2009 Sixth International Conference on Information Technology: New Generations

Exchange Routing Information between New Neighbor Nodes to Improve AODV Performance

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Abstract

In Ad hoc On-Demand Distance Vector (AODV) protocol, once an on-demand link is established, it only maintains that link and does not care about any other paths. AODV may not use some more optimal or reserved paths which occur later but may improve its current transfer. We modify AODV that each node uses routing information provided by the new neighbor nodes to find out and update to better paths and create accumulated routes for later use. Our modeling results in NS2 show that the approach can create more optimal routes and significantly improve the performance with high mobility and traffic level network in term of delay and packet delivery ratio.

1. Introduction

Nodes in AODV have no way to update the current link if it is not broken. It may miss many optimal paths as the example shown in Figure 1: At starting position, node A communicates with node F through the path A-B-C-D-E-F (5 hops). When F moves to a new position as in Figure 1.(b), F has A as a new neighbor node. A new optimal path occur (A-F: 1 hop) but it cannot be used because the current path is not broken.

Each node in AODV maintains a routing table and neighbor list [1]. Knowing one node's routing table and neighbor list may lead to discover a new optimal route (with less number of hops) or accumulated paths [3] through that node. Accumulated paths are not on-demand paths but can be discovered with no additional cost. There is possibility that the next on-demand destination can be reached by one of those accumulated paths. In this case, source can transmit packet immediately instead of discovering a new route. This can reduce the delay time and routing overhead for the network.

This paper studied the proposed modification by incorporating the learning information from new neighbor nodes mechanism in AODV. In order to evaluate the new modification, we created detail packet levels simulations in NS2 to compare its performance with the original one.

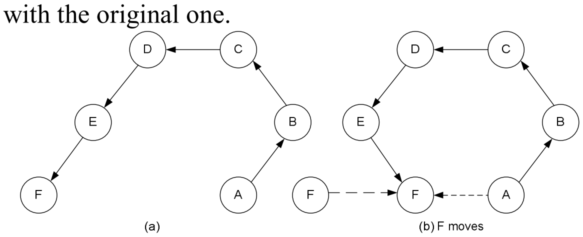

Figure 1. A disadvantage scenario

2. Our Proposed Solution: AODV-M

AODV can be modified to use effectively the routing information provided by the new neighbor nodes. Each time a node discovered a new neighbor node; these two nodes exchange the necessary information. For each routing table entry, we extracted destination address, number of hop towards that destination, sequence number and expire time of that entry. The extracted entries are formed into a destination table to exchange with the new neighbor node.

The destination table is processed like the following: For each entry, look up its destination address in the routing table. If the destination is found, it means that besides the current path in the routing table, there has a new path through the new neighbor node. The number of hops of these two paths is then compared. Consider the number of hops of the old path and new path are hop_{old} and hop_{new} respectively. If $hop_{old} > hop_{new} +1$: the new path is better (with smaller number of hops), it will replace the current one; otherwise, there will be no change. If the destination is not found in the routing table and neighbor list, an entry toward that destination is created in the routing table as a new accumulated path. The update and accumulated path both obtain the

978-0-7695-3596-8/09 $25.00 © 2009 IEEE
DOI 10.1109/ITNG.2009.68

sequence number, number of hop and expire time from the destination table.

With this modification, source can discover and change to a better path even if the current path is not broken. The accumulated paths will also decrease the number of Route Discovery cycles and reduce the delay time for finding a path. This design therefore improves the performance of AODV.

3. Simulations and results

The simulations use 5 different movement patterns (pause time 0, 20, 40, 100 seconds) and 4 different traffic patterns (5, 10, 15, and 20 sources). These patterns create 20 scenarios; each scenario combines a movement pattern and a traffic pattern. A wide variety of node scenario files and CBR scenario files were generated to evaluate varying network conditions. The results are as following:

A. Packet Delivery Ratio

Figure 2 presents the comparison of Packet Delivery Ratio. We can see that AODV-M performs better in most of the case. The reason is AODV-M updates the path immediately when it has chance to do so while original AODV keeps the link until it is broken. Because of that, there will be more broken link in original AODV, which creates more packet loss than the one in modified AODV.

B. Average Time Delay

Figure 3 indicates the comparison of Average Time Delay. The modified solution has less delay in most of the cases. It is because AODV-M creates accumulated paths, therefore, with higher traffic, the possibility of using accumulated paths increases. Original AODV does not have accumulated paths so it will take time to discover the route if traffic required is not found in the routing table.

C. Routing Control Overhead

Figure 4 shows the comparison of Routing Control Overhead. AODV-M creates more overhead than original AODV but it decreases in the high traffic network to compare with in low traffic. This is because when the nodes have less communication demands, the creating paths may not be used. When the traffic increases, the accumulated paths may be used and it will decrease the message cost by discovering a new route. We therefore reckon that AODV-M can be used as an optimization under moderate to high load scenarios.

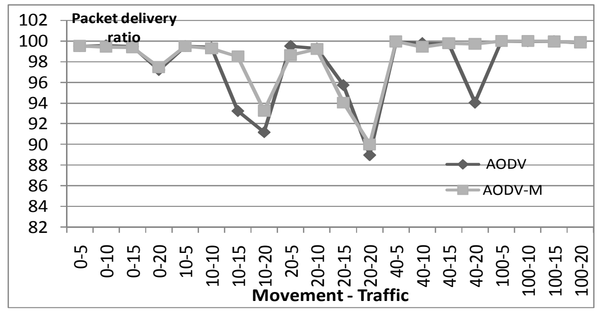

Figure 2. Packet Delivery Ratio

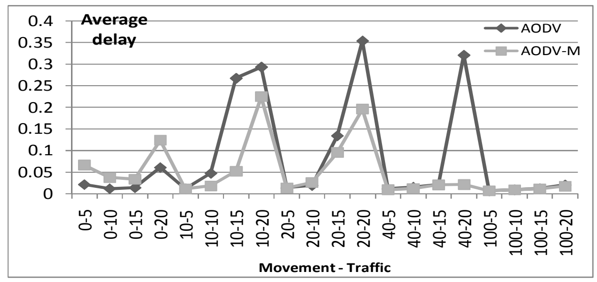

Figure 3. Average Time Delay

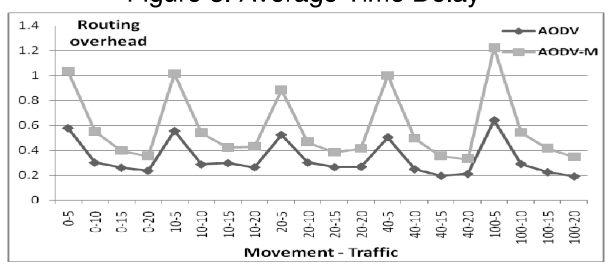

Figure 4. Routing Control Overhead

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