

A Study on Manet: Applications, Challenges and Issues

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Abstract:- Wireless ad hoc networks have become an important area of research in wireless communications systems. Mobile Ad hoc Network is an ad hoc network that can be formed to allow nodes to communicate without any infrastructure. The set up of MANET makes it very popular as compared to the traditional wireless network. In traditional wireless network, mid-point is required for overall process of the network, whereas MANET is self-organized and infrastructure-free network, which is considered as a good approach for some specific applications such as battlefield survivability, communication in the natural or manmade disaster areas, emergency or rescue operations. This research work attempts to provide a wide overview of this active field and it first explains detailed survey of MANET in different fields and then takes over several challenges and issues in the Ad hoc networking area. Finally specify the active application areas of MANET and describes the future work.

Keywords: *Ad Hoc Networks, Disaster, Mobile Ad Hoc Networks (MANET).*

I. INTRODUCTION

MANET is an assembly of affordable, small and strong devices and it is a rapidly growing network. MANET is adaptive and self-organizing in nature. Adhoc networks allow the device to maintain its connection and facilitate to remove or add devices from the network. The topology of ADHOC networks is also not stable it changes rapidly and randomly over time.

There is no central authorization or centralized infrastructure to maintain the connections. Due to the absence of centralized authorization and vary topology the message routing is a big problem but the nodes themselves execute the message delivery. In the static networks, the packet is the route from source to destination, which is based on the shortest path and given the cost of function to extend this method in MANET, is difficult.

In military operation and disaster recovery scenarios, Mobile Ad-hoc Network (MANET) has emerged as a key enabler in facilitating effective operation. The important traits that resulted in the widening popularity of MANET are quick to deploy ability and reconfigurability on the fly. In a disaster scenario, where probably the preexisting communication infrastructures might have been destroyed, MANET can come into play in providing Internet connectivity. As nodes in a MANET move around, a routing algorithm for packet exchange between a pair of nodes plays significantly an important role in throughput and end-to-end delay performance. Several factors can affect the behavior of routing protocols, including nodes mobility. Different routing protocols will behave

differently across different mobility models. The objective of this paper is to study and evaluate the performance of TCP traffic under three MANET routing protocols (Dynamic Source Routing, Ad Hoc On-Demand Multipath Distance Vector and Zone Routing Protocol) in a disaster recovery scenario. To reflect node mobility in a disaster recovery scenario realistically, in our simulation, we have considered a disaster area mobility model. The end goal of this paper is to determine which routing protocol would be the most suitable to be used under the disaster area mobility model based on the network performance evaluation.

This paper is organized as follows. Section II provides detail review of the various classifications of protocols used in the literature. Section III gives the Characteristics of MANET. Section IV discusses the Issues in the MANETs and finally concludes the paper in Section V.

II. LITERATURE REVIEW

Kishore et al, 2016 incorporate four sensors such as Gas, Light, Temperature and Vibration, for detecting disasters in mining industries. These sensors were kept in a single package, and can be carried by each miner. By using wireless communication if any disaster occurs the corresponding sensor will sense the anomaly and sends the information to control station. The MANET topology can be used for communication in order to provide uninterrupted communication. To sense innumerable abnormalities various sensor circuits have been implemented and cascaded together on a single chip. Further chip has been integrated with Gas sensor, Light sensor, Temperature sensor and vibration sensor, if respective sensors will sense any abnormality found in mining and same information will be sent to the base station for rescue operation.

The information, which is sensed by the sensor, will be in the analog form, which will be further converted in to the digital form by using A/D converter. This output is then data encoded using a 4:1 HT-12E Encoder, which produces a single output. This is then transmitted by using RF transmitter to receiver which receives the transmitted data by receiving antenna and which is fed to the 1:4 HT-12D decoders. The decoder decodes the data and sends to process to microcontroller PIC18F2420 after processing data can be outputted by using output devices like computer, a buzzer or LED.

Sani et al, 2017 evaluate performance their proposed method under wide range of traffic scenarios and used DAM model in order to increase accuracy of

performance results. NS2 simulator is used for their performance evaluation. They assumed that each recovery unit is carrying a mobile terminal and serves as a node. In order to realize the routing performance of the different routing mechanism of each protocol, one TCP traffic flow is set up between the furthest nodes in the network to allow multi-hop packets routing. The furthest nodes is configured as the source-destination pair and background TCP connections are set up via peer-to-peer fashion between the intermediate nodes according to the different traffic scenario.

The intermediate nodes will also act as relays, forwarding packets via multi-hop manner. The protocol routing performance is evaluated based on three performance metrics: average throughput, Packet Delivery Ratio and average end-to-end delay. Each of the node will move according to the movement pattern defined in the DAM model. For different traffic scenarios, a different number of nodes (recovery units) are introduced to study how node density impacts the performance of these routing protocols. At the end of the performance evaluation, routing protocol with the most favorable performance will be concluded.

Dharmesh Bhatt and Bijendra Agrawal, 2017 discussed the active and passive attacks including black hole attacks, spoofing, worm hole, flooding and traffic monitoring, traffic analysis and eavesdropping respectively. The attacks are classified into two parts i.e. active and passive attacks then after some other challenges are also discussed. The application are use to prevent such attacks but an algorithm must be introduced to prevent such attacks at which is based on the layers. Following figure shows the categories of attacks present in routing mobile ad hoc networks.

III. CHARACTERISTICS OF MANET

- MANET is self-contained in which each node is router and host and it has no centralized authentication.
- Distributed nature is adapted for the operation of host configuration, routing and security and there is dynamic topology in the MANET for the process.
- Nodes are free to add or remove from the network anytime and Multi-hop is good individuality of MANET.
- When the source node and destination node are not in the radio range, the multi-hop routing has an option in MANET for carried out.
- Less human intercession is required in the MANET due to its compatible and impulsive behavior.
- Asymmetric location is created by the nodes of MANET, which have analogous features, responsibility, and capability.
- In the comparison of the wired networks, the wireless network has less stability, reliability, efficiency, and capacity.

Device Heterogeneous:

Devices or nodes in MANET are heterogeneous. Mobile nodes can be phones, laptops or it can be tablets, etc. with different configurations.

Shared Broadcast Radio Channel:

All nodes in MANET shared radio interface for receiving and transmission.

Random and Dynamic Topology:

Due to the compatibility of nodes in MANET, the topology of the network changes very habitually and is very complicated to calculate.

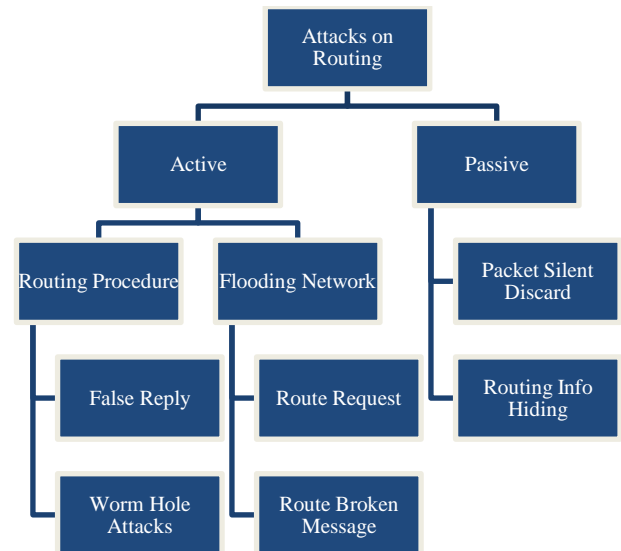


Figure 1: Attacks on Routing in Mobile Ad Hoc Networks

Autonomous Nature of Nodes:

Due to a lack of infrastructure, the nodes of the network are responsible for various functions like routing, forwarding, and transmission.

Bandwidth Constraints:

Nodes of the MANET use wireless links to communicate and these links are with low bandwidth compare to wired networks.

Lossy Links:

The nodes of the MANET are compatible, that way any node can go out of range of the network at any time. This one causes frequently loss links between the nodes.

Network Scalability:

Nodes in the MANET can enter the network at any time. In other words, the network can grow up to any extent.

Self-Organized:

MANET can be deployed without any central point or access point. Nodes in the MANET are intelligent to handle all the network functions including their data transmission and hence are self-organized.

Distributed Operational Environment:

MANET performs distributed operation because of two main reasons:

- Nodes that are present in the network are heterogeneous;

- The complete task of network management is dividing among various nodes that are participating in the network due to the lack of central authority.

Applications:

Following are the major application areas of MANET

- Emergency Services
- Disaster Management
- Tactical Networks
- Education
- Entertainment
- Home & Enterprise Networking
- Convergence Extension
- Military
- Sensor Networks
- Context aware services

IV. ISSUES IN MANETS

No specific routing protocols or routing decisions are necessary if there are only two nodes to communicate with each other and are located very closely. In another way, if several mobile hosts are wishing to communicate, then the routing protocols come into the picture, in this case, some critical decisions have to be made such as which is the optimal route from the source to the destination which is very important because the mobile nodes operate on battery power. Thus, it becomes necessary to transfer the data with minimal delay to lossless power. There will be a kind of compression involved in which it could be provided by the protocol to lossless bandwidth. Further, there is a need for encryption to protect the data from prying eyes. In addition to this, the Quality of Service support is also needed so that the least packet drop can be obtained. The other factors, which need to be considered while choosing a protocol for MANETs, are as follows:

- **Multicasting:**
Ability to send packets to multiple nodes at once. This is similar to broadcasting except for the fact that the broadcasting is done to all the nodes in the network. Multicasting is important as it takes less time to transfer data to multiple nodes.
- **Loop-Free:**
The path is taken by a packet never transits the same intermediate node twice before it arrives at the destination. To improve the overall performance in the routing protocol to guarantee that the routes supplied are loop-free. This avoids any loss of bandwidth or CPU consumption.
- **Multiple routes:**
One route gets broken due to some disaster, then the data could be sent through some other route. Thus, the protocol should allow creating multiple routes.
- **Distributed Operation:**
The protocol should be distributed. It should not be dependent on a centralized node.
- **Physical security:**

Networks are more vulnerable to physical security threats such as eavesdropping and jamming attacks.

- **On-demand operation:**

Uniform traffic distribution cannot be assumed within the network, the routing algorithm must adapt to the traffic pattern on a demand or need basis, thereby utilizing power and bandwidth resources more efficiently.

- **Unidirectional Link Support:**

Radio environment can cause the formation of unidirectional links. Utilization of these links and not only the bi-directional links improves the routing protocol performance.

- **Entering/Departing nodes:**

Routing protocol should be able to quickly adapt to entering or departing nodes in the network, without having to restructure the entire network.

V. CONCLUSION

A broad review of MANET including its characteristics, challenges, and issues has been discussed in this paper. From the review presented above, it is concluded that in spite of many advantages of MANET, the real-time implementation of MANET is a very challenging task. It is very hard to achieve confidentiality, authentication and other security goals. Further, the characteristic of nodes is very difficult to address co-operation in MANET. Finally, it is concluded that the issues & challenges of MANET discussed in this article must be addressed very carefully which designing various protocols before its real-time application. Further research will be carry in the area of disaster management, which is considering as an important application of MANET.

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