

A Survey on Location Based Routing Protocols in Mobile Ad-hoc Networks

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Abstract- Mobile Ad-hoc networks (MANET) is a collection of wireless mobile nodes forming a temporary network without using any centralized access point, infrastructure, or centralized administration. Till now wireless networking community designed hundreds of new routing protocols targeting the various scenarios of this design space. The paper present taxonomy of the mobile ad-hoc routing protocols and survey of location based routing protocols.

Keywords: MANET, Location Aided routing

1. INTRODUCTION

Mobile Ad-hoc network is the infrastructure –less networking. Mobile nodes in MANET communicate with each other by sharing the limited radio channel in peer to peer fashion. In order to provide communication throughout the network, the mobile nodes must cooperate to handle network functions, such as packet routing. One of the major technological challenges of Mobile Ad-hoc networks is that they require new types of routing protocols. As opposed to the wired infrastructure, because in ad hoc networks there are no dedicated router nodes: so the task of routing needs to be performed by the user nodes, which can be mobile, unreliable and have limited battery power and other resources .The aim of this paper is to survey the location based routing protocols .As early ad hoc routing protocols have been classified into on topology based routing protocols and location based routing protocols.

The rest of this paper is organized as follows: Section 2 introduces categories of routing protocols, Section 3 describes location based routing protocols and Section 4 has conclusion.

2. CATEGORIES OF ROUTING PROTOCOLS

The routing protocols are divided following categories based on their underlying architectural framework as follows:

(i) *Topology-Based Routing Protocols*

A. *Source-initiated (Reactive or On-demand)*

These types of protocols create route only when the source requests a route to a destination .They create a route through a route discovery procedure. In which route request packets are flooded throughout the network starting with the immediate neighbors of the source. Once a route is formed or multiple routes are found for the destination, the route discovery process comes to an end .A route maintenance procedure maintains the continuity of the route for the time

span it is needed from the source. Some of the examples of the source- initiated routing protocols are [3, 4] DSR, AODV, and TORA etc.

B. *Table-driven(Proactive)*

These types of routing protocols always maintain up-to-date information on routes from each node to every other node, means that a source node to every possible node in the network. Routing information is stored in the routing table of each mobile node and route update packets are propagated throughout the network to keep the routing information as update as possible. All protocols have the common goal of reducing route maintenance overhead as much as possible. Some of the examples of Table driven routing protocols are [2, 8, 22] DSDV, OLSR, and FSR etc.

C. *Hybrid Protocols*

Hybrid routing protocols are the third category of routing protocols in the MANET that combine the advantages and remedy the shortcomings of both proactive and reactive routing protocols. Generally, these protocols exploit hierarchical network architectures. Proper proactive and reactive routing approaches are utilized in different hierarchical levels, respectively. Some hybrid routing protocols for MANET are Zone [9, 19] Routing Protocol (ZRP), Zone-based Hierarchical Link State routing (ZHLS).

(ii) *Location-aware (Geographical or Position based)*

These types of protocols assume that the individual nodes are aware of the locations of all the nodes within the network .The best and easiest technique is the use of the Global Positioning System (GPS) to determine exact coordinates of these nodes in any geographical location .This location information is then utilized by the routing protocol to determine the routes. Some examples of location aware routing protocols are [, 7, 17, 25] LAR, DREAM, GPSR, and LARDAR etc.

3. LOCATION BASED ROUTING PROTOCOLS

• *Ko and Vaidya [25]* present Location-Aided Routing (LAR) protocol which uses the location information to identify the request zone and expected zone. Request zone in this protocol is the rectangular area including both senders as well as receive. By decreasing the search area, this protocol leads to the decrease in routing overheads.

- *Zaruba, Chaluvadi and Suleman [9]* propose LABAR (Location Area Based Ad-hoc Routing) protocol. It requires only a subset of nodes to know their exact location forming location areas around these nodes. Nodes that are enabled with GPS equipment are referred to as G-nodes. G-nodes are interconnected into a virtual backbone structure to enable efficient exchange of information for the mapping of IP addresses to locations. This protocol is a combination of proactive and reactive protocols, since a virtual backbone structure is used to disseminate and update location information between G-nodes, while user packets are relayed using directional routing towards the direction zone of the destination.
- *S. Basagni et al. [20]* proposes DREAM (A Distance Routing Effect Algorithm for Mobility) which maintains each node's location information in routing tables. Data packet is sent by using this location information. To maintain the location table accurately, each node periodically broadcasts a control packet containing its own coordinates maintain the location table accurately; each node periodically broadcasts a control packet containing its own co-ordinates.
- *Karp and Kung [1]* propose GPSR (Greedy Perimeter Stateless Routing) which uses the location of node to forward the packets on the basis of distance. The packets are forwarded on a greedy basis by selecting the node closest to the destination. This process continues until the destination is reached. In some cases the best path may be through a node which is farther in distance from the destination node. In such scenario right hand rule is applied to forward around the obstacle and resume the greedy forwarding as soon as possible.
- *Tzay and Hsu [24]* presents a location based routing protocol called LARDAR. Firstly, it uses the location information of destination node to predict a smaller triangle or rectangle request zone that covers the position of destination in the past. The smaller route discovery space reduces the traffic of route request and the probability of collision. Secondly, in order to adapt the precision of the estimated request zone, and reduce the searching range, it applied a dynamic adaptation of request zone technique to trigger intermediate nodes using the location information of destination node to redefine a more precise request zone. Finally, an increasing –exclusive search approach is used to redo route discovery by a progressive increasing search angle basis when route discovery failed.
- *Mohammad A. Mikki [17]* introduced an Energy Efficient Location Aided Routing (EELAR) Protocol for MANETs that is based on the Location Aided Routing (LAR). EELAR makes significant reduction in the energy consumption of the mobile nodes batteries by limiting the area of discovering a new route to a smaller zone. Thus, control packet overhead is significantly reduced. In EELAR a reference wireless base station is used and the network's circular area centered at the base station is divided into six equal sub-areas. At route discovery instead of flooding control packets to the whole network area, they are flooded to only the sub-area of the destination mobile node. The base station stores locations of the mobile nodes in a position table.
- *Karim El Defrawy and Gene Tsudik [15]* address some interesting issues arising in suspicious MANETs by designing an anonymous routing framework (ALARM). It uses node's current locations to construct a secure MANET map. Based on the current map, each node can decide which other nodes it wants to communicate with. ALARM takes advantage of some advanced cryptographic primitives to achieve node authentication, data integrity, anonymity and intractability (tracking-resistance). It also offers resistance to certain insider attacks.
- *Haiying Shen and Lianyu Zhao [11]* propose an Anonymous Location-based Efficient Routing protocol (ALERT) to offer high anonymity protection at a low cost. ALERT dynamically partitions the network field into zones and randomly chooses nodes in zones as intermediate relay nodes, which form a non-traceable anonymous route. In addition, it hides the data initiator/receiver among many initiators/receivers to strengthen source and destination anonymity protection. ALERT achieves better route anonymity protection and lower cost compared to other anonymous routing protocols. Also, ALERT achieves comparable routing efficiency to the GPSR geographical routing protocol.
- *Mohammad Al-Rabayah and Robert Malaney [18]* introduce a new hybrid wireless routing protocol specifically designed to address this issue. This protocol combines features of reactive routing with location-based geographic routing, in such a manner so as to efficiently use all the location information available. The protocol is designed to gracefully exit to reactive routing as the location information degrades. Another aspect of this protocol is that it can be spatially dependent – meaning different physical areas of the network can be using quite different routing procedures at the same epoch. This protocol can dramatically increase scalability can be measured via the routing control overhead.
- *Dan Luo and Jipeng Zhou [5]* propose an improved Hybrid Location based routing Protocol approach combines geographic routing with topology based routing protocol. It over comes the major problems of reactive routing and the end-to-end delay is reduced by this algorithm. In addition, the path length performance of geographic routing is also improved. This routing protocol outperforms the pure reactive routing in terms of average delay and packet delivery rate.
- *Lee, Yoo and Kim [12]* propose a mechanism that considers not only the location of nodes but energy consumption to solve the several problems in wireless networks by improving LAR algorithm. This protocol provides efficient routing by minimizing the flooding of unnecessary control message, considering the limited energy of a mobile node and using appropriate transfer power to communicate. Proposed scheme can reduce energy consumption and the average lifetime increases 12 percent than Location Aided Routing Protocol.
- *Shanshan, Yanliang, Yonghe, Mohan [21]* propose LOOP (A Location Based Routing Scheme for Opportunistic Networks), a new location based routing scheme for opportunistic networks. By forwarding messages to specified location instead of a targeted node, LOOP can

serve as the underlying routing protocol for a plethora of pervasive applications. This protocol effectively employs node's movement patterns that are learnt from mobility trace in message forwarding. They evaluate the performance of LOOP and compare with well known protocols including Epidemic, Prophet and Bubble Rap. The Proposed scheme is able to deliver messages at a high ratio, drastically reduce network load and nodes' buffer occupation, especially when more messages are involved in the network.

- *Prakash Raj, Selva Kumar, Lekha [6]* propose protocol LBRP (Location-Based Routing Protocol) for ad hoc networks based on location system. The aim is extracting an optimum topology from the dynamic and irregular topology of a mobile ad hoc network to reach more quickly the destination applying for routing. The scheme operates in a loop free manner.
- *Kim, Young-Song, Hwang [13]* proposes the location-based routing algorithm that is possible to have a stable data transmission with less energy consumption. The proposed technique does not ask for the BS to be aware of locations of nodes and tries to consume balanced distributed energy of all nodes through the Lifecycle of the network. It also operates location-based routing algorithm which transmits location information of node with cluster-based to widen extension and mobility and makes itself possible to apply to the distributed environment network.
- *Haidar Safa, Hassan Artail and Diana Tabet [10]* propose a novel cluster based trust-aware routing protocol (CBTRP) for MANETs to protect forwarded packets from intermediary malicious nodes. The proposed protocol organizes the network into one-hop disjoint clusters then elect the most qualified and trustworthy nodes to play the role of cluster-heads that are responsible for handling all the routing activities. The proposed CBTRP continuously ensures the trustworthiness of cluster-heads by replacing them as soon as they become malicious and can dynamically update the packet path to avoid malicious routes.
- *Putthiphong Kirdpipat and Sakchai Thipchaksurat [23]* present the impact of mobility on a scheme called Location-based Routing with Adaptive Request Zone (LoRAREZ). In LoRAREZ, the size of expected zone and request zone is set adaptively based on the distance between the source node and destination node. Proposed protocol evaluates the impact of mobility on the performance of LoRAREZ in terms of packet delivery fraction, routing overhead, end-to-end delay, and throughput and power consumption by comparing with those of the traditional Ad Hoc On-Demand Distance Vector (AODV) and Modified Ad Hoc On-Demand Distance Vector (MAODV).
- *Juanfei Shi and Kai Liu [14]* propose PLCR (A power-efficient location-based cooperative routing algorithm) to reduce the overall power for routing in wireless networks. With theoretical analysis, by means of a cooperative relay, the probability of successful packet reception can be increased, and the overall power for routing can be reduced, given the outage probability of the link constrained at a certain target level. PLCR algorithm uses the location information of nodes to select the optimum

next-hop node and cooperative node hop by hop with minimum power so that the cooperative route with minimum overall power from source to destination can be set up. PLCR routing algorithm significantly reduces the overall power in comparing to non-cooperative routing algorithm.

4. CONCLUSION

The paper introduces different categories of ad-hoc routing protocols and reviewed several location based routing protocols. These Location based routing protocols differ with each other in a ways of finding and maintaining the routes b/w source to destination but share the common aim of reducing control packet overhead, maximize throughput, minimize the power consumption and end-to-end delay.

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