Volume 3, Issue 1, January 2013 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Comparison of AODV and RAODV Routing Protocols in Mobile Ad Hoc Networks

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Abstract: A Mobile Ad hoc NETwork (MANET) is a group of mobile nodes that form a multihop wireless network. The topology of the network can change randomly due to unpredictable mobility of nodes and propagation characteristics. AODV (Ad-hoc on-demand Distance vector routing) is a representative among the most widely studied on-demand ad hoc routing protocols. AODV and most of the on demand ad hoc routing protocols use single route reply along reverse path. Rapid change of topology causes that the route reply could not arrive to the source node, i.e. after a source node sends several route request messages; the node obtains a reply message, especially on high speed mobility. This increases both in communication delay and power consumption as well as decrease in packet delivery ratio. To avoid these problems, a reverse AODV was proposed which tries multiple route replies. The extended AODV is called reverse AODV (R-AODV), which has a novel aspect compared to other on-demand routing protocols on Ad-hoc Networks: it reduces path fail correction messages and obtains better performance than the AODV and other protocols have. In this paper, we compared the performance of AODV and RAODV protocol by using simulation parameters.

Keywords: Ad-hoc, AODV, RAODV, NS-2

I. INTRODUCTION

Mobile ad hoc networks (MANET) consist of mobile platform which communicate with each other through wireless links without any predetermined infrastructure. Each node not only is a host but also as a router that maintains routes to and forwards data packets for other nodes in the network that may not be within direct wireless transmission range. Topology of a mobile ad-hoc network often changes rapidly and we need to manage this change and cope with problems raised through this type of networks. If the source and destination nodes are not within the transmission range of each other, then intermediate nodes would be served as intermediate routers for the communication between the two nodes. Moreover, mobile platform moves autonomously and communicates via dynamically changing network. Thus, frequent change of the network topology is a main challenge for many important topics, such as routing protocol, robustness and performance degradation. Recently, some adaptive ad hoc routing protocols have been reported. For example, Associativity Based Routing (ABR) [3] which according to this algorithm, each node periodically transmits beaconing ticks to identify itself, and a stable link exists if a large amount of the ticks are received and accumulated at the receiving node. This protocol selects a shortest route pass through stable links. Another protocol that uses stability is Signal Stability-based Adaptive routing (SSA)[4] chooses the route if the receiving signal strengths of radio links along this route are larger than a threshold value; otherwise, the shortest path routing algorithm applies to find another route. However, since the correlation time between two receiving signals or ticks is short for an MANET, these two protocols find stable links and routes from deterministic parameters without considering the variation of signal strengths and network topologies of mobile ad hoc networks.

In this paper we first consider the Ad-hoc On-Demand Distance Vector Routing Protocol (AODV) that uses a demand-driven route establishment procedure, then we present an optimized version of this algorithm namely Reverse AODV (RAODV). For increasing of protocol performance, we use route stability parameter to select the best route between available routes. For path discovery, the route with highest stability will be selected. We then present our routing protocol namely RAODV (RAODV) routing algorithm which it can be an extension for RAODV. The RAODV routing algorithm can present good performance for high mobility environments. In this paper we compared the performance of AODV and RAODV.

2. LITERATURE SURVEY

2.1. Theoretical background of AODV

AODV is a reactive routing protocol; that do not lie on active paths neither maintain any routing information nor participate in any periodic routing table exchanges.

Further, the nodes do not have to discover and maintain a route to another node until the two needs to communicate, unless former node is offering its services as an intermediate forwarding station to maintain connectivity between other nodes.

AODV has borrowed the concept of destination sequence number from DSDV [5], to maintain the most recent routing information between nodes. Whenever a source node needs to communicate with another node for which it has no routing information, Route Discovery process is initiated by broadcasting a Route Request (RREQ) packet to its neighbors. Each neighboring node either responds the RREQ by sending a Route Reply (RREP) back to the source node or rebroadcasts the RREQ to its own neighbors after increasing the hop_count field. If a node cannot respond by RREP, it keeps track of the routing information in order to implement the reverse path setup or forward path setup [6].

The destination sequence number specifies the freshness of a route to the destination before it can be accepted by the source node. Eventually, a RREQ will arrive to node that possesses a fresh route to the destination. If the intermediate node has a route entry for the desired destination, it determines whether the route is fresh by comparing the destination sequence number in its route table entry with the destination sequence number in the RREQ received. The intermediate node can use its recorded route to respond to the RREQ by a RREP packet, only if, the RREQ's sequence number for the destination is greater than the recorded by the intermediate node.

Instead, the intermediate node rebroadcasts the RREQ packet. If a node receives more than one RREPs, it updates its routing information and propagates the RREP only if RREP contains either a greater destination sequence number than the previous RREP, or same destination sequence number with a smaller hop count. It restrains all other RREPs it receives. The source node starts the data transmission as soon as it receives the first RREP, and then later updates its routing information of better route to the destination node. Each route table entry contains the following information:

- Destination node
- Next hop
- number of hops
- Destination sequence number
- Active neighbors for the route
- Expiration timer for the route table entry

The route discovery process is reinitiated to establish a new route to the destination node, if the source node moves in an active session. As the link is broken and node receives a notification, and Route Error (RERR) control packet is being sent to all the nodes that uses this broken link for further communication. And then, the source node restarts the discovery process.

2.2. Theoretical background of R-AODV

Analyzing previous protocols, we can say that most of on-demand routing protocols, except multipath routing, uses single route reply along the first reverse path to establish routing path. As we mentioned before, in high mobility, pre-decided reverse path can be disconnected and route reply message from destination to source can be missed. In this case, source node needs to retransmit route request message. Purpose of our study is to increase possibility of establishing routing path with less RREQ messages than other protocols have on topology change by nodes mobility.

Specifically, the proposed R-AODV protocol discovers routes on-demand using a reverse route discovery procedure. During route discovery procedure source node and destination node plays same role from the point of sending control messages. Thus, after receiving RREQ message, destination node floods *reverse request* (R-RREQ), to find source node. When source node receives an R RREQ message, data packet transmission is started immediately. Since R-AODV is reactive routing protocol, no permanent routes are stored in nodes.

The source node initiates route discovery procedure by broadcasting. Whenever the source node issues a new RREQ, the broadcast ID is incremented by one. Thus, the source and destination addresses, together with the broadcast ID, uniquely identify this RREQ packet [1, 9]. The source node broadcasts the RREQ to all nodes within its transmission range. These neighboring nodes will then pass on the RREQ to other nodes in the same manner. As the RREQ is broadcasted in the whole network, some nodes may receive several copies of the same RREQ. When an intermediate node receives a RREQ, the node checks if already received a RREQ with the same broadcast id and source address. The node cashes broadcast id and source address for first time and drops redundant RREQ messages. The procedure is the same with the RREQ of AODV.

When the destination node receives first route request message, it generates so called reverse request (R-RREQ) message and broadcasts it to neighbor nodes within transmission range like the RREQ of source node does. R-RREQ message contains following information: reply source id, reply destination id, reply broadcast id, hop count, destination sequence number, reply time (timestamp). When broadcasted R-RREQ message arrives to intermediate node, it will check for redundancy. If it already received the same message, the message is dropped, otherwise forwards to next nodes.

3. PERFORMANCE RESULTS

In this section, we first describe the simulation environment used in our study and then discuss the results in detail [8].

3.1. Simulation Environment

Our simulations are implemented in Network Simulator (NS-2) . The simulation parameters are as follows:

- Number of nodes: 10, 20, 30, 40, 50, respectively;
- Testing area: 1000m x 1000m;
- Mobile speed: uniformly distributed between 0 and MAXSPEED (we choose MAXSPEED = 2, 5, 10, 25, 50, 75m/s, respectively);

• Mobility model: random way point model (when the node reaches its destination, it pauses for several seconds, e.g., 1s, then randomly chooses another destination point within the field, with a randomly selected constant velocity);
Traffic load: UDP, CBR traffic generator;
• Radio transmission range: 250 m; and
• MAC layer: IEEE 802.11.
• Each simulation is run for 100 seconds and repeated for 10 times. We compare our proposed AODV with RAODV.

3.2. Results
To evaluate performance of AODV with that of RAODV protocol, we compare them using two metrics:

• Delivery Rate: the ratio of packets reaching the destination node to the total packets generated at the source node.
•Average End-to-End Delay: the interval time between sending by the source node and receiving by the destination node, which includes the processing time and queuing time.

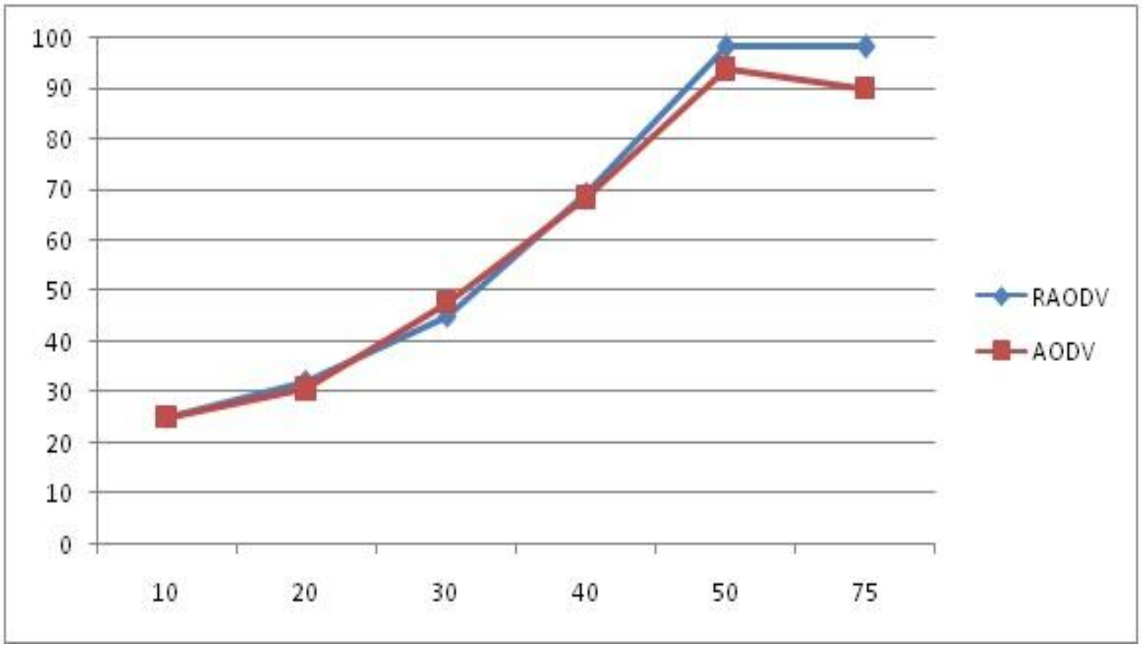

Figure 1: Packet Delivery ratio when number of node varies

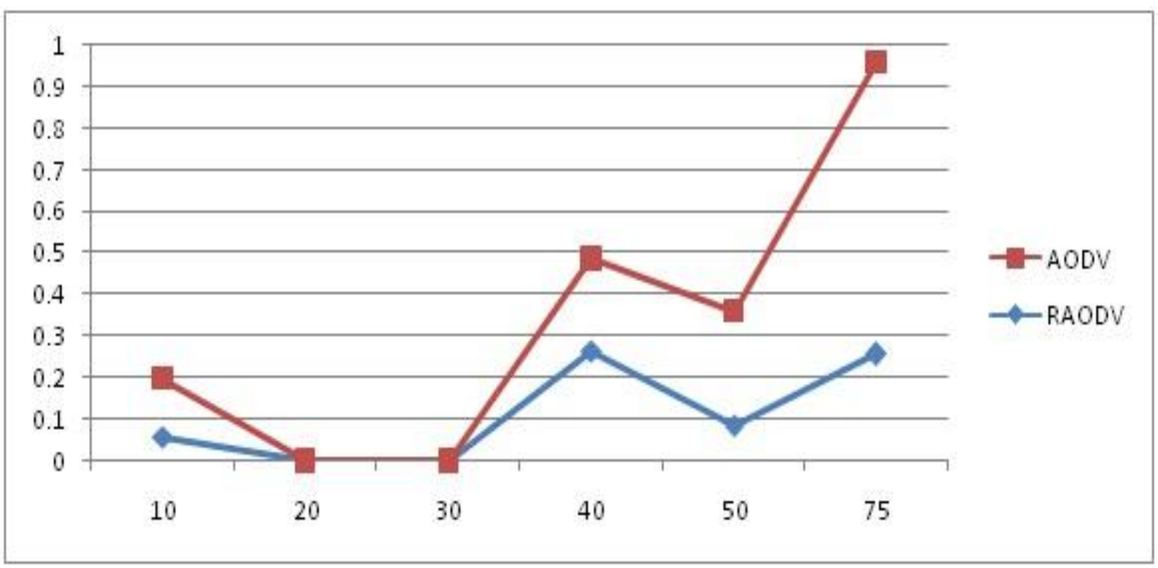

Figure 2: Average End to End delay when number of node varies

4. CONCLUSION

This paper does the comparison of AODV and RAODV routing protocols. In RAODV we changed route replay packet configuration of AODV and named it RRREQ. These packets should be transmitted to destination node for building multiple routes. According to the simulation results, this algorithm is better than other version of AODV algorithm. For the future work, In RAODV the concept of energy is also included and so assign the priority of different dedicated paths between source and destination on the basis of both energy as well as the stability of nodes or paths.

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