

July 2012

MINIMIZATION OF DATA REPLICA IN MOBILE ADHOC NETWORK ROUTING

M. K. NAGESWARI

Dept of CSE, Madanapalle Institute of Technology and Science, Madanapalle.,
nageswarimk816@gmail.com

Follow this and additional works at: <https://www.interscience.in/ijssan>



Part of the [Digital Communications and Networking Commons](#), and the [Electrical and Computer Engineering Commons](#)

Recommended Citation

NAGESWARI, M. K. (2012) "MINIMIZATION OF DATA REPLICA IN MOBILE ADHOC NETWORK ROUTING," *International Journal of Smart Sensor and Adhoc Network*: Vol. 2 : Iss. 4 , Article 6.

DOI: 10.47893/IJSSAN.2013.1174

Available at: <https://www.interscience.in/ijssan/vol2/iss4/6>

This Article is brought to you for free and open access by the Interscience Journals at Interscience Research Network. It has been accepted for inclusion in International Journal of Smart Sensor and Adhoc Network by an authorized editor of Interscience Research Network. For more information, please contact sritampatnaik@gmail.com.

MINIMIZATION OF DATA REPLICA IN MOBILE ADHOC NETWORK ROUTING

M. K. NAGESWARI¹ & M. V. JAGANNATHA REDDY²

^{1,2}Dept of CSE, Madanapalle Institute of Technology and Science, Madanapalle.
E-mail : nageswarimk816@gmail.com

Abstract- Adhoc networks have characteristics such as flexibility ,easy deployment,robustness which makes them an interesting technology for various applications.Adhocnetworks are considered as the most promising terminal networks in future mobile communications.A novel Position based Opportunistic Routing protocol, in which several forwarding candidates cache the packet that has been received using MAC interception. If the best forwarder does not forward the packet in certain time slots, suboptimal candidates will take turn to forward the packet according to a locally formed order. In this way, all candidates receives the packet, the data transmission will not be interrupted. Potential multi-paths are exploited on-the-fly on a per-packet basis. We propose minimization of data replica at forwarding candidates in Mobile Adhoc network routing.The forwarding candidates will be ranking ,based on the location variance of candidate within the time factor has given to it.

General Terms- This paper exposes the minimization of data replica in MANETS routing.

Keywords - *Opportunistic routing, geographic routing,greedy forwarding,moile adhoc network.*

I. INTRODUCTION

Adhoc network is a dynamoc multihop wireless network that is established bya set of mobile nodes on a shared wireless channel.Each mobile host performs local broadcasts in order to identify its existence to the surrounding hosts.Sorrounding hostsare nodes that are in close proximity to the transmitting host.In that way each mobile hosts becomes potentially a router and it is possible to dynamically esablish routes between itself and nodes to which a route exists .Adhoc networks wre initially proposed for military applications such as battlefield communications and Emergency application, i.e. emergency rescue operations, police, earthquakes.

The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic.MANETs are a kind of wireless adhoc networks that usually has a routable networking environment on top of a link layer ad hoc network. The growth of laptop and 802.11/Wi-Fi wireless networking have made MANETs a popular research topic since the mid 1990s. Many academic papers evaluate protocols and their abilities, assuming varying degrees of mobility within a bounded space, usually with all nodes within a few hops of each other. Different protocols are then evaluated based on measure such as the packet drop rate, the overhead introduced by the routing protocol, end-to-end packet delays, network throughput etc.

Traditional topology based MANET routing protocols such as AODV,DSR,DSDV etc are the susceptible to node mobility.one of the main reason is due to the predetermination of an end-to-end route

before data transmission .Fast changing network topology ,it is very difficult to maintain determinstic route.once the path breaks data packets will get lost or be delayed for a long time untill the reconstructoon of the route,causing transmission interruption.

Geographic routing (also called georouting or position-based routing) is a routing principle that relies on geographic position information. It is mainly proposed for wireless networks and based on the idea that the source sends a message to the geographic location of the destination instead of using the network address. The idea of using position information for routing was first proposed in the 1980s in the area of packet radio networks and interconnection networks. Geographic routing requires that each node can determine its own location and that the source is aware of the location of the destination. With this information a message can be routed to the destination without knowledge of the network topology or a prior route discovery.

There are various approaches, such as single-path, multi-path and flooding-based strategies.Most single-path strategies rely on two techniques: greedy forwarding and face routing. Greedy forwarding tries to bring the message closer to the destination in each step using only local information. Thus, each node forwards the message to the neighbor that is most suitable from a local point of view.

The opportunistic forwarding, which was proposed to increase the network throughput, also shows its great power in enhancing the reliability of data delivery. a novel Position based Opportunistic Routing protocol

in which several forwarding candidates cache the packet that has been received using MAC interception. If the best forwarder does not forward the packet in certain time slots, suboptimal candidates will take turn to forward the packet according to a locally formed order. In this way, as long as one of the candidates succeeds in receiving and forwarding the packet, the data transmission will not be interrupted. Potential multi-paths are exploited on the-fly on a per-packet basis, leading to POR's excellent. A position based opportunistic routing mechanism which can be deployed without complex modification to MAC protocol and achieve multiple reception without losing the benefit of collision avoidance provided by 802.11. The concept of in-the-air backup significantly enhances the robustness of the routing protocol and reduces the latency and duplicate forwarding caused by local route repair. POR which takes advantage of the stateless property of geographic routing and the broadcast nature of wireless medium.

This work focuses on minimization of data replica at forwarding candidates based on the displacement of nodes. So data will be delivered to only few candidates by using the time factor, cumulative variance, ratings.

II. RELATED WORK

2.1 Destination-Sequenced Distance-Vector Routing Protocol:

The Destination-Sequenced Distance-Vector (DSDV) Routing Algorithm is based on the idea of the classical Bellman-Ford Routing Algorithm with certain improvements. Every mobile station maintains a routing table that lists all available destinations, the number of hops to reach the destination and the sequence number assigned by the destination node. The sequence number is used to distinguish stale routes from new ones and thus avoid the formation of loops.

2.2 Ad hoc On-demand Distance Vector Routing:

Ad hoc On-demand Distance Vector Routing (AODV) is an improvement on the DSDV algorithm. AODV minimizes the number of broadcasts by creating routes on-demand as opposed to DSDV that maintains the list of all the routes. To find a path to the destination, the source broadcasts a route request packet. The neighbors in turn broadcast the packet to their neighbors till it reaches an intermediate node that has a recent route information about the destination or till it reaches the destination. A node discards a route request packet that it has already seen. The route request packet uses sequence numbers to ensure that the routes are loop free and to make sure that if the intermediate nodes reply to route requests, they reply with the latest information only. When a node forwards a route request packet to its

neighbors, it also records in its tables the node from which the first copy of the request came. This information is used to construct the reverse path for the route reply packet. AODV uses only symmetric links because the route reply packet follows the reverse path of route request packet. As the route reply packet traverses back to the source, the nodes along the path enter the forward route into their tables. If the source moves then it can reinitiate route discovery to the destination.

2.3 Dynamic Source Routing Protocol:

The Dynamic Source Routing Protocol is a source-routed on-demand routing protocol. A node maintains route caches containing the source routes that it is aware of. The node updates entries in the route cache as and when it learns about new routes. The two major phases of the protocol are: route discovery and route maintenance. When the source node wants to send a packet to a destination, it looks up its route cache to determine if it already contains a route to the destination. If it finds that an unexpired route to the destination exists, then it uses this route to send the packet. But if the node does not have such a route, then it initiates the route discovery process by broadcasting a route request packet. The route request packet contains the address of the source and the destination, and a unique identification number. Each intermediate node checks whether it knows of a route to the destination. If it does not, it appends its address to the route record of the packet and forwards the packet to its neighbors. To limit the number of route requests propagated, a node processes the route request packet only if it has not already seen the packet and its address is not present in the route record of the packet. A route reply is generated when either the destination or an intermediate node with current information about the destination receives the route request packet. A route request packet reaching such a node already contains, in its route record, the sequence of hops taken from the source to this node.

2.4 Position based opportunistic routing protocol:

A novel Position based Opportunistic Routing protocol (POR) is proposed, in which several forwarding candidates cache the packet that has been received using MAC interception. If the best forwarder does not forward the packet in certain time slots, suboptimal candidates will take turn to forward the packet according to a locally formed order. In this way, as long as one of the candidates succeeds in receiving and forwarding the packet, the data transmission will not be interrupted. Potential multi-paths are exploited on the-fly on a per-packet basis, leading to POR's excellent robustness.

Opportunistic Forwarding in Multi-Rate and Multi-Hop Wireless Networks

MULTI-HOP wireless networks have attracted a lot of research interest in recent years since they can be

easily deployed at low cost without relying on the existing infrastructure. Routing in such networks is very challenging mainly due to variable and unreliable wireless channel conditions. Traditional routing schemes for multi-hop wireless networks have followed the concept of routing in wired networks by abstracting the wireless links as wired links, and finding the shortest path between a source and destination. However, the traditional shortest path approach is not ideal for wireless environment, because fluctuations in the quality of any link along the predetermined path can cause excessive retransmissions at the link layer or reroutings at the network layer, thus consume precious network resources, such as bandwidth and energy. Recently, a new routing paradigm, known as opportunistic routing, was proposed to mitigate the impact of link quality variations by exploiting the broadcast nature of the wireless medium and the spatial diversity of network topology.

The general idea behind these schemes is that, for each destination, a set of next-hop forwarding candidates are selected at the network layer and one of them is chosen as the actual relay at the MAC layer on a per-packet basis according to its availability and reachability after the transmission. As more forwarding candidates are involved in helping relay the packet, the probability of at least one forwarding candidate having correctly received the packet increases, which results in higher forwarding reliability and lower retransmission cost. Some variants of opportunistic routing schemes use nodes' location information to define the forwarding candidate set and prioritize candidates.

In this paper, we mainly focus on this kind of opportunistic routing by assuming that nodes' location information are available. Two important issues in opportunistic routing are candidate selection and relay priority assignment. The existing works on opportunistic routing typically address these issues in the network with a single channel rate.

Position-Based Routing in Mobile AdHoc Networks

These *ad hoc networks*, as they are commonly called, consist of autonomous nodes that collaborate in order to transport information. Usually, these nodes act as end systems and routers at the same time. Ad hoc networks can be subdivided into two classes: *static* and *mobile*. In static ad hoc networks the position of a node may not change once it has become part of the network. Typical examples are rooftop networks. For the remainder of this work we will solely focus on mobile ad hoc networks.

In mobile ad hoc networks, systems may move arbitrarily. Examples where mobile ad hoc networks may be employed are the establishment of connectivity among handheld devices or between

vehicles. Since mobile ad hoc networks change their topology frequently and without prior notice, routing in such networks is a challenging task. We distinguish two different approaches: *topology-based* and *position-based* routing. Topology-based routing protocols use the information about the links that exist in the network to perform packet forwarding.

They can be further divided into *proactive*, *reactive*, and *hybrid* approaches. Proactive algorithms employ classical routing strategies such as distance-vector routing (e.g., DSDV) or link-state routing. They maintain routing information about the available paths in the network even if these paths are not currently used.

The main drawback of these approaches is that the maintenance of unused paths may occupy a significant part of the available bandwidth if the topology of the network changes frequently. In response to this observation, reactive routing protocols were developed. Reactive routing protocols maintain only the routes that are currently in use, thereby reducing the burden on the network when only a small subset of all available routes is in use at any time.

III. PROPOSED WORK

3.1 Minimization of data replica in MANET Routing:

In existing routing protocol, source forwards data to all forwarding candidates within its forwarding area based on the conditions. It unnecessarily sends data to forwarding candidates that are not stable. We are proposing a pruning strategy to minimize data replica at forwarding candidates. A time limit will be given for forwarding candidates, during this time period location variance will be observed for each forwarding candidate. The forwarding candidates will be assigned with a rating.

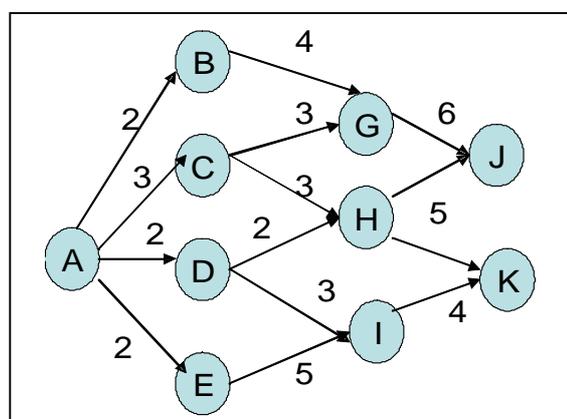


Figure 1. selection of few forwarding candidates Pruning Strategy based on displacement of nodes

TABLE 1

Time	Forwarding candidates
------	-----------------------

(in units)	B		C		D		E	
	d	v	d	v	d	v	d	v
1	2		3		2		2	
2	2	0	4	1	4	2	2	0
3	4	2	5	1	2	2	2	0
Cumulative variance	2		2		4		0	
Rating	3		2		4		1	

Candidate selects the next forwarding candidate based on the rating to forward the packet.

One of the key problems in POR is the selection and prioritization of forwarding candidates. Only the nodes located in the forwarding area [14] would get the chance to be backup nodes. The forwarding area is determined by the sender and the next hop node. A node located in the forwarding area, satisfies the following two conditions: i) it makes positive progress towards the destination; ii) its distance to the next hop node should not exceed half of the transmission range of a wireless node (i.e. $R/2$) so that ideally all the forwarding candidates can hear from one another. In Fig. 1, the area enclosed by the bold curve is defined as the forwarding area. The nodes in this area, besides node A (i.e. node B, C), are potential candidates. According to the required number of backup nodes, some (maybe all) of them will be selected as forwarding candidates. The priority of a forwarding candidate is decided by its distance to the destination. The nearer it is to the destination, the higher priority it will get. When a node sends or forwards a packet, it selects the next hop forwarder as well as the forwarding candidates among its neighbors. The next hop and the candidate list comprise the forwarder list.

Algorithm 1 shows the procedure to select and prioritize the forwarder list. The candidate list will be attached to the packet header and updated hop by hop. Only the nodes specified in the candidate list will act as forwarding candidates. The lower the index of the node in the candidate list, the higher priority it has. Every node maintains a forwarding table for the packets of each flow (identified as source-destination pair) that it has sent or forwarded. Before calculating a new forwarder list, it looks up the forwarding table, an example is illustrated in Table 1, to check if a valid item for that destination is still available. The forwarding table is constructed during data packet transmissions and its maintenance is much easier than a routing table. It can be seen as a tradeoff between efficiency and scalability. As the establishment of the forwarding table only depends on local information, it takes much less time to be constructed. Therefore we can set an expire time on the items maintained to keep the table relatively small. In other words, the table records only the

current active flows, while in conventional protocols, a decrease in the route expire time would require far more resources to rebuild.

Forwarding candidate table

Source , destination	next hop	Candidate list
N1,N11	N4	N5,N6
N2,N12	N7	N8,N9

.....

IV. SIMULATION SETUP

To evaluate the performance, we simulate the Algorithm in a variety of mobile network topologies in NS-2 [19] and compare it with AOMDV [20] (a famous multipath routing protocol) and GPSR [5] (a representative geographic routing protocol).

The improved random way point (RWP) [21] without pausing is used to model nodes' mobility. The minimum node speed is set to 1 m/s and we vary the maximum speed to change the mobility degree of the network. The following metrics are used for performance comparison:

- *Packet delivery ratio.* The ratio of the number of data packets received at the destination(s) to the number of data packets sent by the source(s).
- *End-to-end delay.* The average and the median end-to-end delay are evaluated, together with the cumulative distribution function (CDF) of the delay.
- *Path length.* The average end-to-end path length (number of hops) for successful packet delivery.
- *Packet forwarding times per hop (FTH).* The average number of times a packet is being forwarded from the perspective of routing layer to deliver a data packet over each hop.
- *Packet forwarding times per packet (FTP).* The average number of times a packet is being forwarded from the perspective of routing layer to deliver a data packet from the source to the destination.

V. RESULTS AND ANALYSIS

5.1 Memory Consumption & Duplicate Relaying

One main concern of POR is its overhead due to opportunistic forwarding, as several copies of a packet need to be cached in forwarding candidates. However, it will be presented need to be cached in the forwarding candidates, leading to more memory consumption, and duplicate relaying would possibly happen if the suppression scheme fails due to node mobility. In our analysis, we only consider the effect of node mobility as stated at the very beginning of this section. Then we look into the overhead due to duplicate relaying.

Duplicate relaying will be minimized by giving the time factor and observing the location variance of forwarding candidates. Based on the ranking only limited candidates will receive the packets.

VI. CONCLUSION

In this paper, we address the problem of duplicate relaying in dynamic mobile ad hoc networks.

Constantly changing network topology makes conventional ad hoc routing protocols incapable of providing satisfactory performance. In the face of frequent link break due to node mobility, substantial data packets would either get lost, or experience long latency before restoration of connectivity. Inspired by opportunistic routing, we propose minimization of data replica at forwarding candidates in MANET routing. The efficacy of the involvement of forwarding candidates against node mobility, as well as the overhead due to opportunistic forwarding is analyzed. Through simulation, we further confirm the effectiveness of POR: high packet delivery ratio is achieved while the delay and duplication are the lowest.

ACKNOWLEDGMENT

Students work is incomplete until they thank the almighty & his teachers. I sincerely believe in this and would like to thank Mr.M.V.Jagannatha Reddy, M.Tech(Ph.D), Associate prof., of the department of Computer Science & Engineering, MITS Madanapalle, for his encouragement, motivation and for guiding me to write this paper. Also I am grateful

to Dr.A.Nagaraja Rao, M.Tech.,Ph.D. Prof., in CSE and Head Of the Department of Computer Science, MITS, Madanapalle .

REFERENCES

1. Z. Ye, S. Krishnamurthy, and S. Tripathi, "A framework for reliable routing in mobile ad hoc networks," in *INFOCOM 2003*, vol. 1, March-3 April 2003, pp. 270–280 vol.1.
2. A. Valera, W. Seah, and S. Rao, "Improving protocol robustness in ad hoc networks through cooperative packet caching and shortest multipath routing," *Mobile Computing, IEEE Transactions on*, vol. 4, no. 5, pp. 443–457, Sept.-Oct. 2005.
3. M. Mauve, A. Widmer, and H. Hartenstein, "A survey on position-based routing in mobile ad hoc networks," *Network, IEEE*, vol. 15, no. 6, pp. 30–39, Nov/Dec 2001.
4. "Location-aided opportunistic forwarding in multirate and multihop wireless networks," *Vehicular Technology, IEEE Transactions on*, vol. 58, no. 6, pp. 3032–3040, July 2009.
5. D. Chen, J. Deng, and P. Varshney, "Selection of a forwarding area for contention-based geographic forwarding in wireless multi-hop networks," *Vehicular Technology, IEEE Transactions on*, vol. 56, no. 5, pp. 3111–3122, Sept. 2007.
6. F. Wu, T. Chen, S. Zhong, L. E. Li, and Y. R. Yang, "Incentive-compatible opportunistic routing for wireless networks," in *MobiCom '08*, 2008, pp. 303–314.
7. R. Groenevelt, "Stochastic models for mobile ad hoc networks," Ph.D. dissertation, Universite de Nice, Sophia Antipolis, France, 2005.
8. S. Mueller, R. Tsang, and D. Ghosal, "Multipath routing in mobile ad hoc networks: Issues and challenges," *Lecture Notes in Computer Science*, vol. 2965, pp. 209–234, 2004.

