Implementation of Autonomous Mobile Mesh Network

Amit Lok[1] Pawan Jaiswal[2] Prabhat Kumar[3]

[123]8th Semester B.E. ISE SJB Institute of Technology, Bangalore, Karnataka, India.

ABSTRACT

Mobile Ad-Hoc Networks (MANETs) are the most advancing and popular communication technologies. Mobile Ad-Hoc Networks are the widely used in the areas where a fixed infrastructure is either infeasible or unavailable. In spite of having vast applications areas, it fails in mission critical applications such as crisis management, disaster management and battlefield communications. In such applications, team members might need to work in groups scattered in the applications terrains. This situation raises network partitioning which leads MANET's unsuitable for use. Our greatest challenge is to design a robust MANETs so that it can minimize network partitions.

To address this challenging problem, in this paper we propose a new class of robust mobile ad-hoc networks called Autonomous Mobile Mesh Networks (AMMNETs). The mesh nodes used in AMMNETs has capability of following the mesh clients in the applications terrains maintaining good connectivity for both intragroup and intergroup communications between all nodes even they form different groups. 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. The simulations results shows that the AMMNET is robust against network partitioning and capable of providing high relay through put for the mobile clients.

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).

Related work

The highly successful architecture and protocols of today's Internet may operate poorly in environments characterized by very long delay paths and frequent network partitions. These problems are expected by end nodes with limited power or memory resources. Often deployed in mobile and extreme environments lacking continuous connectivity, many such networks have their own specialized protocols, and do not utilize IP. To achieve interoperability between them, we propose a network architecture and application interface structured around optionally-reliable asynchronous message forwarding, with limited expectations of end-to-end connectivity and node resources. The architecture operates as an overlay above the transport layers of the networks it interconnects, and provides key services such as in-network data storage and retransmission, interoperable naming, authenticated forwarding and a coarse-grained class of service.

The existing TCP/IP based Internet service model provides end-to-end inter-

process communication using a concatenation of potentially dissimilar link-layer technologies. Although often not explicitly stated, a number of key assumptions are made regarding the overall performance characteristics of the underlying links in order to achieve this service: an end-to-end path exists between a data source and its peer(s), the maximum round-trip time between any node pairs in the network is not excessive, and the end-to-end packet drop probability is small. Unfortunately, classes of challenged networks, which may violate one or more of the assumptions, are becoming important and may not be well served by the current end-to-end TCP/IP model. Examples include: reasons.

In this paper, and its extended version [8], we argue that to achieve interoperability between very diverse networks, especially those engineered for extreme environments or that often suffer from network partitioning, link repair approaches alone will not suffice and network-specific proxies are undesirable. Instead, we suggest a general purpose message oriented reliable overlay architecture as the appropriate approach to tie together such networks, forming an "internetwork of challenged internets." The approach, which provides the service semantics of asynchronous message delivery, may be used in combination with TCP/IP where appropriate. Its design is influenced by the interoperability properties of the classical Internet design, the robust non interactive delivery semantics of electronic mail, and a subset of the classes of service provided by the US Postal System. These networks have all evolved to become highly successful communication networks supporting millions of daily users.

We get the basic idea to improve the coverage over and to put faster and secure network to the telecommunication sector. AMMNET reduces manpower and are 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]

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 plays 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.

Liabilities of Existing System
- Node and router, and its computing ability, storage capacity, communication ability, and power supply are limited.

- Existing system are not flexible enough to adapt to topology changes for the dynamic applications.

- There is no guarantee of finding a routing path to forward data.

- Difficult to design robust MANETs for minimize network partitions.

Proposed System

In this paper, we introduced a mobile infrastructure called AMMNET. Unlike conventional mobile ad hoc networks that suffer network partitions when the user groups move apart, the mobile mesh routers of an AMMNET track the users and dynamically adapt the network topology to seamlessly support both their intragroup and intergroup communications. Since this mobile infrastructure follows the users, full connectivity can be achieved without the need and high cost of providing network coverage for the entire application terrain at all time as in traditional stationary infrastructure.

Advantages of Proposed System
- AMMNET can forward data for mobile clients along the routing paths built by any existing ad hoc routing protocols.

- AMMNET is robust against network partitioning and capable of providing high relay throughput for the mobile clients.
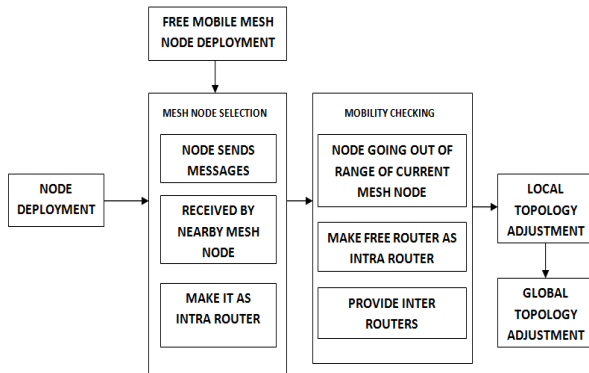
System Architecture for AMMNET

Figure1: AMMNETs System Architecture

Modules

- Node Deployment
- Mobile Mesh Node Deployment
- Local Topology
- Global Topology

Node Deployment

A user sends a request to connect to the network. The network provider will provide service and update connected user information to the nodes and also find out the neighbor nodes in the network to communicate.

Mobile mesh node Deployment

The network provider provides so many mobile mesh nodes in the network area and declares them first as free mobile mesh node. The node send beacon messages and the nearby mobile mesh node provide service to that node. Mobile mesh node also checks the mobility of the nodes. If some node is moving out of the range of current mesh node, then it will send request to other mesh node to monitor that node. If some mesh node got that node, then declare that free node as the intra node and previous node as inter node.

Local Topology Adjustment

Whenever two nodes want to communicate with each other, it will send request to the inter node and so on until it reaches the destination. To find out whether any neighbor node is present or not, whenever one node sends request it will attach the path information, and after that it will make a star connection with the neighbors.

Global Topology Adjustment

If the network is big for a large geographical area, after making doing local topology adjustment, it will find out neighbors and cluster it. Then the communication will be between clusters.

Use Case Diagram

A use case diagram presents a collection of use cases and actors. It is typically used to specify or characterize the functionality and behavior of a whole application system interaction with the system is the actors. Actors represent system users and it gives a clear picture of what it is supposed to do. Use cases are developed on the basis of the basis of the actor's needs. This insures that the system will turn out to be what the user expected. Use-case diagram is used to depict the requirements and the users of this project.
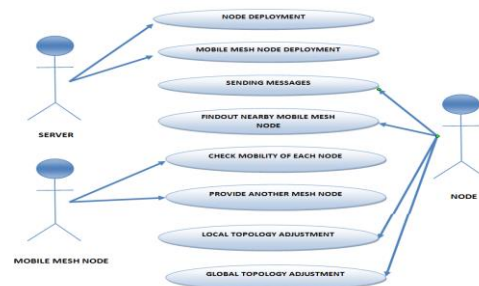

Figure2: Use-Case Diagram of AMMNET

SITUATION

For applications such as crisis management and battlefield communications, the mobile users need to work in dynamically formed groups that occupy different parts of a large and uncertain application terrain at different times. There is currently no cost-effective solution for such applications. Since the user groups occupy only a small portion of the terrain at any one time, it is not justifiable to deploy an expensive infrastructure to provide network coverage for the entire application terrain at all time. Other challenges are due to the potentially hostile environment and the uncertainty in how the application terrain unfolding with time.

In this paper, we introduced a mobile infrastructure called AMMNET. Unlike conventional mobile ad hoc networks that suffer network partitions when the user groups move apart, the mobile mesh routers of an AMMNET track the users and dynamically adapt the network topology to seamlessly support both their intragroup and intergroup communications. Since this mobile infrastructure follows the users, full connectivity can be achieved without the need and high cost of providing network coverage for the entire application terrain at all time as in traditional stationary infrastructure. We conducted extensive simulation study to assess the effectiveness of AMMNET

RESULTS

We next examine the throughput performance in a critical environment, where the number of mesh nodes is not sufficient to always provide full coverage. As a result, we set the number of available routers to 125 because the result shows that the number of routers required to cover all clients is about 130 on average. In this simulation, we also compare AMMNET with the traditional mobile ad hoc network. Since MANET is not an infrastructure-based network, we let each MANET user act as a mobile router, which can transmit/receive its own data and also forward data for other users.

Each simulation includes 100 clients partitioned into five mobility groups. Each router forwards data at the transmission bit-rate of 11 Mb/s. From the 60th to 90th time slots, we randomly select five pairs of nodes to concurrently transmit UDP flows, each with a data rate of 800 Kb/s.

To isolate the impact of frequent route update on the forwarding throughput, we measure the throughput of Oracle only when the routing table in each router has been reconfigured after each topology adaption. Nevertheless, the throughputs of all the other schemes are measured for the entire duration of the simulation to evaluate how they are affected by dynamic topology and route reconfiguration. It shows the average throughput of all the traffic given various numbers of mesh nodes. The figure shows that the average throughput obtained in AMMNET is about 33 percent higher than that in the grid-based mesh.

This is due to the fact that some source-destination pairs in the grid-based mesh are not served by any routers and data could not be delivered. AMMNET can achieve a throughput about 70 percent of that of the Oracle scheme. The performance gap comes from the slightly longer relay paths, and, more deterministically, the packet loss due to route reconfiguration. More specifically, when mesh nodes adapt their locations to client movements, each router cannot relay data along the previous relay paths and needs to discover new

routes. Some packets buffered in the original routing paths might be dropped, resulting in throughput degradation.

CONCLUSION

The results confirm that the proposed distributed topology adaptation scheme based on autonomous mobile mesh routers is almost as effective as a hypothetical centralized technique with complete knowledge of the locations of the mobile clients. 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. Although an excessively large number of user groups may affect the performance of AMMNET, the number of user groups is typically very small relative to the number of users for most applications and AMMNET is effective for most practical scenarios.

FUTURE ENHANCEMENT

We conducted extensive simulation study to assess the effectiveness of AMMNET. There are still many interesting issues not yet examined in our study such as searching for disappearing mobile clients, minimizing routing paths, and utilizing non overlapping channels. We leave these changes for future research.

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