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Research Article

RECENT TECHNICAL REVIEWS, ISSUES AND CHALLENGES IN MOBILE DENSE NODES

Rekha M* and Subramani A

Department of Computer Science, M. V. Muthiah Government Arts College for Women, Dindigul, Tamil Nadu, India

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ABSTRACT

MANETs are a kind of wireless ad hoc network (WANET) having continuous self-configuring with limited infrastructure network formed by a set of wireless mobile nodes that has no central administration for connecting to the devices as laptops, wireless telephones, and wireless sensors etc., and establish their own network dynamically. This paper aims to review the technical aspects of MANETs to improve the performance of highly dense MANET architecture, types and its characteristics, advantages, application, routing protocol, recent challenges and issues of MANETs for efficient and effective communication between the mobility nodes to participate dynamically in an established network.

INTRODUCTION

Mobile Ad-hoc NETworks (MANETs) are formed dynamically by an independent system of mobile nodes that are connected through wireless links. There is no existing fixed infrastructure or centralized administration (i.e., no base station) so far, the mobile nodes are free to move randomly (Majharul Haque *et al*., 2013). Therefore, the network topology changes frequently as shown in figure 1.

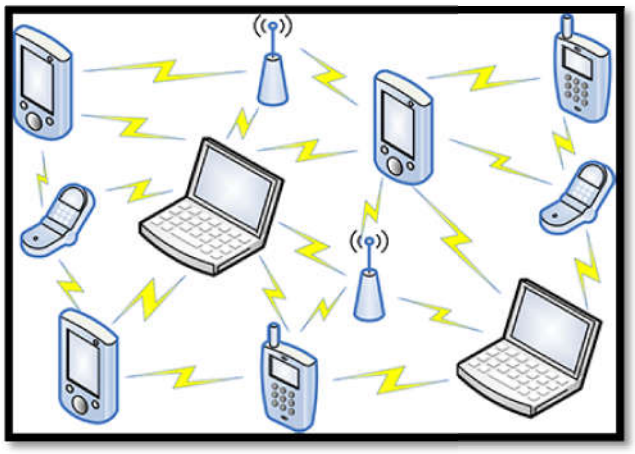

Figure 1 MANET Paradigm

It may be operated as a standalone fashion or also can be connected to the larger internet. Hence, each node in this network acts as router. As the number of applications of mobile ad hoc network grows, the size of the network varies significantly from a network of several mobile nodes in a location, to a network of hundreds of mobile units deployed. A network of a thousand nodes may be split into a number of smaller networks of a few hundred nodes or vice versa, as the nodes dynamically move around a deployed area.

MANETs Types and Its Characteristics

There are different types of MANETs including its characteristics are, inVANETs the Intelligent vehicular ad hoc networks make use of artificial intelligence to tackle unexpected situations like vehicle collision and accidents. Vehicular ad hoc networks (VANETs) enables effective communication with another vehicle or helps to communicate with roadside equipments and Internet Based Mobile Ad hoc Networks (iMANET) helps to link fixed as well as mobile nodes. MANETs characteristics (Reddy *et al*., 2016) are listed as follows,

- In MANET, each node acts as both host and router. That is it is autonomous in behavior.
- Multi-hop radio relaying - When a source node and destination node for a message is out of the radio range, the MANETs are capable of multi-hop routing.

Corresponding author:* **Rekha M
Department of Computer Science, M. V. Muthiah Government Arts College for Women, Dindigul, Tamil Nadu, India

- Distributed nature of operation for security, routing and host configuration. A centralized firewall is absent here.
- The nodes can join or leave the network anytime, making the network topology dynamic in nature.
- Mobile nodes are characterized with less memory, power and light weight features.
- The reliability, efficiency, stability and capacity of wireless links are often inferior when compared with wired links. This shows the fluctuating link bandwidth of wireless links.
- Mobile and spontaneous behavior which demands minimum human intervention to configure the network.
- All nodes have identical features with similar responsibilities and capabilities and hence it forms a completely symmetric environment.
- High user density and large level of user mobility.
- Nodal connectivity is intermittent.

MANET Application and Its Services

The various application usage areas of MANETs (Parvinder Kaur *et al*., 2015) are described as follows,

Tactical Network Services

- Military communication, automated battlefields
- Emergency Services
- Search and rescue operations
- Disaster recovery. Example: Earthquakes, hurricanes.

Educational Services

- Virtual classrooms or conference rooms.
- Setting up ad hoc communication during conferences, meeting, or lectures

Commercial and Business Services

- Electronic bill payment
- Dynamic database access, mobile offices
- Road or accident guidance, transmission of road & weather conditions, taxi cab network, inter-vehicle networks.
- Sports stadium, trade fair, shopping malls.
- Networks of visitors at airport.

Home and Entertainment Services

- Home or office wireless networking.
- Personal Area network
- Multiuser games
- Outdoor internet access.

Sensor networks

- Sensors and actuators embedded in consumer electronics.
- Data tracking of environmental conditions, animal movements, and chemical / biological detection.

Context aware services

- Call forwarding, location specific areas, and time dependent services.
- Touristic Information.

Coverage extension services

- Extending cellular network access..
- Linking up with internet, intranet etc.,

Overview of Manet Routing Protocols

Routing is the act of moving information from sender to receiver in an internetwork. During this process, at least one intermediate node within the internetwork is encountered. Routing protocols use several metrics to calculate the best path for routing the packets to its destination. These metrics are a standard measurement based on number of hops, which is used by the routing algorithm to determine the optimal path for the packet to its destination (Neeraj Verma and Sarita Soni, 2017). The process of path determination is that, routing algorithms initialize and maintain routing tables, which contain the total route information for the packet. This route information varies from one routing algorithm to another. Routing is mainly classified into static routing and dynamic routing. Static routing refers to the routing strategy being stated manually or statically, in the router. It maintains a routing table usually written by a networks administrator. The routing table doesn't depend on the state of the network status, i.e., whether the destination is active or not. Dynamic routing refers to the routing strategy that is being learnt by an interior or exterior routing protocol. This routing mainly depends on the state of the network i.e., the routing table is affected by the activeness of the destination.

MANET changes their topology dynamically in this manner, packet routing result as troublesome at that moment. Routing protocol controls the stream of information in systems and furthermore chooses the efficient way to achieve the target destination. It can be categorized on various basis as depicted in figure 2 such as on the topology of network for routing i.e. proactive and reactive routing protocols, on the basis of communication strategy used for transmitting of information from source to destination i.e. unicast, broadcast and multicast routing (Dimpy Grover and Sunil Saini, 2015). Routing protocols define a set of rules which governs the strategy of message packets transfer from source to destination in a network (Parul Gupta, 2016). The geographical position of a moving node can be used to improve the performance of routing algorithms. The global positioning system (GPS) can be used for acquiring position information.

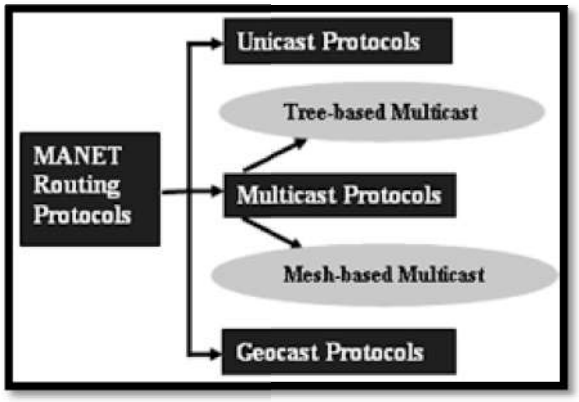

Figure 2 Overview of MANET Routing Protocols

The major disadvantage with static routing is that if a new router is added or removed in the network then it is the responsibility of the administrator to make the necessary changes in the routing tables. But this is not the case with

dynamic routing as each router announces its presence by flooding the information packet in the network so that every router within the network learn about the newly added or removed router and its entries. Similarly this is the same with the network segments in the dynamic routing (Dhenakaran and Parvathavarthini, 2013).

LITERATURE REVIEW

Murali *et al*. (2017) have presented the most popular Zone Routing Protocol (ZRP. The significance of this paper aims to ensure needed security by providing a comprehensive architecture of Secure Zone Routing Protocol (SZRP) based on efficient secure neighbor discovery, secure routing packets, detection of malicious nodes, and preventing these nodes from destroying the network. In order to fulfil these objectives, both efficient key management and secure neighbor mechanisms have been designed to perform the prior functions of the protocol. The model is simulated for 35 nodes spread randomly in a 1200 * 1200 m network. Here, the nodes are designed to move in a three-dimensional topology. The transmission at each hop along the route is counted as one transmission. As the data rate increases the delivery packet ratio of low mobility networks increases. During the data transmission route discovered to the destination will not change and thus the success of packet delivery to the same destination will increases. In addition, it detects the effect of malicious node.

Inderpreet Kaur and A. L. N. Rao (2017) have proposed key management scheme to improve the network security with less mobility overhead and less key distribution time. It can execute the tasks such as removal of misbehaviour node, key generation, cluster head verification, key generation and management schemes. The performance of this model is analyzed for 36 nodes with packet size of 512 bytes, transmission range of 100 m, simulation time of 200 s using grid topology in ns2 simulator 5.0. At that time number of keys generated is varies from 100 to 800 with sending and receiving time values are recorded in an efficient manner.

Khalid Hussain Mohammadani *et al*. (2017) have examined the execution of TCP and TCP variants (TCP-Reno, TCP-New Reno, TCP-Vegas and TCP-Sink). This paper aims to strengthen by Ad-hoc On-demand Distance Vector (AODV) routing protocol with the incorporation of various network complexities of the versatile mobile ad-hoc network utilizing random waypoint for portability model. It demonstrates the portable nodes situated especially for a grounds zone. On the premise of simulation, end-to-end delay, jitter, throughput, and packet deliver ratio as the Quality of Service (QoS) measurements are analyzed. The least impact of network complexity has analyzed on TCP Reno. TCP, TCP-Reno, TCP-New Reno, TCP-Vegas degraded the throughput in high network complexities and they have got more packet delay time in terms of an end-to-end delay and jitter time to deliver the packets as compared with TCP Reno. TCP Reno could be better from network complexity as the quality perspective of QoS metrics in the MANET. The imitations is that the ideal execution is not traced. The creation of network complexities leads to the crash execution of TCP variants.

Vimal Kumar and Rakesh Kumar (2017) have proposed a Service Oriented Architecture (SOA) based signature scheme to mitigate wormhole attack. It is a type of middleware that supports application development and communication through various services deployed at every node constituting the network. Basically, it has three modules as, service provider, service broker and service consumer that work collectively to provide functionality as requested by a mobile node. The simulation results are evaluated using ns-2. It shows that wormhole attack is mitigated successfully and it outperforms over existing schemes in terms of packet delivery ratio, end-to-end delay and throughput. The authors also proposed SOA-based signature scheme on cluster-based MANET to provide various benefits are, interoperability, flexibility, heterogeneity, coupling, platform-independence, scalability, reusability and some security goals as authentication, non-repudiation and integrity. A very few limitations observed in this model are when overall network conditions are taken into consideration then the computation cost gets increased due to high mobility of nodes. Therefore, signature computation phase extends longer and hence the overall communication time gets increased.

Rajesh *et al*. (2017) have proposed and established the novel cluster based routing algorithms to evaluate and improve the performance of highly dense MANET architecture. The lemmas and subsequent theory are established with this model for analyzing the cluster head detection. The energy consumption is demonstrated with the comparison of existing method and proven the result as, 50% improvement in the power awareness.

Qamar Jabeen *et al*. (2016) have proposed a scheme for enhancement of TCP performance in MANET. This scheme collects the useful information from physical and MAC layer for approximation of channel utilization per station. The contention window (CW) has been adjusted to control the competition between stations. It also achieves the fair channel access by each station with equivalent throughput. The value of bandwidth allocation to each flow is calculated and sent to the next layer for getting the fair bandwidth allocation to each flow. Then, control the sending rate of TCP flow to resolve the problem of contention between flows. Each flow got almost equal throughput and fairness has been improved. The performance of this method is examined by using network simulator [NS-2] on various topologies of multi-hop ad hoc network.

Issues and Challenges

Some of the limitations observed are that MANETs not only have the traditional problems of wireless communications like power management, security, and bandwidth optimization but also a lack of any fixed infrastructure, and their multi-hop nature poses new research problems (Jayalakshmi, 2015). For example, routing, topology maintenance, location management, and device discovery, to name a few, are important problems and still active areas of research. The challenges for the researcher's are:

- Less infrastructure
- Brings new network designing challenges.
- Dynamically changing topologies.
- Cause route changes, frequent network partitions and packet loss.
- Physical layer limitations.

- Limited wireless range.
- Packet loss during transmission.
- Broadcast nature of the communication.
- Limitations of Mobile Nodes.
- Short battery life.
- Limited processing power.
- Network security.

CONCLUSION

In this paper, the researchers have concluded the enormous growth in the field of mobile dense nodes in MANETs model. A brief description on this review article promotes the various research activities to re-design or enhance MANETs model is far from being exhaustive. More effort is spend on formulating the MANETs to support the effective and efficient communication between mobile dense nodes that are part of the network. As a prospect for future work, the research is focused to speed-up the movements in the networks to achieve the maximum optimum node density.

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