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Connectivity in Autonomous Mobile Mesh Network

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Abstract: ***MANETs are among the most popular network communication technologies. One great challenge in designing robust MANETs is to minimize network partitions. As autonomous mobile users move about in a MANET, the network topology may change rapidly and unpredictably over time and portions of the network may intermittently become partitioned. We address this challenging problem by proposing a new class of robust mobile ad hoc network called AMMNET. To maintain the communication between all nodes even they are in different groups Mesh Nodes are used. Mesh Nodes which have the capability of changing its nature into Inter-group router or Intra-group router, even it can act as a bridge router. Unlike conventional mesh networks, the mobile mesh nodes of an AMMNET are capable of following the mesh clients in the application terrain. We propose a distributed client tracking solution to deal with the dynamic nature of client mobility, and present techniques for dynamic topology adaptation in accordance with the mobility pattern of the clients.***

Keywords: Mobile Mesh Networks, Dynamic Topology Deployment, Client Tracking

1. Introduction

A wireless network is any type of computer network that uses wireless data connections for connecting network nodes. Wireless networking is a method by which homes, telecommunications networks and enterprise installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations. Wireless telecommunications networks are generally implemented and administered using radio communication. This implementation takes place at the physical level of the OSI model network structure. Examples of wireless networks include cell phone networks, Wi-Fi local networks and terrestrial microwave networks. In particular, mobile ad-hoc networks (MANETs) are among the most popularly studied network communication technologies. In such an environment, no communication infrastructure is required. The mobile nodes also play the role of the routers, helping to forward data packets to their destinations via multiple-hop relay. This type of network is suitable for situations where a fixed infrastructure is unavailable or infeasible. They are also a cost effective solution since the same ad-hoc network can be relocated, and reused in different places at different times for different applications.

One great challenge in designing robust MANETs is to minimize network partitions. As autonomous mobile users move about in a MANET, the network topology may change rapidly and unpredictably over time and portions of the network may intermittently become partitioned. This condition is undesirable, particularly for mission-critical applications such as crisis management and battlefield communications. We address this challenging problem in this paper by proposing a new class of robust mobile ad-hoc network called Autonomous Mobile Mesh Networks (AMMNET)

2. Related Works

In this paper we get the basic idea to improve the coverage over and to put faster and secure network to the telecommunication sector. AMMNET which reduces manpower and very economic.[1]

These recent evolutions have been generating a renewed and growing interest in the research and development of MANET. This paper attempts to provide a comprehensive overview of this dynamic field. It first explains the important role that mobile ad hoc networks play in the evolution of future wireless technologies. [2].

Cooperative Communication, a new research area, has revealed a recent origin in the wireless networks, which combines the link-quality and the broadcasting nature of the wireless channels. It is a pure network layer scheme that can be built on top of the wireless networking equipment. Nodes in the network use a lightweight proactive source routing protocol to determine a list of intermediate nodes that the data packets should follow en route to the destination.[3]

3. Existing System

WIRELESS technology has been one of the most transforming and empowering technologies in recent years. In particular, mobile ad hoc networks (MANETs) are among the most popularly studied network communication technologies. Mobile nodes in MANET"s play the role of routers, helping to forward data packets to their destinations via multiple-hop relay. This type of network is suitable for situations where a fixed infrastructure is unavailable or infeasible. As autonomous mobile users move about in a MANET, the network topology may change rapidly and unpredictably over time; and portions of the network may intermittently become partitioned. This condition is undesirable, particularly for mission-critical applications such as crisis management and battlefield communications.

4. Proposed Work

We classify the works related to AMMNET into three categories: 1) stationary wireless mesh networks: AMMNET is a new type of mesh networks, but supports dynamic topology adaptation, 2) sensor covering: the techniques for sensor covering is related to the design of covering mobile clients in AMMNET, and 3) location tracking: tracking mobile clients in AMMNET is an application of location tracking.

In a standard wireless mesh network, stationary mesh nodes provide routing and relay capabilities. They form a mesh-like wireless network that allows mobile mesh clients to communicate with each other through multihop communications. Such a network is scalable, flexible and low in maintenance cost. When a mesh node fails, it can simply be replaced by a new one; and the mesh network will recognize the new mesh node and automatically reconfigure itself. The proposed AMMNET has the following additional advantage. The mobility of the mesh clients is

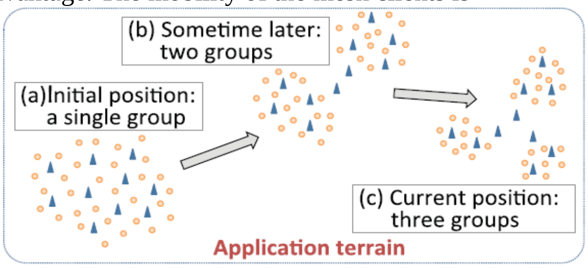

Figure 1: Partition and its topology adaptation

We note that it is not always feasible to replace a mobile mesh network with a standard stationary mesh network which is large enough to provide coverage for the entire application terrain as shown in Fig. 2. In this paper, we have deal with application terrains that are too large and too expensive for such a deployment. Besides, pre-deployment of such a fixed mesh network might not even be possible for many applications such as disaster recovery and battlefield communications. Specifically, LTE [1] and [2] might be able to support broadband access for a given application terrain. They however are not flexible enough to adapt to topology changes for the dynamic applications considered in this work, and hence might require a much higher deployment cost, including the costs of equipments, manpower and rewiring. In other words, they are a cost effective technology only whenconfined to the fixed area serviced by a standard wireless mesh network due to the stationary mesh nodes. In contrast, an AMMNET is a wireless mesh network with autonomous mobile mesh nodes. In addition to the standard routing and relay functionality, these mobile mesh nodes move with their mesh clients, and have the intelligence to dynamically adapt the network topology to provide optimal service. In particular, an AMMNET tries to prevent network partitioning to ensure connectivity for all its users. This property makes AMMNET a highly robust MANET.

The topology adaptation of an AMMNET is illustrated in Fig. 1:

- Fig. 1a: The mesh clients initially concentrate in one group. All the mesh nodes position themselves within the same proximity to support communications inside the group.
- Fig. 1b: The mesh clients move northwards and split into two groups.
- Reorganize themselves into a new topology not only to facilitate intra-group communications, but also to support inter-group communications effectively preventing a network partition.
- Fig. 1c: The same mesh clients now move and form three groups.

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Our challenge was in designing the proposed AMMNET are twofold. First, the mesh clients do not have knowledge of their locations making it difficult for the mobile mesh nodes to synthesize a global map of the user locations. Second, the topology adaptation needs to be based on a highly efficient distributed computing technique in order to keep up with the dynamic movement of the mobile users. These challenges are done in the proposed work. We introduce the framework of an AMMNET, and present how to realize mobile client tracking in a distributed manner.

4.1 Tracking Mechanism

A client can connect to any nearby mesh node, which helps relay data to the destination mesh node via multihop forwarding [6]. To support dynamically changing mesh topology, mobile mesh nodes can be classified into three types,

i) Intergroup routers.

ii) Intra-group routers.
iii) Free routers.

Intra-Group Router
A mesh node is an intra-group router if it detects at least one client within its radio range and is in charge of monitoring the movement of clients in its range. Intra-group routers that monitor the same group of clients can communicate with each other via multi-hop routing. For example, routers r1 and r2 in Fig. 2 are intra-group routers that monitor group G1

Inter-Group Router
It plays the role of a relay node helping to interconnect different groups. For each group, we designate at least one inter-group router that can communicate with any intra-group routers of that group via multi-hop forwarding as the bridge router, e.g., router b1 for group G1.

Free Routers: A mesh node is a free router if it is neither an intra-group router nor an inter-group router

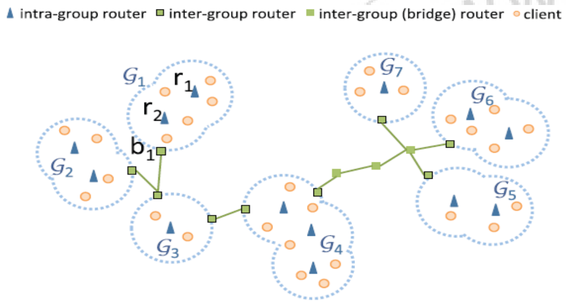

Figure 2: AMMNET framework

4.1.1Algorithm Description
For all the beacon messages, the router splits into either 1.Intra group or 2. Inter group If any missing clients is detected in intra group then first it request to its neighboring client group and also it checks if all the clients are covered or filled Then it switches to inter-group Or else it assigns free routers to navigate for the coverage of the network.

In the case of inter group bridge Packets are forwarded to its location by piggy backing .Retrieve the information of the locations of the bridges and also indentify the forwarded packets from the inter- group router Or else it will initialize topology adaption. If any node is free the it first switches to inter group navigate n detect d the missing clients after detecting missing client it again switches to inter group. If anything is free then it just follows the intra group router.

4.2 Topology Adaptation

The clients in the coverage region of particular router can move from one location to another location. According to client's mobility, the topology is set and routing is performed. Before communication we need to adapt the topology. The topology adaptation can be classified into two methods.
i) Local Adaptation.
ii) Global Adaptation

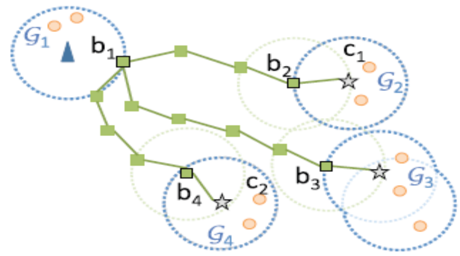
Figure 3a: By Applying Adaptation

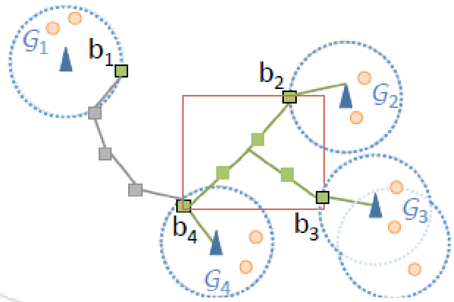
Figure 3b: Local Adaptation

4.2.1 Local Adaptation
Consider the example in Fig. 3a. To save intergroup routers, we can replace three independent bridging networks with a star network as shown in Fig. 3b. A star topology generally provides shorter relay paths, and, as a result, requires fewer inter-group routers. To construct a star topology, we let the bridge routers exchange their location information opportunistically, and perform local adaptation. When clients in different groups are communicating with each other, the corresponding bridge routers can exchange their location information by piggybacking such information in the data packets.

4.2.2 Global Adaptation
Local topology adaptation provides local optimization. It is desirable to also perform global topology adaptation to achieve global optimality. This method provides better overall end-to-end delay and free up intergroup routers.

5. Discussion and Results Performance Evalution

There are various schemes in the network .

Table: Performance of Schemes

Grid-mesh	This simple scheme employs a grid-based square topology for the mobile mesh nodes. This mobile mesh network follows the users by tracking & following one randomly selected client. The network maintains the same grid topology as it moves over the application terrain.
AMMNET	This is our design of AMMNET, in which routers adapt their locations using only locally cached location information about some of the bridge routers. Global adaptation is also performed
Global-Ammnet	Global adaptation is performed by a randomly selected bridge router whenever any client moves out of the current network coverage area
Oracle	It assumes location information of all clients is available. The routers can move to the assigned locations in the network instantaneously without any moving delay.

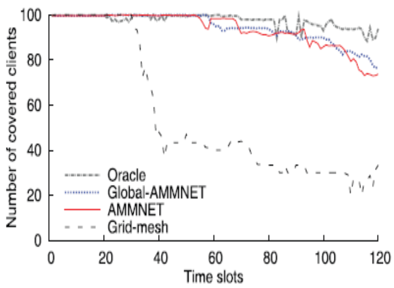

Figure 4: Number of clients covered by mesh nodes

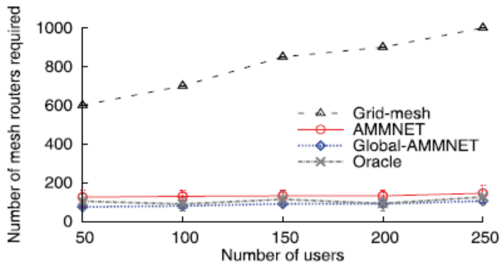

Figure 4b: Number of routers required to cover numbers of clients

The result shows that that AMMNET is scalable with increases in the number of mesh clients if clients are partitioned into a limited number of groups.

5. Conclusion and Future work

Generally, the conventional mobile ad-hoc network suffer from network partitioning, this problem was solved in the AMMNET. It supports both intra-routing and inter-routing. Here, the mobile mesh routers of an AMMNET track the users and dynamically adapt the network topology and perform routing. It simply forwards the date from source to destination via multiple hops. This infrastructure provides full connectivity without need of high cost of network coverage. AMMNET does not consider that, whether the routing path is the one, which is shortest distance between the source-destination pair. It maintains the information's such as location, ID, distance and mobility of its neighbors and provides cost-effective solution. The simulation results also indicate that AMMNET is scalable with the number of users. The required number of mobile mesh nodes does not increase with increases in the user population.

In my future research, many other issues are yet to be examining, such as security, disappearing of mobile, minimizing routing paths, and utilizing non overlapping channels.

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