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Presentation proper routing protocol to select the best route in Wireless ad hoc networks

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ABSTRACT

Mobile Ad hoc networks include a number of moving nodes that are continuously moving and related to each other via wireless links. Today, due to the high mobility of nodes, the number of nodes and high traffic, the amount of route failure has increased. A lot of methods were provided for routing for sending the necessary information to these networks. These methods include a wide range of designing methods and each of these methods has its own advantages and disadvantages. Thus, they can be useful for specific environment with its own special conditions. In this study, an appropriate method was suggested in network congestion and rapid mobility of nodes in order to select an appropriate route and send information properly and on time. Simulation results show that the proposed method has a high performance than similar methods.

Keywords: *On-demand, Simulation, Route maintenance, Link expiration, Route request, Simulation, Mobile ad hoc networks.*

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INTRODUCTION

The change of typology in mobile network [4] usually makes the movement of routing nodes in Mobile ad hoc networks difficult. Routing should have efficiency while it needs to have low control overhead. On-demand protocols establish routing as receiving demand. AODV is an example of this type.

In on-demand routing algorithms, nodes update the information of network typology and maintain the information of route regardless of the fact that there is data traffic or not. In these methods, the overhead due to the update of typology information is very high and costly. Some examples of these methods are DSDV method [1] and FSR method [2]. In on-demand routing methods, network routes are searched only when the source establishes a relationship with the destination node. In other words, the process of routing occurs when a demand node has a relationship with another node. In Mobile ad hoc networks, active routes can be properly cut off (disconnected) due to the movement of nodes. For this reason, route maintenance is one of the important actions (procedures) of routing protocols.

AODV routing protocol

This protocol can be considered as the improvement of DSDV routing protocol. AODC [3] minimizes the number of broadcasts by creating routes when necessary. Unlike DSDV that maintained a list of all routes, the source broadcasted a requested package to find a route to the destination. When a source node tries to send a message to several nodes and there is not an acceptable route to the destination, it creates a routing process to find another node and broadcasts a RREQ route request to its neighbors until the destination, a middle node or a free route is found to the destination.

AODV uses the ordinal numbers of destination to make sure that all routes have loop freedom and include most of the route information.

Each node maintains its own ordinal number as broadcast ID. Broadcast ID for each RREQ of node increases and is specified with IP address for each RREQ of node. With its ordinal number and broadcast ID, the source node has the last (recent) ordinal

number to destination in its RREQ. Middle nodes can respond the destination ordinal number that is accessible, larger or equal to RREQ content if they only have a route to destination.

During the process of sending RREQ, middle nodes register the address of a neighbor to which the first copy of broadcast package was sent, thus they create a reverse route. If extra (additional) copies of similar RREQ are received, these packages will be rejected. Once RREQ reaches to the destination of the middle node with a route with enough free size, the destination/middle node uses unicast to the back of a package to send RREP route response to a neighbor to which the first RREQ was sent. When RREP is routed with reverse route, the nodes with this route put the routes after them in their route tables that refer to a node from which RREP has come. These route inputs determine the next active route. There is a route timer depending on each route input. So that if the input is not used at the specified life time, it will be deleted because RREP inputs with the found route will be sent by RREQ and AODV only supports the use of symmetric links. (Figure 1)

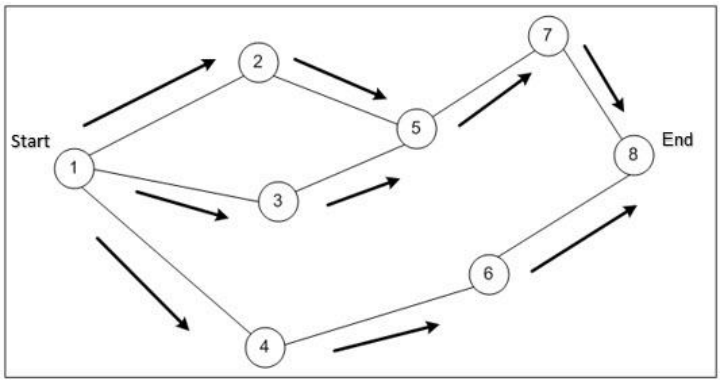


Figure 1. Broadcast to find route in AODV

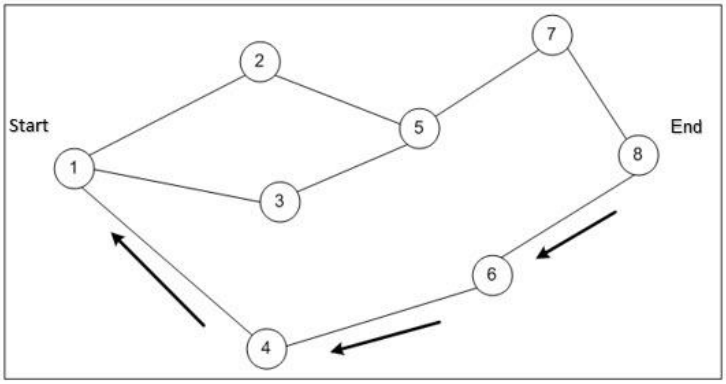


Figure 2. Routing in AODV

When a package node sends route request for its neighbors, it registers a node from which the first request has come. These information are used to a route back to the response package routing, AODV only uses symmetric and two-way links because response package routing is done by reversing the package route, in other words the response package reversely reaches the source by passing this route. (Figure 1-2). The nodes which are along this route enter the route in their tables. If the source node moves, it should do the procedure of routing to destination. But if one of the middle nodes move, then the neighbor node that moved will find the link failure and will send a link failure warning to the neighbors contrary to the route, so that the source node receives it and re-perform routing if necessary.

The proposed method

In this method the selection of next nodes can be more limited by sending (transferring) data packages in order to improve AODV routing protocol and prevent the large broadcast of data packages in the network. Since GPS is used in these networks, the variables like speed and direction can be involved in order to make the nodes selected for broadcasting data packages more valid and less limited (less number). To do this, the link expiration time should be obtained for the neighboring nodes of the middle node and the variables of speed and direction have a fundamental role. To select the neighboring node, link expiration time is calculated by the following formula:

Formula = $(F+ m * d) / (|V_1+n*V_2|)$

In which m and n assign the values of 1 or -1 according to the speed and direct of the node. F is the range of relation and nodes and d is the distance between two nodes. Two nodes can only relate to each other and transfer data and d should be smaller than F. TH less is the formula, the less will be the probability of selecting that node to transfer the package. If the number of neighbors is very limited (one neighbor) and the formula is close to zero, this method will not be considered.

With this method, the nodes which have stronger connection with middle node are selected and the delivery rate of the package will increase.

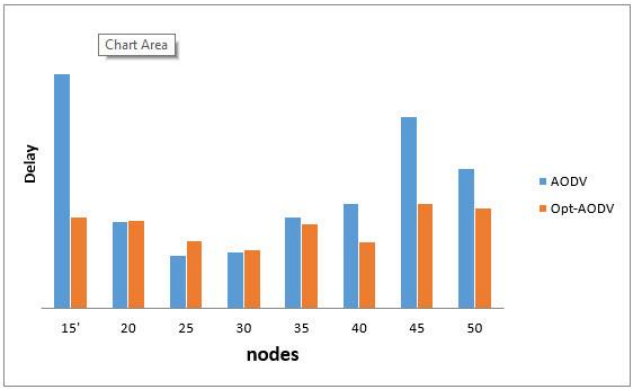
Simulation

For evaluation, the simulation tool of NS2 [5] version 2.34 was used. Each scenario is comprised of a set of information about the position of specified number of nodes in a certain area. To obtain the result, each simulation was performed with the number of different nodes in a different scenario and the final result per each evaluation parameter is the average result of all simulations. The purpose of this work was to increase the reliability of simulation results.

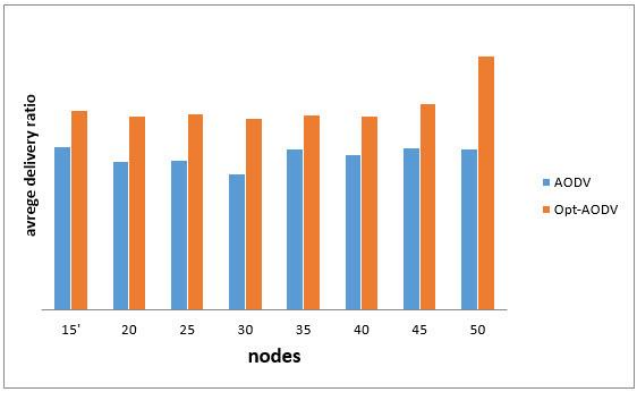
Simulation table

Amount	Name
1000*1000	Simulation environment
s **1000**	Simulation time
AODV	Routing protocol
DropTail	Type of queue
802.11	standard MAC
15.20.25.30.35.40.45	Number of nodes
0s	Downtime of nodes
m**255**	Transmission range

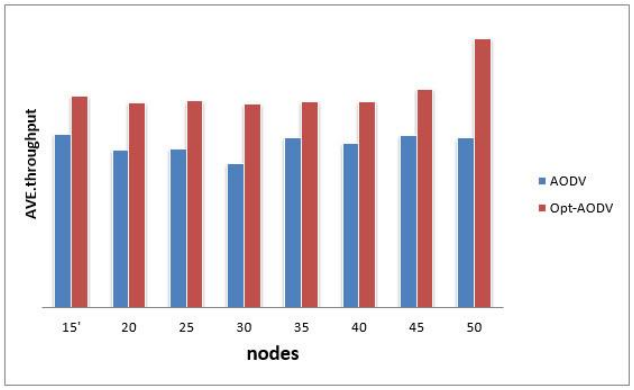
Average end-to-end delay than the number of nodes



The delivery rate of packages than the number of nodes



Throughput than the number of nodes



Conclusion

With the help of NS-2 network simulator, the proposed method was evaluated and compared in a totally different scenario. According to the obtained results, the results obtained from simulation and the analysis of mentioned metrics, it is concluded that the proposed method has less delay and more average delivery rate of package than AODV and has a significant efficiency in Mobile ad hoc network due to the selection of a better and optimal route by determining the link expiration time among the nodes.

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