

A Survey on Dynamic Source Routing Protocol in Wireless Ad hoc Network

JayashreeAgarkhed

Professor, Department of Computer Science & Engineering,
P.D.A College of Engineering, Kalaburagi, India.

Abstract— *Availability of limited resources and stringent characteristics of MANET, has made designing an efficient and reliable routing strategy a challenging task. The strategy to design a routing protocol should take into consideration, limited resources availability and be adaptive to the variable network conditions such as traffic density, network size and network partitioning. In addition, for certain applications, it is required to satisfy Quality of Service (QoS) as demanded. This paper discusses a reactive routing protocol called Dynamic Source Routing (DSR) protocol and its variants to satisfy different demands of multi-hop wireless ad hoc network applications using mobile nodes.*

Keywords— On Demand Routing, Ad Hoc Network, Dynamic Source Routing, Quality of Service

I. INTRODUCTION

Mobile ad hoc network is characterized as network with dynamic topology due to nodes mobility, limited battery power of nodes and limited channel bandwidth. These stringent features of MANET have made routing in efficient manner as challenging task. The reactive protocol finds the route when demanded and hence reducing the unnecessary control overhead. One of the reactive protocol, DSR lets the networks to be self organized, self-configured, without any existing network infrastructure or administration. Routing in DSR comprised of two mechanisms: Route Discovery which allows nodes to find efficient routes and Route Maintenance which allows the nodes to maintain source routes to arbitrary destinations in the network.

The advantageous feature of DSR protocol is the source routing which avoids keeping up to date routing information in the intermediate nodes on the path to the destination. As DSR finds routes on demand, the routing protocol experiences reduced control overhead by reacting to the changes in the routes currently in use [1].

Authors in [2], have analyzed the effect of the on-demand behavior on the routing protocol's forwarding latency, routing overhead cost, and route caching correctness.

Many of the features of the DSR protocols have been modified and new extensions of DSR protocols are devised to satisfy application demand in MANET.

The structure of the paper is organized as follows. Section II discusses the related work. Section III presents the classification of routing protocols. Section IV explains the

working of basic DSR and its enhancements. Section V concludes the work.

II. RELATED WORK

Extensive literature work has been done on ad hoc network technology and various routing methodologies were discussed in MANET. In [3], authors proposed DSR using multipath techniques in order to reduce the frequency of flooding query and shows that providing all intermediate nodes in the primary or the shortest route with alternative paths has significantly better performance than providing only the source with alternate paths.

In [4], the authors discussed that goal of an ad hoc network routing protocol is to achieve correct and efficient route establishment between a pair of nodes so that messages may be delivered in a timely manner. Route construction should be done with a minimum of overhead and bandwidth consumption. The routing protocols for ad hoc networks are evaluated based on a given set of parameters and provided an overview of eight different protocols by presenting their characteristics and functionality along with their respective merits and demerits.

In [5], authors have evaluated the operation of DSR through detailed simulation on a variety of movement and communication patterns. By the addition of new features to the protocol, such as multicast routing and adaptive Quality of Service (QoS) reservations and resource management helped to create an integrated set of protocols that allow mobile computers, and other applications running on them and communicating with them, to seamlessly make the most efficient use of the best available network connections at any time.

For the design of efficient routing protocols, the basic routing protocols are listed in next section.

III. TYPES OF ROUTING PROTOCOLS

The design of routing protocol is based on the way routing path is been constructed. Some of the protocols may use proactive or reactive method. In Mobile Ad-Hoc Network different types of routing protocols have been discovered. These protocols can be classified into three main categories [4]. They are

- Reactive or on-demand routing protocols,
- Proactive or table-driven routing protocols

- Hybrid routing protocols.

Table driven routing protocols include

- DSDV (Destination Sequenced Distance Vector)
- WRP (Wireless Routing Protocol),
- GSR protocols.

On-demand protocols include

- AODV (Ad-hoc On Demand Routing Protocol),
- DSR (Dynamic Source Routing),
- CBRP
- TORA protocol.

Hybrid routing protocols which based on both pro-active and reactive protocols include

- ZRP (Zone Routing Protocol)

a. Table driven routing protocols

In this protocol each node of the network maintains routing table in which information about their neighbors and hop-counts were mentioned. If any node moves out of the network the routing table gets updated. Routing table at each node helps to discover the shortest route from source to destination. Existing protocols in this category are: DSDV, WRP, GSR.

b. On-demand routing protocols

These are the protocols which find routes from source to destination on-demand. The routing strategy consists of Route discovery and Route maintenance phases. The current route information stored at route cache of each node is maintained for future use. If route failure, an error packet is sent to intimate about the routes which have become now obsolete. Many On-demand routing protocols have been proposed in the literature including DSR, AODV, CBRP, TORA routing protocols.

c. Hybrid routing protocols

It is a combination of reactive & proactive protocols both. ZRP comes under this category. The further study is focused on enhancement to On-demand Dynamic Source Routing protocol.

IV. DSR PROTOCOL AND ITS ENHANCEMENTS

This section has highlights basic DSR and the extension to this basic DSR routing protocol.

A. Dynamic Source Routing (DSR)

The Dynamic Source Routing (DSR) protocol is a pure on demand routing protocol based on source routing.

- Working Principle of DSR:

DSR protocols [1,6] uses source routing technique. The source of a data packet determines the complete sequence of nodes through which to forward the packet. This route is explicitly placed in packet's header. Route discovery

technique used by DSR to builds routes on demand. A source initiates route discovery by flooding the query messages throughout the network to seek a route to the destination. Each of the query messages carries the sequence of hops it passed through network in the message header.

When query packet reaches to the destination, the reply packet is sent back by storing the routing information stored in the query packet. The data packets can later use the whole route to the desired destinations stored in the reply packets. An error packet is sent back to the source on detection of route failure by an unsuccessful message transmission. The error packet deletes all routes stored in the route caches of all intermediate nodes on the path which consists of the failed link. If a route is still required a fresh new route discovery is initiated.

Routing loops are not formed as route is part of packet itself. And can also be easily detected and eliminated.

Advantages:

- i. It maintains multiple route cache entries for each destination
- ii. It does not use periodic routing messages like AODV and reduces bandwidth

Limitations:

- a) Uses source routing where the whole route is carried as an overhead.
- b) It has the highest end-to-end delay and routing load increases the bandwidth and consuming energy

The limitations of existing DSR are overcome by Multipath Source Routing (MSR).

B. Multipath Source Routing (MSR)

MSR routing protocol is based on DSR protocol. The route discovery and maintenance mechanism of DSR is extended by MSR to deal with multipath routing. The load between multiple paths is distributed based on round trip time (RTT). MSR improves TCP and UDP throughput and packet delivery ratio. It also reduces end to end delay with little overhead [8]. MSR has three elements to achieve alternate path. These are path calculation between nodes, efficient packet forwarding on calculated paths and effective end host usage of multiple paths [9]. This protocol achieved improved throughput, less delay and minimized drop rate [10].

C. QoS driven Multipath DSR protocol

This protocol is extension of DSR. In this multipath extension protocol, only a selected set of queries are replied by the destination. The number of alternate routes considered as a selectable parameter of the protocol.

Following is the algorithm given for QoS driven multipath DSR protocol.

Algorithm: QoS driven multipath DSR protocol

Step 1: Multiple copies of the flooded queries message arrive at the destination via different routes.

Step 2: The only queries that carry a source route that is link-wise disjoint from the primary source routes are replied.

Step 3: shortest route between the source and the destination: Primary source route is the route considered by the first query reaching the destination.

Step 3.1: Routes are sorted based on QoS parameter.

Step 4: The primary route is cached by destination, in order to find out later requests to be responded.

Step 5: Only disjoint routes are chosen. The link failure in one route does not affect the other routes.

Step 6: The source keeps all routes received reply packets in its route cache.

Step 7: When the primary route breaks, the shortest alternate route is used.

Step 8: This process continues until all routes fails,

Step 9: If need a fresh route discovery is initiated.

Step 10: End [10].

The multipath extension to DSR reduces the frequency of route discovery is one of the key advantage. Alternate routes in always tend to be longer than the primary routes. This makes the end-to-end delay of data packets longer, presenting a trade-off between end-to-end delay and routing overhead.

D. Performance of Multipath Routing for On-Demand Protocols in Mobile Ad Hoc Network

MPDSR is an extension to DSR. In this source is provided with multiple alternate routes and each intermediate node on the primary route gets an alternate route. The key advantage is the reduction in the frequency of route discovery, which is recognized as a major overhead in on-demand protocols [7].

E. Multiple Source Routing

Multiple Source Routing (MSR) protocol achieves maximize throughput and reduces the overheads in wireless ad hoc networks. MSR builds multiple source routing paths between a source node and a sink node. MSR solves the scalability, privacy and efficiency problems caused by long paths. MSR also ensures the efficiency of request packet propagation in route discovery operation. MSR provides a acceptable level of efficiency. MSR helps utilizes resources of network efficiently and provide significantly throughput with the minimal protocol overheads [13].

V. CONCLUSION

Communication among mobile node is provided using standard routing protocols. The main issue that has to considered is satisfying QoS requirements in order to provide efficient utilization of underlying resources with less delay and reliable transmission. For this design of efficient routing protocol plays an important role. This can be achieved by DSR on demand routing protocol which has been discussed along with routing protocol based on DSR protocol.

REFERENCES

- [1] Wu, Kui, and Janelle Harms. "On-demand multipath routing for mobile ad hoc networks." Proceedings of EPMCC. 2001.
- [2] Johnson, David B., and David A. Maltz. "Dynamic source routing in ad hoc wireless networks." Mobile computing (1996): 153-181.
- [3] Nasipuri, Asis, Robert Castañeda, and Samir R. Das. "Performance of multipath routing for on-demand protocols in mobile ad hoc networks." Mobile Networks and applications 6.4 (2001): 339-349.
- [4] Royer, Elizabeth M., and Chai-Keong Toh. "A review of current routing protocols for ad hoc mobile wireless networks." IEEE personal communications 6.2 (1999): 46-55.
- [5] Johnson, David B., David A. Maltz, and Josh Broch. "DSR: The dynamic source routing protocol for multi-hop wireless ad hoc networks." Ad hoc networking 5 (2001): 139-172.
- [6] Abolhasan, Mehran, Tadeusz Wysocki, and Eryk Dutkiewicz. "A review of routing protocols for mobile ad hoc networks." Ad hoc networks 2.1 (2004): 1-22.
- [7] Broch, Josh. "The Dynamic Source Routing Protocol for Mobile Ad Hoc Networks." IETF Internet-draft (2004).
- [8] Josh Broch, David Johnson, and David Maltz, "The dynamic source routing protocol for mobile ad hoc networks," <http://www.ietf.org/internetdrafts/draft-ietf-manet-dsr-01.txt>, Dec 1998. IETF Internet Dr
- [9] Wang, Lei, et al. "Multipath source routing in wireless ad hoc networks." Electrical and Computer Engineering, 2000 Canadian Conference on. Vol. 1. IEEE, 2000.
- [10] Review of Multipath Routing Protocols in Wireless Multimedia Sensor Network – A Survey
- [11] Agarkhed, Jayashree, Patil Yogita Dattatraya, and Siddarama R. Patil. "Performance Evaluation of QoS-Aware Routing Protocols in Wireless Sensor Networks." Proceedings of the First International Conference on Computational Intelligence and Informatics. Springer Singapore, 2017.
- [12] Unnikrishnan, Pillai. "Introduction and Analysis of DSR protocol." (2004).
- [13] Tang, Su-Kit, and Dongyang Long. "Ad Hoc Multiple Source Routing." Trends in Communication Technologies and Engineering Science. Springer Netherlands, 2009. 29-39.