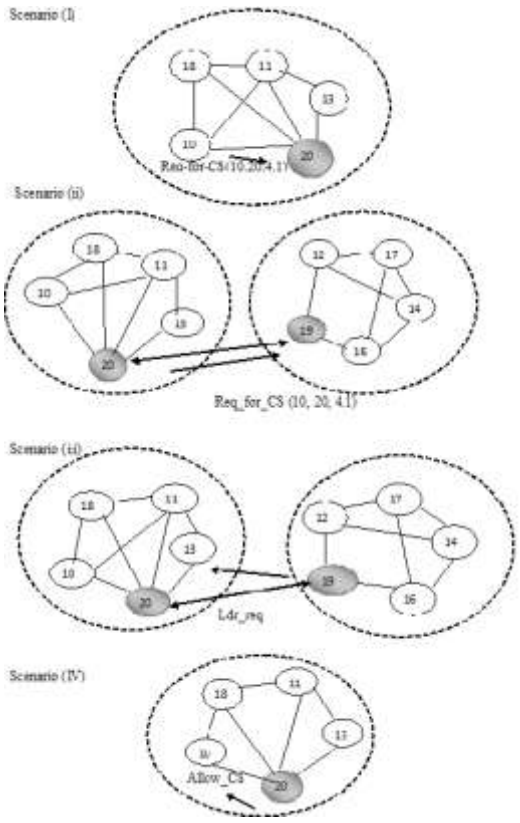

Fig.1.3 Proposed Framework

V. EXPERIMENTAL RESULTS

The whole scenario is implemented on NS2 simulator tool. Graphical comparison of the previous algorithm with the proposed algorithm are discussed below which shows the

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correctness of the proposed algorithm. The "red" colored is the existing algorithm and the "green" are the results of the proposed algorithm.

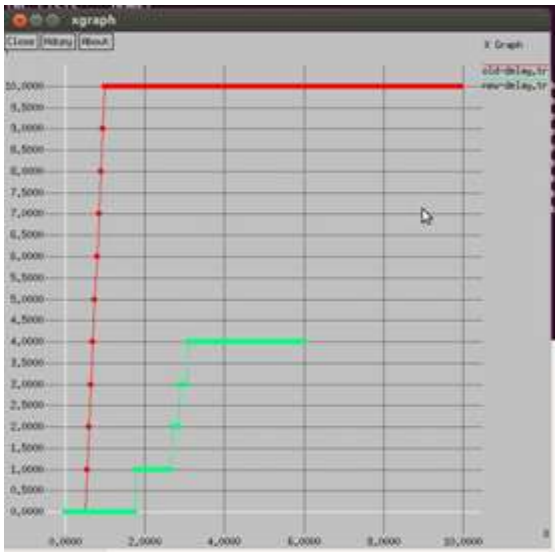

Fig. 5.1 Delay Graph

As illustrated in the figure 5.1, the delay comparison has made. In the figure its shows that delay of the proposed technique is less as compared to existing technique.

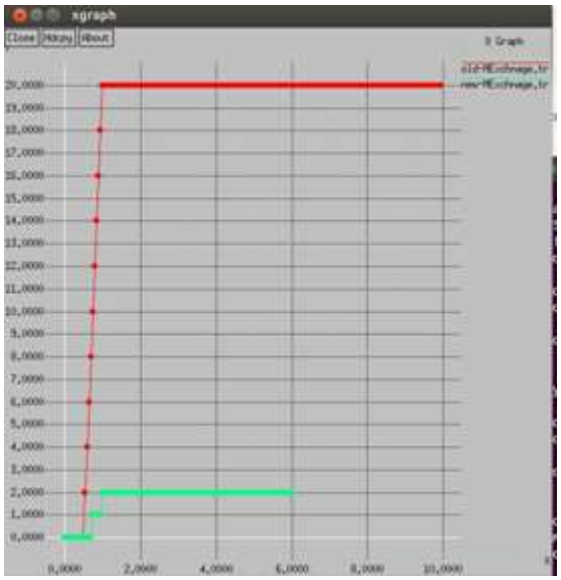

Fig.5.2 Message Exchange

As shown in figure 5.2, the comparison graph of number message exchange is shown. In the graph old technique has more number of messages i.e. 20 messages per CS execution as compare to proposed technique which resulted in 2 Messages per CS execution.

As shown in figure 5.3, the response time of the old and existing technique has been shown. It shows that response time of proposed technique 2 Seconds is less as compared to existing technique which is around 10 Seconds.

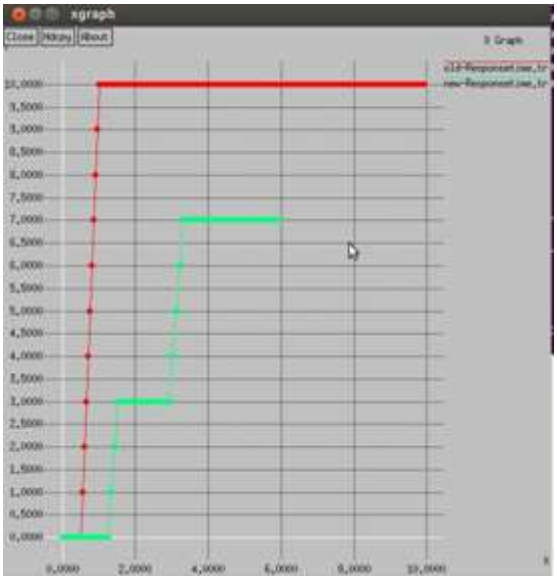

Fig.5.3 Response Time

Practical Implementation results:

Performance Parameter	Best Case	Worst Case
Synchronization Delay	2T	2T(m+1)
Message Exchange	0 (if the cluster leader retains itself) Or 2 (if any other Node)	n
Response Time	10 Second	7 Second

Where, T is maximum message propagation
m is the number of cluster heads
n is the number of Nodes

VI. CONCLUSION

The MANET is a group of mobiles or devices that are connected together to form a network this is independent of any infrastructure. It means there is no BS required in MANET. So the nodes can communicate with other nodes which are in the range of network only. In MANET, each node has batteries attached to it, which is consumed during the process of transmission i.e. during transmission, reception and overhearing and many other reasons. It is very difficult to replace batteries or to re-charge them. So to increase the longevity of the network; the available battery power must be

judiciously used. To increase the long life of the network or battery power of the node we have used mutual exclusion algorithm. ME algorithms, In this paper, Permission-based MUTEX has used to grow the concurrency of the nodes, to decrease the response time and fall the synchronization time of the nodes. So that it will also support to raise the long life of the nodes. At the end, measure the performance of the exiting algorithm and the future algorithm.

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