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Title: **A Unified Approach to Control the Undesirable Route Discovery Packets in Ad-hoc Networks**

Abstract

Recent advances in wireless communication technology and intelligent wireless monitoring systems have greatly expanded the range of potential applications of the wireless ad-hoc networks. Such wireless technology allows creating self-organizing structures that do not need any pre-established infrastructure or centralized supervision. Due to constantly changing topology, ad-hoc networks need a new set of routing protocols to accomplish the smooth communication. There is a great opportunity to enhance the quality of service (QoS) of routing protocol on different aspects.

Optimum route establishment for data transmission is a very challenging job in Mobile Ad-hoc NETworks (MANETs) due to their dynamic behavior. In order to carry out the route discovery, a large variety of reactive routing protocols have been developed. Ad-hoc On-demand Distance Vector (AODV) routing, Temporally Ordered Routing Algorithm (TORA), Dynamic Source Routing (DSR) etc. are some of the reactive routing protocols. In these routing protocols, route is established as need evolves. Doing so, query packet broadcast takes place to find the optimal path between resources.

Ideally, packet broadcast should be ceased when the desirable route has been determined successfully. The blind query broadcast steers the supine propagation of query packets even after route has been found. It leads to the broadcast storm problem that causes the unnecessary congestion in the network. This unwanted congestion hinders the smooth communication. Moreover, situation worsens as the time elapses. To prevent such deteriorated situation, routing protocols need an efficient query-broadcast. Usually two main measures are taken to reduce the packet retransmission and prolong the network life: (1) query-control broadcast to prevent unnecessary propagation of route-query, and (2) minimizing the route reconstruction problem by avoiding the fluctuated segments of network. An efficient query broadcast coupled with reliable-route and broadcast-repealing is a good solution for optimizing power consumption during route discovery in any routing protocol. Therefore, developing an efficient query-broadcasting technique is considered to be an important research focus for various reasons.

In this thesis, we explore some of the current challenges related to the reactive routing protocols, which includes query-broadcast, route-reconstruction and broadcast cancellation. Functional details of the broadcast repealing schemes, their shortcomings and promising improvements are also critically reviewed that form the basis to address these challenges. Surveyed techniques are also compared based on the standard set of performance metrics

such as routing strategy, complexity, chasing latency, packet retransmission, and energy exhaustion with approaches discussed in the literatures.

We present an energy efficient broadcasting technique, which exploits attribute parameters of node to determine the long-lived route in high mobile ad-hoc networks. It addresses the problem of route-reconstruction, including energy consumed for each packet and route-latency in a unified manner. The novelty of this technique lies in its weight-function, which utilizes the local attribute-parameters of the node to calculate link-weight between two neighboring nodes, besides being able to select strongly-connected nodes with short distance in GPS-devices less networks. Unlike traditional broadcasting techniques, the proposed technique does not require pruning of weakly connected routes at destination node, which is mostly difficult to identify strongly connected nodes by comparing complete weight-metric of available routes. Moreover, experimental results show that the performance of the proposed technique is better than recently proposed state-of-the-art broadcasting techniques like TTL sequence based-ERS and tBERS.

We present a graph-theory based formulation for query-broadcast technique of reactive routing protocols which incorporates a novel chasing-efficiency function utilizing resource-initiated broadcast repealing. This function is extended to implement broadcast repealing technique for cancelling the query-broadcast in ad-hoc networks. This mathematical comparative advantage authenticates that the proposed technique is more retransmission efficient than broadcast-repealing on source-initiated. The novelty of the proposed technique lies in its approach to issue the control-packet from the destination node immediately after unicasting the reply-packet back to the source node. The proposed technique follows destination-initiated broadcast repealing, which includes two-stage query broadcast (within the neighborhood and beyond the neighborhood) and it is validated against some of the recently proposed broadcasting techniques using network simulator. Experimental results on performance metric, including chasing latency and packet-retransmission, show that the proposed broadcast repealing technique considerably reduces the chasing latency, packet retransmission and energy consumption in comparison to the other broadcasting techniques.

Like reactive routing technique, cluster based routing protocols are not appropriate as they continuously use the reactive approach to carry out the route discovery. Therefore, in such cases, traditional broadcasting mechanisms need to be properly extended for use in the cluster based routing architecture. We also present query-control technique for cluster based routing technique to reduce the broadcast expenses. The novelty of proposed technique lies in its approach to cancel the query-broadcast in clustered ad-hoc networks as the desirable route has been determined successfully. Finally, we demonstrate some simulation experiments which compare the proposed technique to other commonly used techniques including standard one-class AODV that follows TTL-sequence based broadcasting technique. Simulation results reveal that the proposed broadcasting techniques are more retransmission and energy efficient than existing ones.