Selective Route-Request Scheme for On-demand Routing Protocols in Ad Hoc Networks

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Abstract. The on-demand routing protocols are appealing because of their lower routing overhead in bandwidth restricted mobile ad hoc networks, compared with Table-driven routing protocol. They introduce routing overhead only in the presence of data packets that need routes. However, the control overhead of on-demand routing protocols is increased by node mobility, node geographic density and traffic pattern density. In fact, this is undesirable feature for the scalable routing protocols whose control overhead should be under control to keep up with increasing offered load. The fundamental cause of these drawbacks is produced by flooding RouteRequest (RREQ) packet. As a solution for such a drawback of current on-demand routing schemes, we propose Selective Request Scheme (SR scheme). In this protocol, the stability of local network can be improved by re-floods or discards RREQ. Therefore in dynamic environment and limited bandwidth, SR Scheme assists in discovery the robust route and reduces the number of flooded RREQ packet. We demonstrate the effectiveness of our enhancement by applying it to Ad hoc On-demand Distance Vector Routing (AODV). Simulation results show that proposed idea significantly reduces the control overhead and improves the performance and scalability of the routing protocols.

1 Introduction

Multi-hop ad hoc networks have been in the spotlight because they are self-creating, self-organizing, and self-administering without using any kind of infrastructure. With the absence of fixed infrastructure in ad hoc networks, nodes can communicate with one another in a peer-to-peer fashion. And each node in an ad hoc network is capable

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of moving independently and functioning as a router that discovers and maintains routes and forwards packets to other nodes. A key component of ad hoc networks is an efficient routing protocol, since all of the nodes in the network act as routers.

Current studies of ad hoc routing protocols can be classified into two approaches – Table-driven and on demand routing [3] [7]. Table driven protocols, which are commonly used in the wired networks, maintain routes by exchanging the route table periodically. In ad hoc networks, the routing table must be updated frequently enough to handle the dynamic topology changes. This constraint may involve a large amount of routing overhead caused by intensive exchanges of the route tables regardless of the actual needs for routes. On the other hand, the principal aim of on demand routing approaches (e.g., AODV, DSR) is to reduce the routing overhead with dynamic maintenance of routes. On-demand routing protocols can reduce control overhead at the expense of setup latency due to the route search. When node requires a route to a destination, a node initiates a route discovery process by flooding RouteRequest (RREQ) packet. It is continued until RREQ packet reaches the destination or the intermediate node with a route to destination. Each node that has received the RREQ packet is in charge of forwarding the packet to reach the destination no matter how much load this node currently has. Upon the reception of a route query packet, the destination sends the route reply packet to the source via the reverse path of the shortest route through which a route request packet passes.

If the demands of route queries are not high, on demand routing protocols work more successfully and effectively than table driven routing schemes. However on demand routing schemes have two drawbacks which degrade network performance. First, except for ABR (Associativity-Based Routing) [4], most on demand routing protocols have not considered the stability of the local network in route-discovery phase. Therefore route failure and reconstruction is frequently incurred. Second, production in common RREQ packet can aggravate congestion in the local network, because of generation of more routing packets. The fundamental cause of these drawbacks is that shortest path is only used as routing metric and the new RREQ is unconditionally broadcasted. The above observation motivate us to investigate SR schemes on demand routing protocols with following characteristics

First, in dynamic environment, SR scheme assists in discovering the robust route by limiting Route Request packet in unstable local network.

Second, SR scheme reduce the number of flooded RREQ packets which produce the congestion of the local network. Also it can reduce the waste of limited bandwidth.

Third, most of on-demand routing protocols can optionally make use of the SR scheme, because of using in the route-discovery phase.

Simulation results demonstrate that our approach improves the performance of AODV protocol. Also we feel sure that will improve the performance when our approach is applicable to DSR (Dynamic Source Routing protocol), ABR.

The organization of the rest part of the paper is as follows. We will present a brief review of the related works and motivations in Chapter 2, and described he detailed scheme in chapter 3, thereafter we demonstrate the contributions of our work through simulation results in Chapter 4. Finally, we draw out conclusions and discussion about the future work in Chapter 5.