



## Review study on MANET Routing Protocols: Challenges and Applications

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**Abstract** - The MANET is the self configuring network in which mobile nodes can join or leave the network any time. Due to its decentralized nature routing is the major concern or major issue on MANET. The primary challenge in building a MANET is equipping each device to continuously withstand the information required to properly route traffic. In this paper presents the study of reactive, proactive and hybrid routing protocols. Due to severe challenges, the special features of MANET bring this technology great opportunistic together. It also includes the applications of ad hoc networks discusses the technological challenges of that protocol must faced for the routing protocols.

**KEYWORDS**:- Mobile Ad Hoc Networks, challenges, applications, AODV, DSDV, DSR.

### I. INTRODUCTION

MANET is a self configuring network, in which topology is dynamic. These nodes are struggling to cope with the normal effect of radio communication channels, multi-user interference, multi-path fading etc. MANET is a combination of wireless mobile nodes that dynamically creates the network in the absence of fixed physical infrastructure and centralized access point. The mobile nodes that are in radio range of each other can directly communicate, whereas others needs the aid of intermediate nodes to route their packets MANET is a self configuring network, in which topology is dynamic. These nodes are struggling to cope with the normal effect of radio communication channels, multi-user interference, multi-path fading etc [3]. The functionality of Mobile Ad-Hoc Network Finds the routes and maintains the routes with the help of routers. In such networks, nodes are capable of moving and coordinating with their neighbours. Routing in MANETs is a One of the dynamically and demanding task and has received

A great amount of awareness from researchers around the global. To overcome this problem, a various number of routing classes have been introduced and the number is still rising day by day fastly.

#### A. MANET ARCHITECTURE

The Mobile ad hoc network has become a very popular in wireless network communication technology. A mobile ad hoc network (MANET) is a combination of wireless mobile nodes that dynamically creates the network in the absence of fixed physical infrastructure and centralized access point. In MANET each node works as a router and an end system for all other nodes in the network. [7].

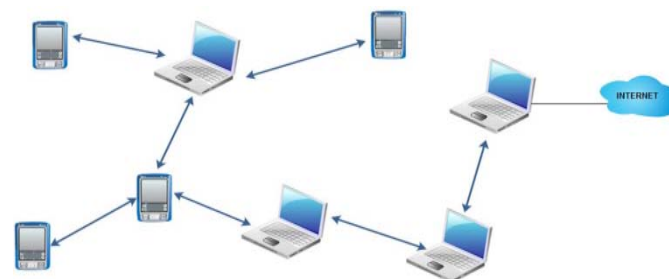


Figure 1: A Simple Mobile Ad Hoc Networks [1]

The nodes in MANETs are interrelated using the multi-hop communication paths. Simply it mentions that all the nodes in the hop must be prepared to contribute in the procedure of deliver a packet by forwarding it from source to destination [4].

#### B. MANETS CHARACTERISTICS

- Distributed operation:** Routing protocols must remain the correct route data even as the nodes appear, disappear and freely move anywhere. It is also known as the loop free protocol to implement a specific function such as a routing and security.
- Multi hop routing:** When a node tries to send a packet to the other nodes which is out of its communication range, they use the intermediate (neighbour) nodes to send these packets.
- Autonomous terminal:** In MANET, each mobile node is an independent node, which could be perform function as both a host and a router which finds and maintain the route.
- Dynamic topology:** In adhoc networks the Nodes are free to move arbitrarily and they can change continuously due to the mobility of nodes. As The nodes move in and out of communication range of each others, some links may be established when the faulty links are occur[1].

#### C. CHALLENGES IN MANET

- Security** The ad hoc nature of MANETs brings various new security challenges to the network design. The wireless medium is a vulnerable to eavesdropping and ad hoc network functionality is established through node cooperation, mobile ad

hoc networks are intrinsically exposed to numerous security attacks.

- b) *Quality Of Service* Due to the dynamic changes in topology in adhoc network, providing the QOS. Because of rapid development in mobile technology and real time applications like multimedia, voice providing Quos in adhoc network is necessary to maintain best-effort-of-service.
- c) *Routing Overhead* In wireless adhoc networks, nodes often change their location within network. So, some stale routes are generated in the routing table which leads to unnecessary routing overhead.
- d) *Inter-networking* In addition to the communication within an ad hoc network, inter-networking between MANET and fixed networks (mainly IP based) is often expected in many cases. The coexistence of routing protocols in such a mobile device is a challenge for the harmonious mobility management.
- e) *Power Consumption* For most of the light-weight mobile terminals, the communication-related functions should be optimized for lean power consumption. Conservation of power and power-aware routing must be taken into consideration.
- f) *Location-aided Routing* Location-aided routing uses positioning information to define associated regions so that the routing is spatially oriented and limited. This is analogous to associatively-oriented and restricted broadcast in ABR.
- g) *Scalability* in the adhoc routing protocol whether the network is able to provide an acceptable level of service even in the presence of a large number of nodes that can communicate with one another.
- h) *Packet losses due to transmission errors* Ad hoc routing protocol networks in which much higher packet loss due to factors such as increased collisions due to the presence of hidden terminals, presence of interference, uni-directional links, and frequent path breaks due to mobility of nodes.

#### D. MANETS APPLICATIONS

In adhoc mobile networking is gaining an importance with the increasing in number of widespread applications like commercial, Military and private sectors etc [17].

- a) *Military battlefield* Ad-Hoc networking would allow the military to take advantage of common place network technology to maintain an information network between the soldiers, vehicles, and military information head quarter.
- b) *Local level* Ad-Hoc networks can autonomously link an instant and temporary multimedia network using notebook computers to spread and share information among participants for e.g. conference or classroom. Another appropriate local level application might be in home networks where devices can communicate directly to exchange information.

c) *Personal area network and Bluetooth* A personal area network is a short range, localized network where nodes are usually associated with a given person. Short-range MANET such as Bluetooth can simplify the inter communication between various mobile devices such as a laptop, and a mobile phone.

d) *Commercial Sector* Ad hoc can be used in emergency/rescue operations for disaster relief efforts, e.g. in fire, flood, or earthquake. Emergency rescue operations must take place where non-existing or damaged communications infrastructure and rapid deployment of a communication network is needed.

## II. LITERATURE SURVEY

This section gives the overview of related work by various authors in routing protocols:

Yu, et al. (2007) [1] in this paper introduces the protocol that repairs the broken or failure route. The routing protocols are compared other to protocols for higher data deliver rate than AODV and DSR. The comparison can do in terms of data deliver rate, control overhead under the light and moderate traffic conditions In future proposed these routing protocols for increasing data delivery packets and route maintenance. Al-Karaki et al. (2008)[5] In this paper introduces the physical properties of MANET are unstable or robust. This scheme has the drawback of minimum overhead. To propose this approach constructs the virtual grid architecture (VGA) for heterogeneous and homogeneous networks in MANET. An integer linear formulation comparison between the VGA clustering and optimal clustering. VGA can be calculated in terms of the size route length, average the route length over VGA should be optimal. Creating and maintaining of VGA is minimum and the performance can be increase. Changling Liu et al. (2009) [3] have presented a significant and indispensable issue for mobile ad hoc networks- routing protocol design. This is the major practical challenge due to the Quality of the network. The design of the protocols is ambitious by specific goals and needs based on the respective assumptions of the network properties or application areas. The survey of the review typical routing protocols gave the characteristics and trade-offs. Shunli Ding et al. (2010) [6] in this paper the MANET uni-path and multi-path routing can done using paths from source to destination. In this paper proposed the new multiple routing in AODV protocol in MANET. In AODV protocol the multiple routing can be used by the other scheme of AODMV. For which the routing it can discovers the multiple paths that send the RERQ source to destination and the destination can send the RERP to source. AODV routing protocol improves the backup route discovering for data transmission to lower the route delay. This algorithm improves the packet transmission and minimizes the end to end delay when the data can be transmitted. Mina Vajed Khiavi et al. (2012) [8] in this paper compared AODV, DSDV, DSR and TORA routing protocol in mobile ad hoc networks to determine the best operational conditions for each protocol. The comparison measure the performance in

the terms of Packet Delivery Ratio, Network Life Time, System Life Time, End-to-End Delay and Routing Overhead. Random Way point Model used in the mobility and the traffic sources are CBR (continuous bit rate), In this the improvement shown by using the simulator the DSDV gives the good performance. Tripti Pandey, et al.(July 2014) [12] in this paper the analyzing the performance of AODV using Travelling Salesman Problem by increasing number of nodes as it is known that routing protocols makes an important task for improving QoS in Mobile Ad hoc Network. The QoS can measure by using several parameters like throughput, network load etc. The simulation work has been carried out in Network Simulator (ns-2). By using the simulation performance for 50 nodes well; here throughput rises at the initial stage and as the time increases throughput also increases and reaches to maximum, but the packet loss is minimum For future work for other parameters can be considered such as end to end delay, packet delivery ratio and varying simulation time. Ritu Parasher et al. (April 2015) [13] Researcher compared the traditional AODV with AODV routing protocols. These protocols shrink the active path whenever optimal pathway is available and switches the traffic on it. Using NS2 to prove that proposed approach enhance network performance when network size, load or the mobility increases. The simulation results clearly indicate the efficiency and effectiveness of proposed approach over the traditional AODV routing protocol. Suneel Kumar Duvvuri et.al (Aug 2016) [14] in this paper survey the Manet wireless networks has various applications in real life. The Manet wireless network setup without any infrastructure in a short time. There are various faults create the malfunctioning nodes in the network due to transmission. To eliminate the faults to design the fault tolerance routing protocol to gain the highest packet delivery ratio. There are various protocols that are End to End Estimation based Fault Tolerant routing algorithm (E2FT), the performance of these protocols increases the packet delivery probability.Arma Amir Mehdi et.al (Feb 2016) [15] defined Topology-based routing protocols; both proactive (DSDV) and reactive protocols (AODV, DSR) have been considered for the study. The objective of this work is to assess the capability of these protocols in different mobile traffic scenarios. Performance metrics such as packet delivery ratio, throughput, are simulated through Qualnet 5-0 simulator.

### III. AD-HOC ROUTING PROTOCOLS

Routing is an action to move the information from source point to destination point within the network. During this process, at least, one intermediate node within the network is encountered. The routing notion basically involves, two activities: firstly, determining best possible routing paths and secondly, transferring the information throughout a network [16]. Routing basically divided into two types: static routing and dynamic routing. Static routing refers to the routing policy being manual. In static routing maintains a routing table by the administrator. Dynamic routing mainly depends upon the state. Mobile ad hoc network present the dynamic routing The routing protocols are of these categories, which include proactive routing protocols,

reactive routing protocols and hybrid routing protocols with respect to the routing topology used in MANET. The Proactive routing protocols constantly retain the updated state of the network topology and are typically table-driven [6]. As they are on demand routing protocols, so they start route discovery only when they are asked. DSR & AODV are example of these types of routing protocols [7].

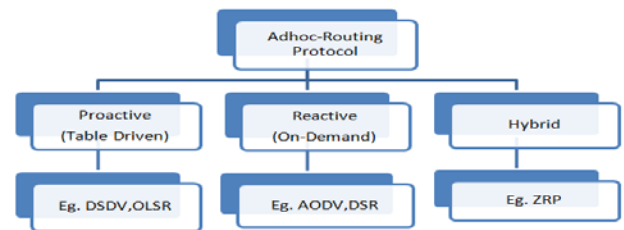


Figure 2. Routing Protocols

In the Adhoc network routing the delivery of data packets from the source to destination they based on the classification of MANET routing protocols which are as follows:

- a) *Unicast Routing Protocols* The routing protocols that have two nodes both nodes are in the range of each other and simply communicate with each other.
- b) *Multicast Routing Protocols* Multicast is the delivery of information between the one or more nodes simultaneously. If we have a three nodes first two nodes are in the range of each other but the third node are not in the range of each other. When first node wants to communicate with node third the first node will send data to second then after forward to the third node [2].

#### A. Proactive Routing Protocol

Routing protocols constantly retain the updated state of the network topology by creating a routing table and having the routing information before it is needed. Therefore they are also called as Table Driven protocols. All the nodes present in the network creates & maintains routing information to every other node in the network which is kept in the routing tables and is updated periodically as the network topology changes [8]. This table is updated all the time and it gives the proactive protocols another name of table-driven. One or more routing tables are maintained at each node and are exchanged frequently to share the topology information with the neighboring nodes in organize to maintain a consistent network [16].

- a) *DSDV (Destination sequenced Distance Vector)* this protocol is planned by Perkins and Bhagwat.DSDV protocol is a proactive routing protocol which follow conventional Bellman-Ford routing algorithm. In this protocol each nodes maintains routing table. This routing information must be periodically updated [11]. If a node invalidates its entry to a destination due to loss of next hop node, it increments its sequence number

and uses new sequence number in its next advertisement of the route. Data broadcast by each mobile computer will contain new sequence number and [12]

- a) Destination IP address
- b) Number of hops required to reach the destination.
- c) Sequence number of the information received regarding that destination [14].

Periodic transmissions of updates of the routing tables help maintaining the topology information of the network. If there is any new significant change for the routing information, the updates are transmitted immediately. So, the routing information updates might either be periodic or event driven. The routing updates could be sent in two ways: one is called a “full dump” and another is “incremental.” In case of full dump, the entire routing table is sent to the neighbours, where as in case of incremental update only the entries that require changes are sent [7].

*Advantages*

- Simple (almost like Distance Vector)
- Loop free through destination seq. numbers
- No latency caused by route discovery

*Disadvantages*

- No sleeping nodes
- Overhead: most routing information never used

*B. Reactive Routing Protocol*

The reactive protocols are also known as source-initiated on-demand routing protocols. They do not have any procedure for creating & updating routing tables with routing information at regular intervals. They finding the suitable route to the destination and establishing the connection in order to transmit and receive the packet [8].

- a) *On demand distance vector routing protocol (AODV)* it is a routing protocol for mobile ad hoc networks and other wireless ad-hoc networks it is a reactive routing protocol, meaning that it establishes a route to a destination only on demand. In AODV route request, route reply and route error are the control messages. When source node wants to establish route to the destination nodes, source node first route request control packets to their adjacent nodes [8].

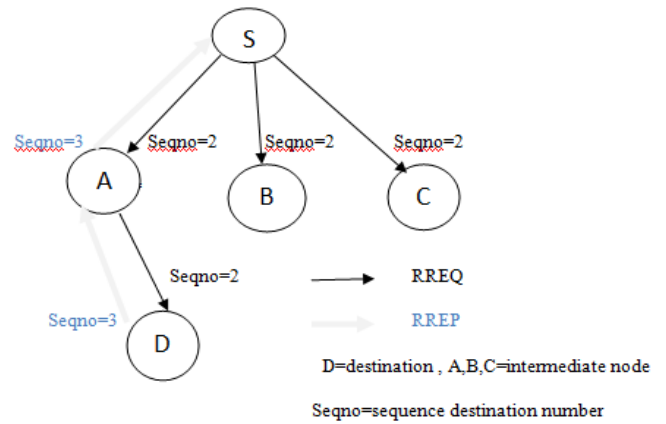


Figure 3: AODV protocol

AODV routing protocol uses the distance vector routing this requires every node in the route to maintain a routing table for the duration of the communication of nodes. AODV has improved upon the DSR route request process using an expanding ring search mechanism based upon incrementing time-to-live (TTL) to prevent the RREQ flooding [2]. Nodes within an active route record the senders address, sequence numbers and source destination IP address within their routing tables, this information is used by route reply (RREP) to construct reverse paths [11]. AODV deals with node mobility using sequence numbers to identify and discard outdated routes, this is combined with route error (RERR) messages which are sent when broken links are detected, RERR packets travel upstream to the source informing nodes to delete the broken links and trigger new route discovery if alternative routes are not available [4].

*Advantages*

- Eliminate periodic updates
- Adaptive to network dynamics

*Disadvantages*

- High flood-search overhead with
- Mobility, distributed traffic
- High route acquisition latency

- b) *DSR Protocol* The DSR Protocol is the reactive type of protocol in which the path from the source to destination is selected when required. The Source node floods the route request packets in the network. The intermediate nodes, which are having route to the destination, will respond with the route reply packets. When the source node starts broadcasting the route request packets, the header of the route request packet is empty .The header of the route request packet starts populating [8].



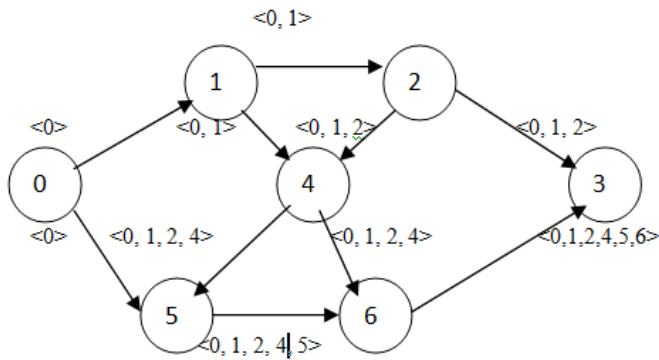


Figure 4: Route Request Flooding

As illustrated in the figure g, the source node A floods the network with route request packets. Every node adds its ID in the packet header until it reaches to the destination.

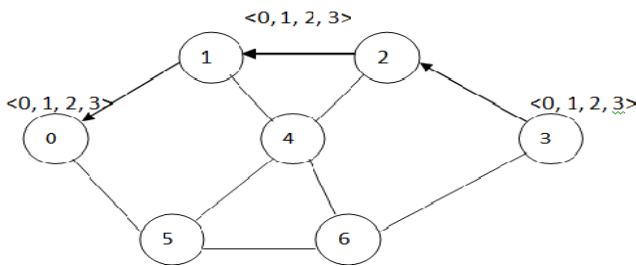


Figure 5: Route Selected between Source and destination

As illustrated in figure f, the route is established between the source and destination. The route has been selected on the basis of hop count and sequence number. The route with the minimum hop count and higher sequence number is selected as the best route. Once the optimal route has been selected, the confirmation packet is unicast via this route only.

### C. Hybrid Routing Protocol

These types of protocols make use of the strengths of both the previously discussed protocols by combining them together to obtain better results. In the initial stage routing is done with some proactively prospected routes and then ormation serves the demand from additionally activated nodes through reactive flooding [4]. Firstly it performs like proactive routing protocol because in initial nodes have tables. Then whenever nodes find that they do not have routes to target, they start route discovery and behave like reactive routing protocols [15].

- a) *ZRP Hybrid Routing Protocol* Zone Routing. Zone invented by Pearlman. Zone Routing Protocol (ZRP) is a hybrid protocol which combines the advantages of both proactive and reactive routing protocols. ZRP routing protocols consists of different modules such as: Intrazone routing protocol, Interzone routing protocols [4]. It includes the qualities of on-demand and proactive routing class. Within every zone, proactive Networks which restricts the nodes into sub-networks (zones). It incorporates the qualities of on-demand and

proactive routing protocols. Within each zone, proactive routing class is modified to speed up communication surrounded by neighbors. ZRP defines each node a zone around itself containing all neighbor nodes with certain k hop (k=1, 2 or 3). If the destination node location is within the zone of the source then it uses proactive routing else it uses reactive routing protocol.

- a) *Intrazone routing protocol*: - This protocol is adopted from the proactive routing protocols that is used to support only the local topology. This protocol works in the within the specified zone only.
- b) *Interzone routing protocol*: This protocol is adopted from the reactive protocol which is used when the route between the different zones is needed for the communication in between the source and destination [2].

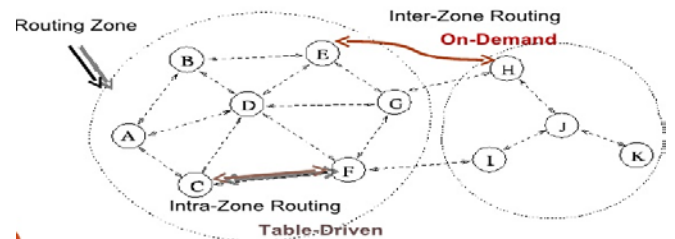


Figure 6: ZRP routing protocol

## IV. CONCLUSION

In this paper, we basically focused on three different approaches of MANETS routing protocols and their examples: Reactive (AODV, DSR), Proactive (DSDV), Hybrid (ZRP) routing protocols. We have review the various papers related to this work and conclude that it is critical issue to select an efficient and reliable path establishment between sources to destination. In this paper, we discuss MANET and its characteristics, challenges, application for adhoc routing protocol. This paper throws a light on different concepts of MANETS that can help researchers to the maximum. It has the intrinsic flexibility, lack of infrastructure, ease of deployment applications make it an essential part of future pervasive computing environments. If we implement proposed technique in future the result may be better.

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