

## Simulation of AODV, DSR and DSDV Routing Protocols for Mobile Ad-hoc Networks

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### ABSTRACT

Routing algorithm has been the various issues in MANETs for a long time due to dynamic nature introduced by the mobility of nodes. This paper summarizes the classification of the Ad Hoc networks routing protocols along with emphasizing on the table-driven class of protocols. The goal of such an ad hoc network routing protocol is 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. This paper examines three routing protocols for mobile ad hoc networks– the Destination Sequenced Distance Vector (DSDV), the table- driven protocol and the Ad hoc On-Demand Distance Vector routing (AODV), an On –Demand protocol DSR and simulation has been done through ns2.31.

### KEYWORDS

AODV, DSDV, DSR, MANET, Performance, Routing Operation

### INTRODUCTION

An ad-hoc network is a special kind of network, where all of the nodes move in time. So the topology of the network changes as the nodes are in the proximity of each other. Ad-hoc networks are generally self-configuring, because of the concept of no stable infrastructure takes a place. Each node in the network must be able to take care of routing of the data and this is the domain of *ad-hoc routing*. So the concept of centralized network with pre-defined central routing tables could be applied only with difficulties or with the loss of the advantage of “*on-the-fly*” nodes changing[1]. *Ad hoc routing protocols* make routing decisions based on individual node mobility even for applications such as disaster recovery, battlefield combat, conference room interactions, and collaborative computing etc.[2]. Based on routing information update mechanism, There are two categories of routing protocols: *table-driven* and *on demand-routing*. In *tabledriven routing protocols (proactive routing)* routing information is periodically advertised to all nodes so all nodes have an up-to-date view of the network.

Alternatively, *on-demand routing protocols (reactive routing)* only discovers a new route when it is required to. *Hybrid routing protocols* also exist and they try to achieve an efficient balance between both categories of protocols [3]. Nodes within

a certain distance from the node concerned , or with in a particular geographical region, are said to be with in the routing zone of the given node. For routing within this zone ,a table driven approach is used .For nodes that are located beyond this zone, an on demand approach is used[4]. Table-driven schemes are more expensive in terms of energy consumption as compared to the on demand schemes because of the large routing overhead incurred in the former [5,6]. Hence, the on-demand approach is preferable for designing minimum energy routing protocols.

By on-demand behavior[7-10], we mean approaches based only on reaction to the presence of data packets. The use of strictly periodic or timer-based activities, such as typical router advertisements, link or neighbor status sensing messages. An on-demand routing protocol attempts to discover a route to a destination only when it is presented with a packet for forwarding to that destination. This discovery must be completed before the packet can be sent , which adds to the latency of delivering the packet. Indeed, some mechanisms to reduce the overhead cost of discovering a new route may result in an increase in latency for some route discovery attempts .A protocol using on demand routing must search the entire network for a node to which it must send packets, but does not know how to reach. Optimizations to the protocol may reduce the cost of initiating communication, but discovering a new route is likely to remain a costly operation. Any on-demand routing protocol must utilize some type of routing cache in order to avoid the need to rediscover each routing decision for each individual packet. However, the cache itself may contain out-of-date information indicating that links exist between nodes that are no longer within wireless transmission range of each other. This stale data represents a liability that may degrade performance rather than improve it[11-19].

### SPECIFIC ROUTING PROTOCOLS BELONGING TO EACH CATEGORY

#### Table-Driven Routing Protocols

*Destination sequenced distance-vector routing protocol(DSDV)*: It is one of the first protocol proposed for the ad hoc wireless networks. It is an enhanced version of the distributed Bellman-Ford algorithm where each node maintains a table that contains the shortest distance and the first node on the shortest path to every other node in the network. It incorporates table updates with increasing sequence number

tags to prevent loops, to counter the count-to-infinity problem, and for the fast convergence. As it is a table driven routing protocol, routes to all destinations are readily available at every node at all times. The tables are exchanged between neighbors at regular intervals to keep up-to-date view of the network topology[4].

### On-demand Routing Protocols

*Ad hoc On-demand Distance Vector Routing(AODV):* Ad hoc On-demand Distance Vector Routing (AODV) [20] is an improvement on the DSDV [21]. 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. If one of the intermediate nodes move then the moved nodes neighbor realizes the link failure and sends a link failure notification to its upstream neighbors and so on till it reaches the source upon which the source can reinitiate route discovery if needed.

*Dynamic Source Routing Protocol:* The Dynamic Source Routing Protocol [22] is a source routed on-demand routing protocol. The key distinguishing feature of DSR is the use of source routing. That is, the sender knows the complete 4 hop-by-hop route to the destination. These routes are stored in a route cache. The data packets carry the source route in the packet header. When a node in the ad hoc network attempts to send a data packet to a destination for which it does not already know the route, it uses a route discovery process to dynamically determine such a route. Route discovery works by flooding the network with route request (RREQ) packets. Each node receiving an RREQ rebroadcasts it, unless it is the destination or it has a route to the destination in its route cache. Such a node replies to the RREQ with a route reply (RREP) packet that is routed back to the original source. RREQ and RREP packets are also source routed. The RREQ builds up the path traversed across the network. The RREP routes itself back to the source by traversing this path backward. The route carried back by the RREP packet is cached at the source for

future use. If any link on a source route is broken, the source node is notified using a route error (RERR) packet. The source removes any route using this link from its cache. A new route discovery process must be initiated by the source if this route is still needed. DSR makes very aggressive use of source routing and route caching. No special mechanism to detect routing loops is needed. Also, any forwarding node caches the source route in a packet it forwards for possible future use.

### ROUTING OPERATION

In Ad hoc routing operation, To send a packet to another host, the sender constructs a *source route* in the packet's header, giving the address of each host in the network through which the packet should be forwarded in order to reach the destination host. The sender then transmits the packet over its wireless network interface to the first hop identified in the source route. When a host receives a packet, if this host is not the final destination of the packet, it simply transmits the packet to the next hop identified in the source route in the packet's header. Once the packet reaches its final destination, the packet is delivered to the network layer software on that host. Each mobile host participating in the ad hoc network maintains a *route cache* in which it caches source routes that it has learned. When one host sends a packet to another host, the sender first checks its route cache for a source route to the destination. If a route is found, the sender uses this route to transmit the packet. If no route is found, the sender may attempt to discover one using the *route discovery* protocol. While waiting for the route discovery to complete, the host may continue normal processing and may send and receive packets with other hosts. The host may buffer the original packet in order to transmit it once the route is learned from route discovery, or it may discard the packet, relying on higher-layer protocol software to retransmit the packet if needed. Each entry in the route cache has associated with it an expiration period, after which the entry is deleted from the cache. While a host is using any source route, it monitors the continued correct operation of that route. For example, if the sender, the destination, or any of the other hosts named as hops along a route move out of wireless transmission range of the next or previous hop along the route, the route can no longer be used to reach the destination. A route will also no longer work if any of the hosts along the route should fail or be powered off. This monitoring of the correct operation of a route in use we call *route maintenance*. When route maintenance detects a problem with a route in use, route discovery may be used again to discover a new, correct route to the destination [22].

### METHODOLOGY

The primary approach for this study was computer simulations. We used the network simulator ns-2 developed by the VINT research group at University of California at Berkeley. The Monarch research group at Carnegie Mellon University extended the ns-2 simulator to include wireless scenarios with mobile nodes. The more established ad-hoc routing protocols were implemented in the CMU extension. Subsequent versions

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of the CMU wireless extension also included energy models for the mobile nodes and these were utilized for this study. However, at present, the energy model for the AODV protocol has not yet been implemented bug-free so this has limited our AODV simulations. From our own observations and comments of others in the ns-2 news groups, we learned that the AODV simulation goes unpredictably into infinite loops for certain scenarios.

### SIMULATION WORK

Implementation has been done for three different protocols (AODV, DSR, and DSDV). And analyzed that AODV data were limited and questionable. As a result, AODV was not reported in the simulation section and only DSR and DSDV were compared. TORA was not considered because It has been found that TORA was not energy efficient and does not scale to large networks (Fig.1 DSR, Fig 2 DSDV, Fig3 AODV).

Fig.1 DSR Implementation

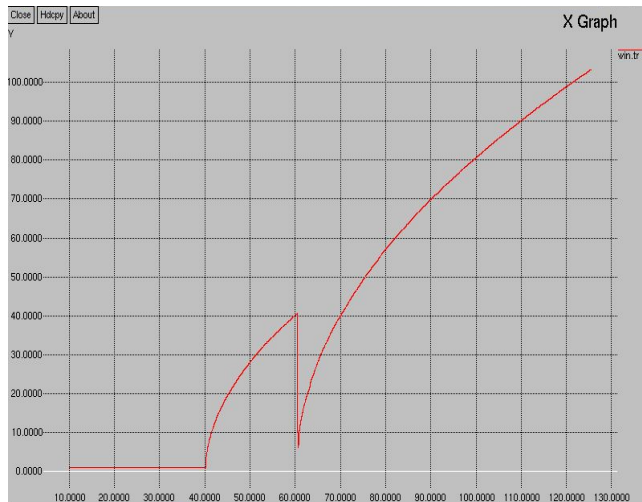


Fig.2 DSDV Implementation

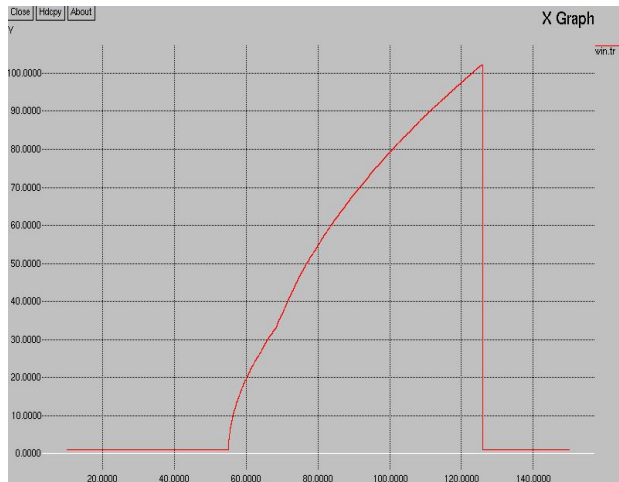
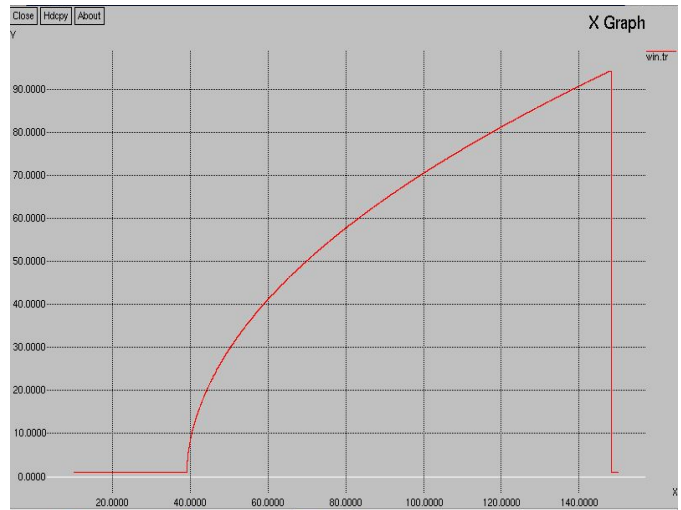


Fig.3 AODV Implementation



### CONCLUSION & FUTURE SCOPE

Many extensions can be applied to this study. It is obvious that this is not a complete study of all the major protocols. A stable and loop-free implementation can be done to evaluate the better performance. Some extensions can be done in AODV, DSR and DSDV to overcome the limitations of such protocols.

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