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An Efficient Approach to Reduce Network Partitioning Using AMMNET

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Abstract: **-- Mobile Ad Hoc Networks (MANETs) are one of the most important and unique applications that enable users to communicate without any fixed network infrastructure. The self-configuring capability of nodes makes it more useful among military applications and crisis management. Though MANETs are very powerful, they suffer from a serious problem known as Network Partitioning. When a Network connection between any two groups of systems fails simultaneously, it results in network partitioning. To overcome this issue, a technique called Autonomous mobile mesh network (AMMNET) has been proposed. The mobile mesh nodes of AMMNETs are used to follow the clients in the application terrain. For larger application terrain, the mesh nodes are capable to adapt a network topology to support intergroup communication. For this a distributed client tracking solution has been implemented which results in dynamic topology adaptation for the mobile clients. AMMNET provides high throughput and packet delivery ratio when compared to other techniques.**

Keywords**:-- Mobile mesh networks, Dynamic topology deployment, Client tracking**

I. INTRODUCTION

Wireless technology has been one of the most developing technologies, and is playing a vital role in the lives of people throughout the world in recent years. Particularly mobile ad-hoc networks are used to communicate without the need of base station around the geographical location. The sharing of data and services with other devices can be adapted easily and the maintenance and replacement of devices are very much reliable in Mobile ad- hoc networks. Here nodes act as routers to transfer the data from source to the destination. Though the MANET has large number of features, it is mainly suffers from a serious problem called network partitioning. Due to this limitation of MANET, it is not desirable to be used in the mission critical applications.

To overcome this problem of MANET, a network named Autonomous Mobile Mesh Network has been developed. A mesh network uses network topology and all nodes cooperate for the distribution of data. It is a form of wireless ad hoc network and it often consists of mesh clients, mesh routers and gateways. MANETs and mesh networks are therefore closely related, but a MANET deals with problems introduced by the mobility of the nodes. When compared to the other standard wireless mesh networks, the mesh nodes in AMMNETs are in mobile platform. These mobile mesh nodes are capable to follow the clients in the application area and also support topology adaptation. In this way AMMNET makes the MANET robust.

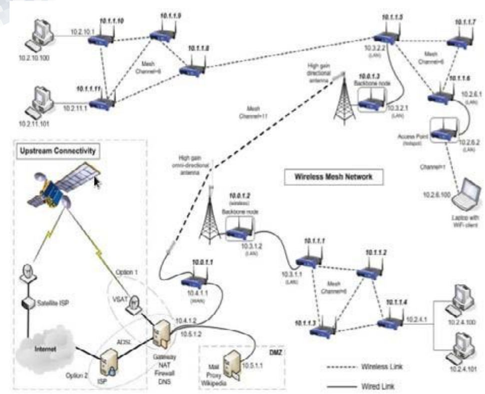

Figure.1. Configuration for a wireless mesh network

II.CLIENT TRACKING SYSTEM IN AMMNET

AMMNET is mainly based on mesh infrastructure and the nodes are mobile in nature. The device is connected with a position capturing device such as GPS to track the clients in the application terrain. It is not necessary for the client to know about their location but it is necessary to send frequently their beacon messages. After receiving the beacon messages, the mesh nodes easily detect the location of the clients. By having such a capability it provides continuous flow of connection.

According to the current stage in the network the mesh nodes can be classified as Intragroup routers, Intergroup routers and free routers. In Intragroup routers communication occurs within the groups, In Intergroup routers communication takes place with different groups but in free routers no communication is involved in both intra and inter groups.

Figure.2.Client movement

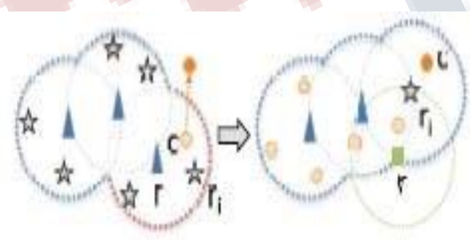

Figure.3. Client Tracking

The operation of the mobile mesh nodes changes while tracking the clients as follows

- ***Intragroup Adaption*** –When the changes happen in the topology the Intragroup routers may adapt themselves according to the network.
- ***Reclamation of the redundant routers-*** The node does not participate in any routing activities and deployed for the future use.
- ***Interconnecting Groups*** –When the splitting happens in the group, free router change their mode to participate in the interconnecting groups.

III.TOPOLOGY ADAPTATION

By reducing the no of nodes and the long path, two types of adaptations are required namely local adaptation and global adaptation. In local adaptations, the intergroup routers are saved by replacing the independent bridge networks with star network. Generally a star network provides the shorter relay parts and as results low number of router which participating in the intergroup activities.

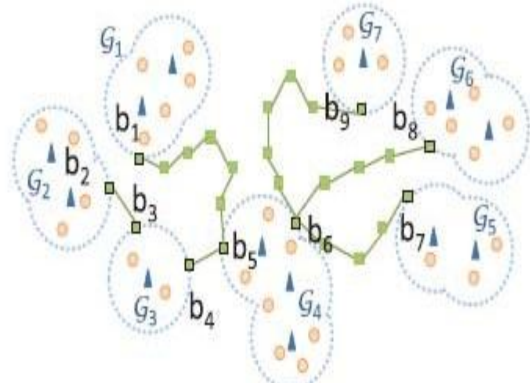

Figure.4.Without adaptation

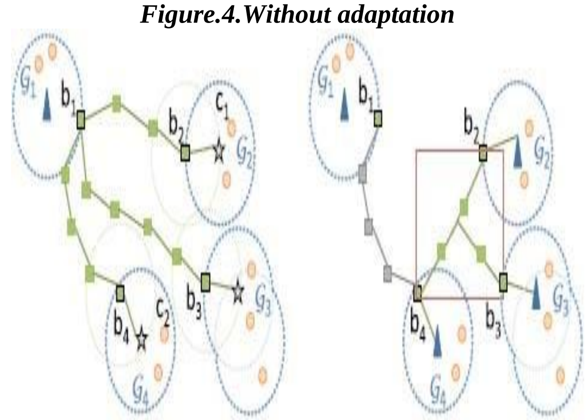

Figure.5.Local Topology Adaptation

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The global adaptation is to acquire a large application terrain and it performs the best use of the network globally .The challenge of the network is to achieve the end to end delay and minimization of intergroup routers for subsequent local adaptation. Here the hierarchical star topology is proposed based on R-tree for minimization of intergroup routers. The structure of the R-tree is a multidimensional tree that has a number of M objects into minimum bounding rectangle. At every next higher level in the tree, the M type rectangles are aggregated into larger boundary rectangles. The value of M is determined by applying k-means clustering.

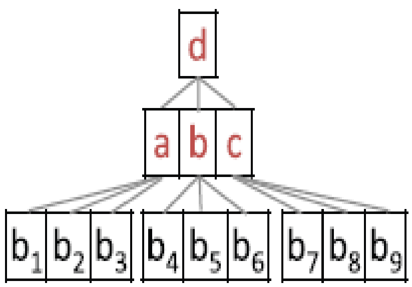

Figure.6. Structure of R-Tree

Consider M is average of the clusters that is

M=™$^k_{i=1}$ Ň&LŇ N

Where k-no of clusters

Ci -no of bridge routers in the ith cluster Ci

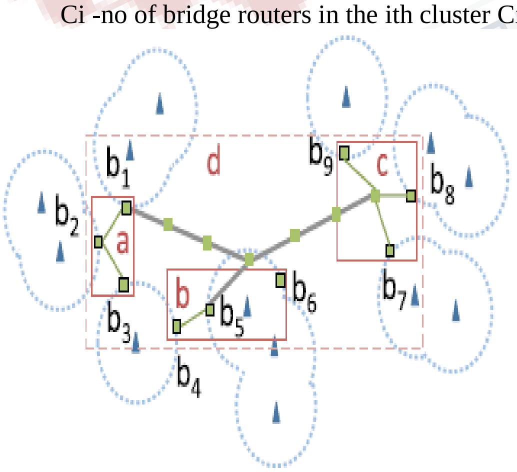

Figure.7. Global Adaptation

IV.PERFORMANCE ANALYSIS

The capability of AMMNET in adapting a dynamic movement of mobile clients and forwarding the data in network is efficient. Here the performance of AMMNET with ORACLE scheme is evaluated. The routers in an AMMNET can be able to adapt their locations using locally cached location information .When the number of free routers of user groups reaches the predefined threshold point, the global adaptation is performed. In ORACLE, the location information of the clients is available due to centralized scheme .It can be used only for the purpose of performance comparison. ORACLE develops the R-tree using the correct location of the mobile users. Though the ability of ORACLE is more enough to transmit the data, this scheme is not suitable for higher density of clients.The figure shows that the average throughput and packet delivery ratio obtained in AMMNETs are higher than that in Oracle scheme.

x Packet Delivery Ratio:

The term Packet Delivery Ratio is defined as the ratio of packets that are successfully delivered to a destination compared to the number of packets that have been sent out by the sender.

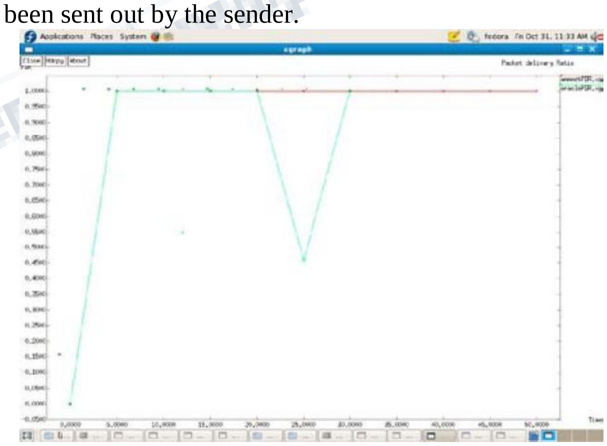

Figure.8.Packet delivery ratio

From Fig.8. the Packet Delivery Ratio for AMMNET is increased and maintained but in ORACLE it reduces.

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Throughput:

Network throughput is the average rate of successful message delivery over a communication channel.

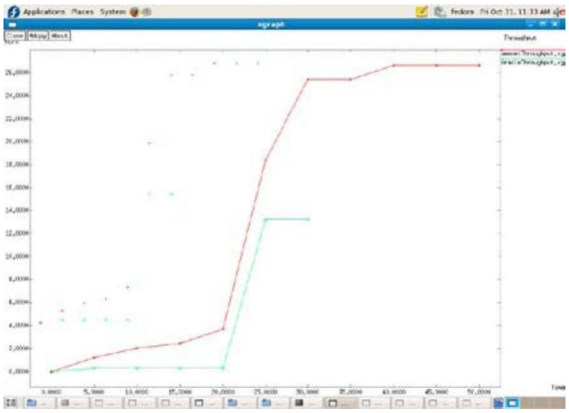

Figure.9. Throughput

From Figure.9, The Throughput for AMMNET has been increased at a higher rate when compared to ORACLE.

VI.RESULT AND DISCUSSION

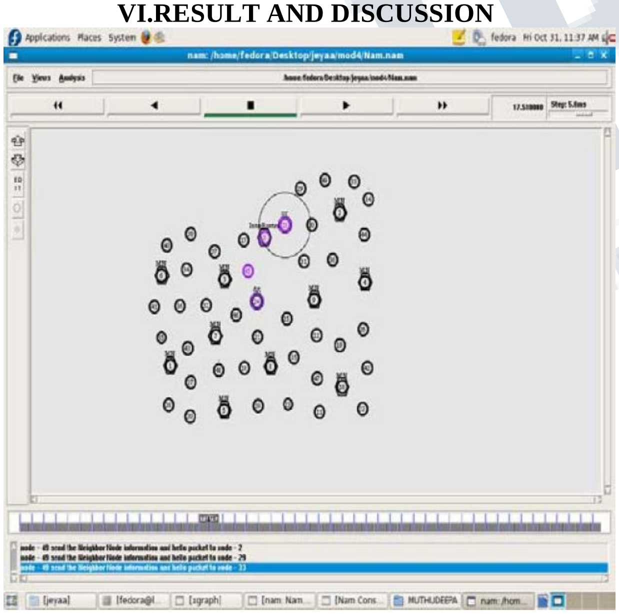

Figure.10. Intergroup Routing

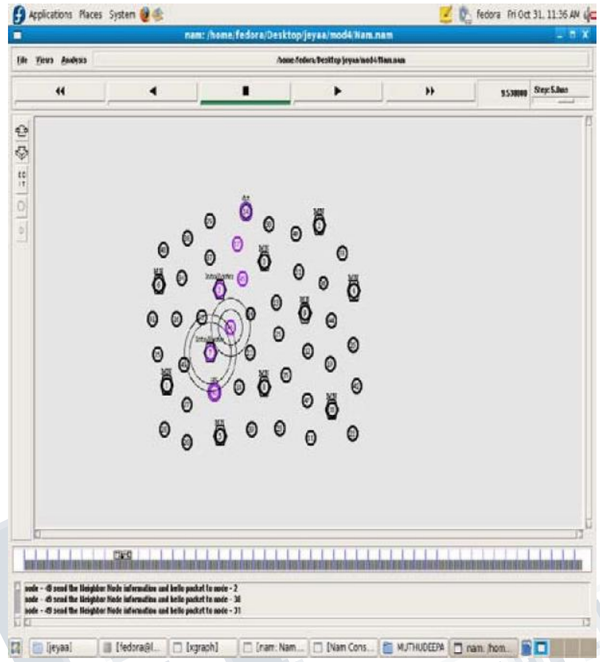

Figure.11. Intragroup Routing

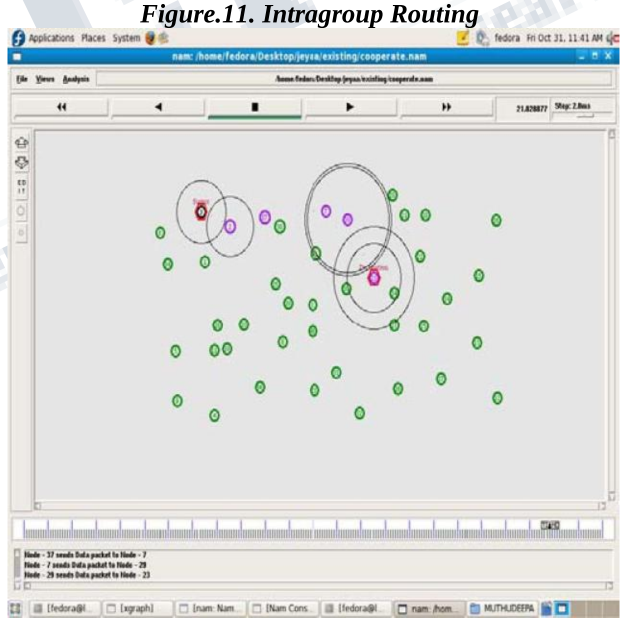

Figure12.Source to destination data transfer

VII.CONCLUSION

Applications involved such as communication in battlefield and crisis management, the mobile users work in dynamically formed groups for a large application terrain. For such applications there is currently no cost effective solution. Though an AMMNET is an efficient method in reduction of network partitioning still many interesting issues not yet examined such as searching for disappearing mobile clients, minimizing routing paths, utilizing non overlapping channels etc. These challenges can be solved by future research.

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