

A State-of-the-Art Survey on MANET Protocols

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Abstract

MANET is an ad-hoc network is a collection of mobile nodes forming an ad-hoc network absent any centralized structures. The mobile ad hoc networks are majorly vulnerable to attacks because of its unique characteristics such as: open network architecture, shared wireless medium and tight resource constraints. These attacks can potentially put down the network performance by constantly transmitting packets and keeping the ad hoc network busy. This paper presents the revue and the comparison between existing variants of MANET protocols, such as Proactive(OLSR, DSDV), Reactive(AODV and DSR) and Hybrid (both proactive and reactive) routing protocols for MANET. Functioning matrix includes parameters like average End-to-End delay, throughput analysis, number of nodes, number of packet drops and packet delivery ratio etc.

Keywords: MANET, AODV, DSDV, DSR.

1. INTRODUCTION:

MANET network is an autonomous system of mobile nodes linked by wireless links each node works as a router and an end system for all other nodes in the network. Nodes in mobile ad-hoc network are free to travel and form themselves in an arbitrary fashion. In recent years, MANET has received enormous attention because of the self configuration and self-maintenance [1] capabilities. The advancement in the wireless communication plays a vital role in emergency and rescue operations because of betterment in end user hardware such as mobile devices, hand held devices, phones and more. In this changing weather conditions disaster get an unavoidable one. Since emergency differ from day to day operations to bigger scale catastrophic events therefore an efficient communication is required to help people where the rescue is needed. In such positions the communication infrastructure is totally absent or damaged or previously deployed network may not be handling the traffic load [2]. The solution is MANET because it can be spread and destroyed easily wherever it is required irrespective of time and situations time and works as a temporary network. It is framed of various elements denoted as scenario which consists of specific number of nodes, topology and also include the definition of mobility patterns such as speed, direction and pauses of the nodes [3]. In emergency and rescue scenario, the topology of the network is often varying due to the obstacles that may occur due to the unexpected events that affect the normal pathway of nodes. Therefore movement of routing algorithm is found by the topology and the corresponding nodes should be moved depending on the obstacles [3].

In MANET we do not need a static centralized structure, so they can be created anytime anywhere[4]. MANET is low in bandwidth and in dynamic shape, our democratic technologies

like cell phones, PDA, digital handheld devices, laptops and even an MP3 player may be the participant in MANET. We use term “mobility” for MANET, which indents that one may move freely. No base station or access point participates in MANET, and it can easily be applicable that is why it is used in different military operations because MANET can be projected at run time. In case of natural tragedy when all existing infrastructure is destroyed, we use MANET technologies for different rescue operations in this circumstances. Bluetooth is new wireless technology. The goal in MANET is to make Bluetooth that may be used to connect with others [5].

MANET in future is going to bring in a revolution, because it takes us in ubiquitous age, where a user whenever and wherever may access everything he desires. A user who wishes to browse internet when he wants to share images, to check mail, to transfer a file may operate all operations through MANET. A traveler with portable computer can be help with internet services at an airport, a public place or at station. A stranger may use GPS services and find required information about his target. It also gives facility to researchers; they may transfer and retrieve their files anywhere and anytime. Business men can do video conferencing with one with other through their cellular phone. It is noticed that mobile internet users increase 20% - 50% in a year, which describes that soon the number of mobile internet users will exceeds the number of those who uses internet without portable computers. Sensor network is one of MANET application. Sensors are placed in a particular environment, which is to be observed, they sense this environment and send back information. Sensor network is specifically used to update regarding weather [6]. Data in the form of packets are transmitted in store and forwarded manner to deliver to the final target [7].

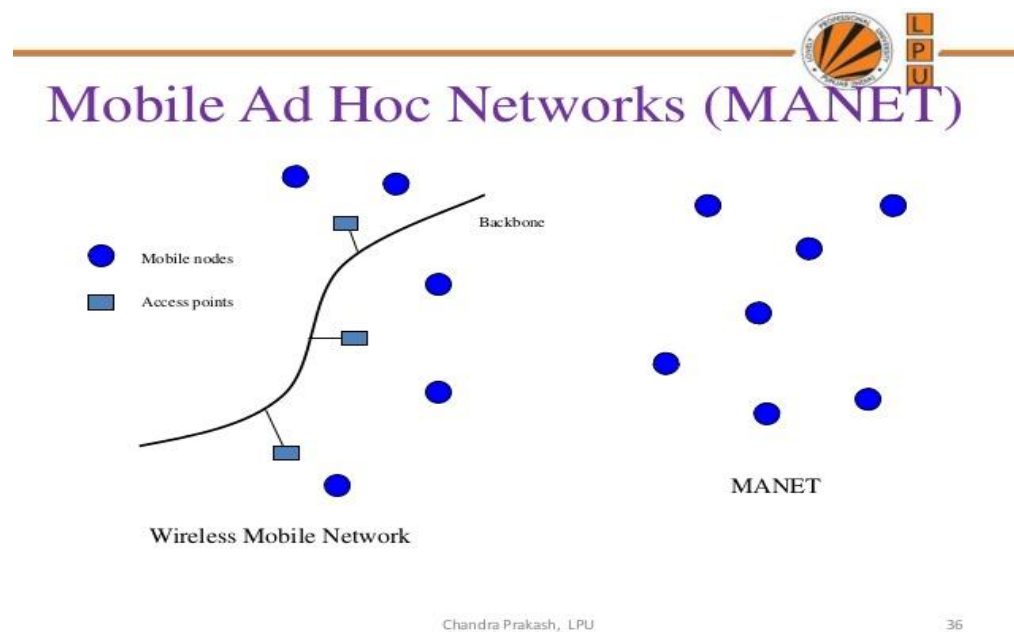


Fig-1: mobile ad hoc network

2. Protocols in MANET's

Protocols are set of procedures and regulations that govern the smooth communication between the communicating devices. Nowadays, many new network routing techniques are introduced for the use of mobile ad-hoc network application. Routing in MANET can also face some difficult challenges like limited range, dynamic topology and scalability. Size of routing table also affect link overhead. Many new routing techniques are developed for effective and reliable routing. The routing protocols are divided in three parts. These parts include table driven, on demand and mixture of both of these protocol known as hybrid routing protocol.

(1) Proactive Protocols:

In proactive protocols, the nodes maintain entire routing information of the network in a table beforehand, even without any demand. On the other hand proactive protocols keep all the routing information in routing tables of nodes even if they are not required. Routes are updated periodically by replacing the control information between nodes so as to maintain consistency in the network. The main reason for periodic updates is to pre-calculate all potential paths. Hence whenever changes occur in the network, in order to keep the routing tables get refreshed, periodic updates are important. Therefore, in such scenario to rescue people who are in affected area is achieved with the help of continuous assessment of route updates between the nodes. Even if it has advantages, too much of updates lead to overall network functioning is in question. Moreover it performs well at static network and not in dynamic networks because of the scalability issues [3]. The well-known proactive routing protocols are DSDV [1] WPR [8] and OLSR [9].

(1) Destination sequenced distance-vector routing protocol (DSDV):

This protocol based on "Bellman-Ford algorithm" with some improvement like as free from loops routes that gives an efficient and dependable path that lead to the final source. To cut the overhead traffic in the network, two techniques are used for updating the whole network. First one known as a Full dump that holds all the information for updating the table and second name as incremental packet bind that information that is changed recently in last full dump. The delivery of Incremental packet is faster than full dump [10].

(2) Optimized link state routing protocol (OLSR):

OLSR is proactive in nature. This protocol is depends on the link state protocol that substitutes topology change information regularly to all other nodes in network. It uses Multi-

Point Relays (MPR) that helps to reduce the duplication retransmission when message can be forwarded. It also reduces control overhead by using MPR. In MPR, the adjacent node known as a MPR that are selected by other nodes are transmitted data. Any other node that are MPR can translate and process packet but do not carried again. This will definitely reduce the duplicate retransmission [11].

(3) *Fisheye state routing (FSR):*

FSR is a proactive technique that depends on a “link state algorithm”. It will reduces the network overhead traffic and also maintains the topology change information. In FSR every node having updated information to maintains the table. Each node also have entire topology map of overall network. This kind of information can share with local neighbors periodically. It is also scalable for wide area network but scalability can reduce the exactness. The main problem of this technique sends link change update regularly that floods the network and also sometimes occurs overhead traffic [12].

II REACTIVE PROTOCOLS:

In reactive routing protocol [13] the routes are generated only when it is needed. There is no need for periodic updates of routing tables equated with proactive or table driven protocol. In order to demonstrate a route between source and the destination, it initiates a route discovery process that is used to send data to the destination. After the successful completion of route discovery process, the path is available to send data. In order to keep the consistency of routes between nodes route maintenance process is used.

The main advantage of using this protocol in emergency and rescue is energy and bandwidth are saved because routes are generated only when it is needed and there is no need of periodical updates so it improves communication with the affected area and generally devices are resource constrained. so if using this protocols it feeds the lifetime of involved devices. On Demand Routing Protocols are taken up for the discussion here. Some of the protocols are DSR [1], AODV [14] and TORA [1].

(1) *Dynamic source routing (DSR):*

Dynamic source routing uses source routing for sending the messages. In this technique sender determine the complete path of node from where the packet is forwarded to destination and node also attach this route information in the header of the packet that pass from one node to

the next nearest node and each node check the address of node until it reach the destination. Route maintenance and route discovery are two main characteristics of this protocol. In route discovery it discover the route that lead to the destination and in route maintenance whenever the topology change it notice a failure of route that lead to the destination. Whenever it points that source route is not present then it again discover route for propagation. The main gain of this method is that when nodes discover routes, it first check in its cache routes and if the some authentic route are present there then the sender don't need to discover the route that is why it is helpful for those network that have low mobility.

(2) *Ad hoc on-demand distance vector routing (AODV):*

Ad-hoc On-Demand Distance Vector routing is the combination of both DSR and DSDV that will guarantee the loop free route. Like in DSR, it use route maintenance and also route discovery for extension and also periodic beaconing and adding sequence of number from DSDV. The main difference between DSR and AODV is that in DSR each node has full routing information for full network but in AODV the nodes have only the address of destination. It maintains the route whenever needed that is why it is reactive in nature. In AODV, It also add the destination sequence address to avoid looping concept when the topology being change during the propagation. The main benefit of AODV is that of adjustment to active networks [15].

III HYBRID PROTOCOLS

Hybrid routing is an on-demand routing protocols. This type of protocols are use distance vectors for more accurate metrics to determine the most beneficial paths to destination networks, and report routing information only when there is a change in the topology of the network. Some examples of Hybrid Routing Protocols include Zone Routing Protocol(ZRP), Hazy Sighted Link State (HSLs) protocol and Secure Routing Protocol (SRP) [11],[16].

(1) *Zone Routing Protocol: (ZRP)*

The Zone Routing protocol mixes the advantages of both reactive and proactive protocol into a hybrid scheme, taking advantage of proactive discovery within a node's local neighborhood and using a reactive protocol scheme for communication in between this neighborhood . The benefit of ZRP protocol is that it decreases the communication channel as

compared to the table driven protocols. It also control the delay of packet delivery as compared to the on demand protocols [16].

In a MANET it can safely be assumed that most communication takes place between nodes is very close to each other. These local neighborhoods are called zones each node may be within multiple overlapping zones and each zone may be of different sizes. The size of zone is not decided by a geographical measurement but is given by a radius of length where the number of hops to the perimeter of the zone is situated. Each component works independently of the other and they may use different technologies in order that maximize efficiency in their particular area.

(2) Dynamic Source Routing protocol (DSR):

DSR is simple and efficient routing protocol planned specifically for use in multi-hop wireless Ad hoc networks of mobile nodes. DSR allows the network to be totally self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two main mechanisms of Route Discovery and Route Maintenance, which is work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. All aspects of the protocol operate entirely on demand, allowing the routing packet overhead of DSR to scale automatically to only what is needed to react to changes in the routes currently in use.

The protocol allows multiple routes to any destination and also allows each sender to select and control the routes used in routing its packets. Other advantages of the DSR protocol include easily guaranteed loop-free routing, operation in networks holding unidirectional links use of only soft state in routing, and very rapid recovery when routes in the network change. The DSR protocol is designed primarily for mobile ad hoc networks of up to about two hundred nodes and is designed to work well even with very high rates of mobility.

(3) Hazy sighted link state (HSLs) protocol:

It is also a “link state protocol” that is based on the narrow propagation. HSLs does not hold the properties of on demand protocol like in ZRP but it actually shows some behavior of on demand protocol. It is used best route for delivery of packet. It takes gains of regularly improve information routing that the packet reaching the document. One most important Advantage of HSLs is that optimizes the overall traffic overhead [17].

Conclusion

During the past decade, environment conditions are acquiring changed hence natural disasters such as flooding, earthquake and landslides can be expected. Emergency and relief operation is demanded to cope up with such situation and today's network communication play a vital role in rescue operation. In the advancement of communication technology, though traditional network infrastructure exists, they could not support such environment due to centralized, difficulty in preparation, lack of self-configuration and changing network structure so alternative solution is Mobile Ad hoc networks because of its significant characteristics. In addition to, routing algorithm that is used for conventional is not suitable for such scenario so finding of new algorithms are necessary; that is provided by MANET for efficient communication in such scenario.

In this paper, we have presented a review of different types of protocols, attacks on physical, data and network layers and also provide security solutions. Various routing protocols are discussed in the paper are very helpful and effective for new researchers to identify current issues for advance research. Nowadays Many new routing protocols are proposed but still there is an open research issue that which protocol shows best behavior in which situation. A lot of areas has been made in this field but several open problems and issues need to be addressed.

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