

A Review: Comparative Study of Routing Protocols for Adhoc Networks

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Abstract: A mobile ad hoc network (MANET) is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure. Every node in MANET moves arbitrarily making the multi-hop network topology to change randomly at uncertain times. There are several familiar routing protocols like AODV, DSR, DSDV etc. which have been proposed for providing communication among all the nodes in the wireless network. In this paper, we have presented a review of these routing protocols and analyze them through various protocol properties. Also a comparison between routing protocols like AODV, DSR and DSDV is presented.

Keywords: MANET; AODV; DSDV; DSR

I. INTRODUCTION

The fast growth of mobile communication in recent years is especially observed in the field of mobile system, wireless local area network, and ubiquitous computing. The rapid growth in the mobile communication is mainly due to the mobility offered to end users, providing information access to anywhere, easy deployment, and user friendliness. The set of mobile terminals that are placed in a close location communicating with each other, sharing services, resources or computing time during a limited period of time and in a limited space forms Spontaneous ad hoc networks. Network management should be transparent to the user. These types of networks have independent centralized administration; user can enter the networks and leave the networks easily.

A mobile ad-hoc network is a kind of wireless ad-hoc network, and is a self-configuring network of mobile routers connected by wireless links - the union of which form an arbitrary topology [1][2]. The routers are free to move randomly and organize themselves arbitrarily thus, the network's wireless topology may change rapidly and unpredictably [3]. Routing is the process of moving a data packet from source to destination. Routing is usually performed by a dedicated device called a router. Part of this process involves analyzing a routing table to determine the best path.

One of the important research areas in MANET is establishing and maintaining the ad hoc network through the use of routing protocols. However there are so many routing protocols present, this paper mainly focuses some of the routing protocols i.e. AODV, DSR and DSDV due to its familiarity among all other routing protocols. The rest of this paper is organized as follows. Section II briefly discusses the MANET routing protocols classification and the functionality of the three familiar routing protocols DSDV [4], AODV [5-6] and DSR [7]. Section III describes the comparative analysis of approaches using various protocol properties i.e. Loop Free, QoS Support, Distributed, Multicast Routes and Demand based Operations etc. Finally, Section IV concludes the paper and discusses the future scope of work.

II. MOBILE ADHOC NETWORK ROUTING PROTOCOLS

Protocol Classifications

The classification of MANET routing protocols are shown below (Figure 1), depending on how the protocols handle the packet to deliver from source to destination [8]. Due to their functionality of Routing protocols are broadly classified into three types such as Reactive, Proactive and Hybrid protocols.

Proactive Protocols

These types of protocols are called table driven routing protocols in which, all the route information is maintained in routing table. The Packets are transferred over the network in the manner of specified and predefined route in the routing table. In this method, the packet forwarding is done faster but the routing overhead is greater because all the routes have to be defined before transmitting the data and control packets. Table-driven protocols have lower intermission because all the routes are maintained at all the times. Example protocols: DSDV, OLSR (Optimized Link State Routing).

Reactive Protocols

This network maintains only the routes that are currently in use, so reducing the burden on the network when only a few of all available routes is in use at any time. These types of protocols are also called as On Demand Routing Protocols where the routes are not before defined for routing. A Source node calls for the route discovery phase to determine a new route whenever a transmission is necessary.

This route discovery mechanism is based on flooding algorithm which employs on the technique that a node just broadcasts the packet to all of its neighbours and intermediate nodes just forward that packet to nearby nodes. On-demand techniques have smaller routing overheads. Example protocols: AODV, DSR.

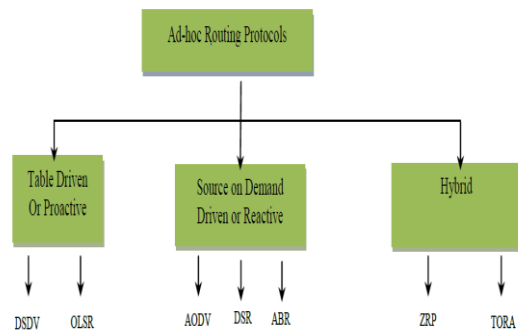


Figure 1. Classification of MANETs Routing Protocols [8]

Hybrid Protocols

The Hybrid protocols are the combinations of reactive and proactive protocols and takes advantages of these two protocols and as a result, routes are found quickly in the routing zone. Example Protocol: ZRP (Zone Routing Protocol).

Now, a short overview of the routing operations performed by the well-known protocols DSDV, AODV and DSR are discussed.

A. Destination-Sequenced Distance-Vector (DSDV) Protocol

DSDV is a table driven routing scheme for ad-hoc mobile networks based on the Bellman-ford algorithm. The improvement made to the Bellman-Ford algorithm includes freedom from loops in routing table by using sequence numbers[4]. Each node acts as a router where a routing table is maintained and periodic routing updates are transfer, even if the routes are not necessary. A sequence number is associated with each route or path to the destination to prevent routing loops. The Routing updates are exchanged even if the network is idle which uses up battery and network bandwidth. So, it is not preferable for highly dynamic networks.

B. Ad hoc On-Demand Distance Vector Routing (AODV)

The Ad hoc On Demand Distance Vector routing algorithm is a routing protocol designed for ad hoc mobile networks [5][6]. It makes routes using a route request / route reply query cycle. When a source node wants a route to a destination for which it does not already have a route, it broadcasts a route request (RREQ) packet across the network.

Nodes receiving this data packet update their information for the source node and set up backwards pointers to the source node in the routing tables. A node receiving the RREQ may send a route reply (RREP) if it is either the destination or if it has number more than or equal to that contained in the RREQ [5]. It uses sequence numbers to ensure the freshness of routes. It is loop-free, self-starting, and scales to large numbers of mobile nodes [5]. Figure 2(a) and 2(b) shows the example of sending RREQ packet and RREP Packet.

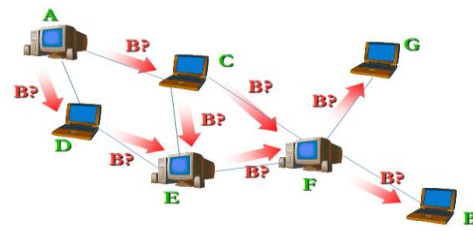


Figure 2 (a): RREQ Message[5]

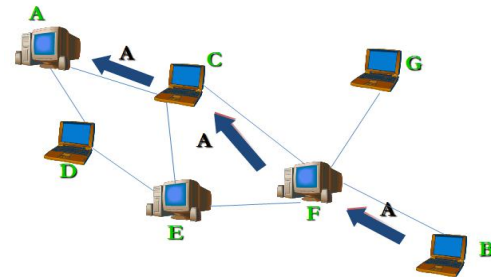


Figure 2 (b): RREP Message[5]

C. Dynamic Source Routing (DSR)

Dynamic Source Routing is a Pure On-Demand routing protocol, where the route is calculated only when it is necessary. It is designed for use in multi hop ad hoc networks of mobile nodes. It has only two major processes which are Route Discovery and Route Maintenance [7]. The key property of Dynamic source routing is the use of source routing instead of relying on the routing table at each intermediate device . Each node receiving a route request packets, rebroadcasts it, unless it is the destination or it has a route to the destination in its route cache. Such a node replies to the RREQ with a route reply (RREP) packet that is routed back to the original source node. RREQ and RREP packets are also source routed. DSR allows the network to be self-organized and self-configured without any central administration and network setup. It uses no periodic routing messages like AODV, thus reduces bandwidth overhead and conserved battery power and also huge routing updates. It needs only the effort from the MAC layer to identify link failure's uses source routing where the whole route is carried as an overhead. In DSR, the whole route is carried with the message as an overhead, whereas in AODV, the routing table is maintained thus it is not required to send the whole route with the message during the Route Discovery process.

III. COMPARATIVE ANALYSIS OF PROTOCOLS

In this section, we have analyzed the various routing protocols through various protocol properties i.e. Loop Free, Distributed, Multicast Routes, QoS Support, Periodic Broadcast, Demand based Operation etc. These properties are defined as:

(a) Loop Free: To improve the overall performance, we want the routing protocol to guarantee that the routes supplied are loop-free. This avoids any waste of bandwidth or CPU consumption.

(b) Distributed: The protocol should of course be distributed. It should not be dependent on a centralized controlling node. This is the case even for stationary networks. The difference is that nodes in an ad-hoc network can enter/leave the network very easily and because of mobility the network can be partitioned.

(c) Multicast Routes: To reduce the number of reactions to topological changes and congestion multiple routes could be used. If one route has become invalid, it is possible that another stored route could still be valid and thus saving the routing protocol from initiating another route discovery procedure network.

(d) QoS Support: The network should support their Quality of Service by taking care of various network parameters.

(e) Periodic broadcast: means periodically send the activation messages, but it consumes more bandwidth.

(f) Demand based operation: To minimize the control overhead in the network and thus not wasting network resources more than necessary, the protocol should be reactive. This means that the protocol should only react when needed and that the protocol should not periodically broadcast control information.

AODV is an On Demand routing protocol which is confluence of DSDV and DSR. Route is calculated on demand, just as it is in DSR via route discovery process.

On the other hand, AODV maintains a routing table where it maintains one entry per destination unlike the DSR that maintains multiple route cache entries for each target. AODV provides loop free routes while repairing link breakages but, DSDV doesn't require global periodic routing advertisements. AODV minimizes the bandwidth consumption instead of DSDV because only those nodes periodically update their routing tables that are used in data flow, but in DSDV the nodes update the routing table regularly.

TABLE I. Comparative Routing Properties Analysis of Protocols

S.No	Protocol Property	AODV	DSR	DSDV
1.	Loop Free	Yes	Yes	Yes
2.	Distributed	Yes	Yes	Yes
3.	Multicast Routes	No	No	Yes
4.	QoS Support	Yes	Yes	Yes
5.	Periodic Broadcast	Yes(comparatively less as in DSDV)	No	Yes
6.	Demand based Operation	Yes	Yes	No
7.	Route Maintained in	Route Table	Route Cache	Route Table

Table 1 show below the comparison between Dynamic Source Routing (DSR), Ad Hoc On-Demand Distance Vector Routing (AODV), and Destination-Sequenced Distance-Vector Routing (DSDV).

V. CONCLUSION

In this paper we have discussed various routing protocols for Mobile Ad-hoc Networks. The AODV and DSR are Reactive Routing Protocols ie. it establish the Route on demand. But in DSDV, each node maintains routing information for all destinations. And it regularly update their routing tables, so consumes more bandwidth as compared to AODV. Further we have analyzed the Routing Properties of protocols i.e Loop Free, Distributed, Multicast Routes, QoS Support, Periodic Broadcast, Demand based Operation. In future, practical implementation of these protocols for Ad-hoc network is to be analyzed for accurate and absolute results.

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