ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

IJARCCE
International Journal of Advanced Research in Computer and Communication Engineering

SITES
Smart And Innovative Technologies In Engineering And Sciences
Gyan Ganga College of Technology
Vol. 5, Special Issue 3, November 2016

Shortest Path Routing Protocol in Scalable Mobile Ad Hoc Networks on Demand Dynamic Randomized Source

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Abstract: Increasing the number of nodes in any wireless and mobile ad hoc network environment give birth to various issues such as higher power consumption, minimized data security, degraded QoS (quality of service) and security. Especially networks without having a centralized system (MANETS) is facing severe security issues. There is a major security issue in the malicious nodes while finding the shortest path. In our proposed paper, a simple hybrid AODSR algorithm is developed to find the shortest path routing in a dynamic network. The algorithm used is an efficient coding scheme which traces the malicious nodes length, which depends on the number of nodes in the network. The aim of this paper is to propose an algorithm to find a secure shortest path against malicious nodes.

Keywords: MANET, Shortest Path, routing protocol, malicious nodes, PDR, End-to-End delay etc.

I. INTRODUCTION

In advance wireless communication technologies, small size and high performance computing and communication devices have been increasingly used in daily life and computing industry (e.g., commercial laptops and personal digital assistants equipped with radios).A mobile ad-hoc network is a cotinuously self configuring, infrastructureless network of mobile devices connected without wires, where the network structure changes dynamically due to member mobility.

MANETS cooperate friendly to engage in multiple-hop forwarding. The routing protocols for ad hoc wireless networks have to adapt quickly to frequent and unpredictable topology changes and must be illiberal of communications and processing resources.

Due to the fact that bandwidth is scarce in MANET nodes and as compared to the wire line Internet, population in MANET is small, the scalability issue for wireless multichip routing protocols is mostly concerned with excessive routing message overhead caused by the increase of network population and mobility. Routing table size is also a big problem in MANETs because large routing tables imply large control packet size hence large link overhead. Here two routing protocols are generally used either distance-vector or link-state routing algorithms [2]. Both types find shortest paths to destinations. In distance-vector routing (DV), a vector containing the cost (e.g., hop distance) and path (next hop) to all the destinations is kept route convergence and tendency of creating loops in mobile environments.

The Link-state routing (LS) algorithm overcomes the problem by maintaining global network topology information at each router through periodical flooding of link information about its neighbors

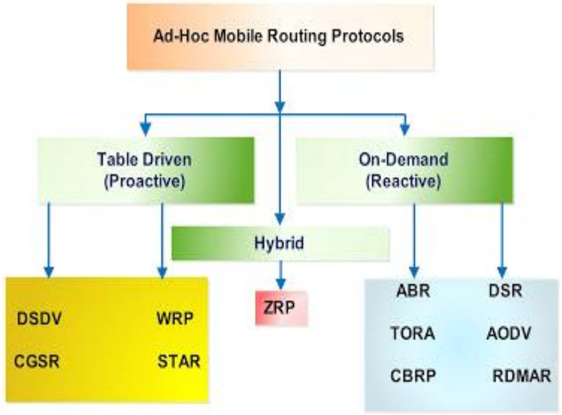

Figure 1: Routing Protocol Classification

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II.PROBLEM STATEMENT

In Figure 3(a) we consider a routing path from a source node A to a destination node I. The initial path is determined through the path discovery process, in which the distance between the source and destination is the shortest in terms of the number of hops, or very close to it. While getting routed from A to I a packet takes eight hops.

During the source of time, the mobility of the nodes may make the shape of the routing path similar to the one shown in Figure 3(b) while retaining the connectivity. In this new shape, J is in the transmission range of A, and E is in the trans- mission range of J. Similarly H is in the transmission range of F.

The routing table entries are not updated because of the usage of route caches and the validity of the existing routing information. Although functionally adequate, using the routing paths of Figure 3(b), a packet still takes eight hops to reach from node A to node I. Ideally the shortest path from A to H needs only five hops as shown in Figure 3(c). The aim of this paper is to identify such situations and self-heal and optimize the paths dynamically by modifying the entries of the routing tables.

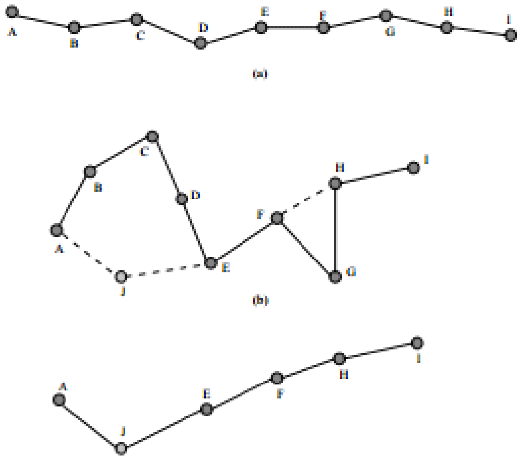

Figure 2: An example of the changes in routing paths

The primary aim of the solution approach is to discover shortest routing paths as and when feasible. The basic scenarios of the short-cut discovery process are shown in Figure 3.It shows that the routing path A-B-C-D can be shortened to A-E-D, since E is in the range of A, and D is in the range of E. This short-cut path formation is termed as (3,2) reduction. Thus, (n, 2) reduction implies that n hops along the path can be reduced to only two hops.

In general terms, (n, k) reduction implies that n routing hops can be reduced to k hops, where k < n. To avoid complexity in terms of overheads, we have considered the values of k as 1 and 2 for the proposed SHORT algorithms. SHORT algorithm is applicable in conjunction with any underlying ad hoc routing protocol that formulates the entries of the routing tables.

The underlying routing protocol need not have to be very efficient or optimal. It could be very simple and adequate enough to ensure a reachable path from a source to the destination. SHORT can self-heal the path for optimization.

III. PROPOSED METHODOLOGY

• AODV ROUTING PROTOCOL

Here we use a trust based management framework for securing Ad hoc On Demand Distance Vector Routing Protocol. In this mechanism, Constant trust factor is used to evaluate the shortest path for communication in the ad-hoc network.

1. The identity information like IP address and Trust factor value has been used to prevent the attack by malicious node. This identity information is assigned to each node when the node will be configured.
2. In the proposed work, a mechanism to check the next node whether it is trusted or not have been deployed where each node will be configured with the constant trust factor value, that value will be known to each and every node. The trust value is initiated in the route discovery phase.
3. Each node keeps a constant trust value that will change in the RREP phase. Initially each node will be configured with the constant trust value 50 using node trust function. Source node broadcasts RREQ to neighboring nodes until a destination node or node having a route to destination determines, during this process hop count is initialized.
4. When we reach the final destination node it will check the trust value of the previous hop and if it is not the destination then it will forward the request to all its neighboring nodes. If the current node is destination then it will evaluate the shortest path from destination to source.
5. AODV can select the better path (trusted and shortest) using trust value and the number of hops. When the RREQ and RREP message are generated in the network, each node annexes its own trust value to the trust accumulator on this route discovery phase.
6. Each node also updates its own routing table It supports both unicast and multicast packet transmissions. The following formula can be used to evaluate the trusted and shortest path.

Sum of trust values * $\sqrt{\text{No of hops}}$/ No of hops Where,
Sum of trust value = $\sum$ trust value (i)

• HYBRID AODSR PROTOCOL

1. On-demand routing protocols for mobile ad hoc networks (MANETs) incur high route discovery latency and also incur frequent route discoveries in the presence of a dynamically changing topology. This is achieved by the source broadcasting a route request packet specifying the intended destination.
2. On reception of a route request by a node that is not the intended destination, if this node has not already processed this packet before (to prevent looping and stop the flood associated with the route request), it will append its identifier onto the route in the packet header and re-broadcast the packet.
3. We propose an Ad-hoc dynamic source routing technique for ad hoc networks combined with Random way point network location awareness. A node always has

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a packet to transmit; it computes its location from location table obtained through the dissemination mechanism, the graph G representing the "current" network topology.

4. Then, it applies to G, locally, an algorithm for the determination of a minimum cost path to the destination. We associate a cost of 1 with each edge of the graph. Thus, the total cost represents the total number of transmissions (hops) a packet must take to reach the destination.

5. Therefore, a minimum cost path minimizes the overall transmission time, the related energy consumption is minimized and the overall needed bandwidth is decreases. Once the source route is computed, the packet is processed in a manner similar to any source routing protocol. Namely, the obtained source route is included in the header of the packet, and the packet is transmitted in a hop-by-hop fashion to those nodes on the path.

6. Our resulting routing protocol is simply easy to implement relying only on a bandwidth and energy efficient dissemination mechanism, rather than on the RREQ and RREP control packets required by DSR. As well, our protocol neither requires any complex route caching schemes, nor any route maintenance to be performed, without which DSR would not be a competitive routing protocol.

IV. IMPLEMENTATION RESULT

An MATLAB simulator has been used to simulate the results. This section presents the performance metric and implementation details of the proposed protocol.

Three performances metric are evaluated in our simulation:

1. Number of packets dropped – Number of packets dropped by the routers at the network layer due to the capacity of the buffer.

2. End to End Delay- It is the most important result to prove the success of each routing protocol.

3. Number of packets received – Number of packets received by the routers at the network layer due to the capacity of the buffer.

V. WORKING OF RANDOM WAY POINT MOBILITY MODEL

The Random Way Point Mobility Model describes the movement of nodes. In this simulation, files are categorized by number of nodes such as 5,10,15,20 and 25. The pause time is set to 10 sec. and maximum speed set to 5 m/s. The simulation time is set to 100 sec. and nodes are equally distributed in 100x100 m area. The graph has been plotted to show the comparison between AODV and AODSR after getting the values of each performance metric according to each protocol.

This section analyzes the results using the three performances metric that are Packet delivery dropped (PDD), End to End delay and number of received packets.

In all graphs x-axis represents the number of nodes and y-axis represents the value of performance parameter.

The results of simulation show that the AO-DSR works more satisfactory than standard AODV. We can see that the End to End Delay in AO-DSR is less than Standard AODV. Also, AO-DSR has more success during node population increment.

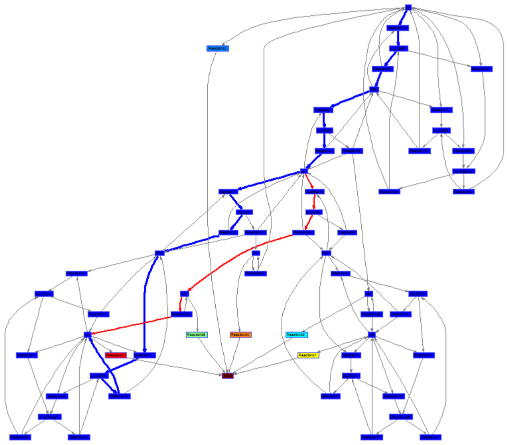

Figure 3.1 Network topology for simulation

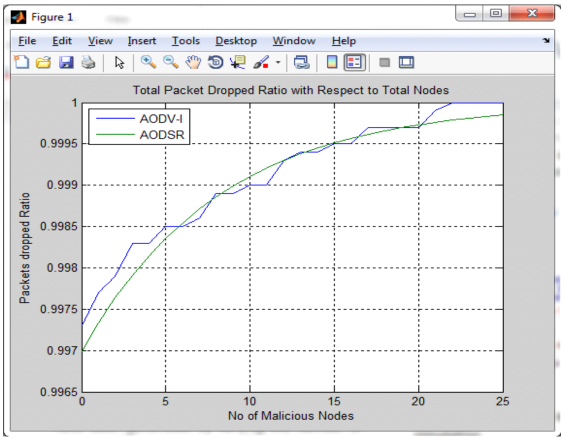

Figure 3.2 Total packet dropped with respect to no. of malicious nodes

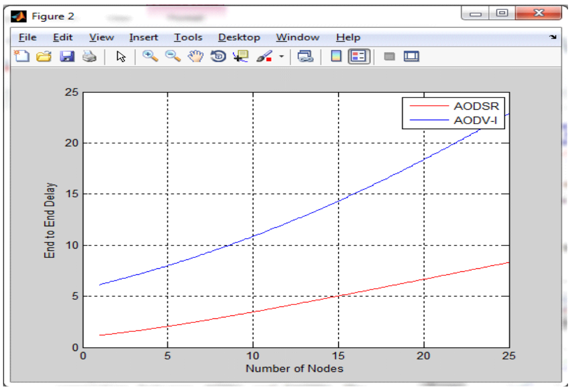

Figure 3.3 End to end delay with respect to total number of nodes

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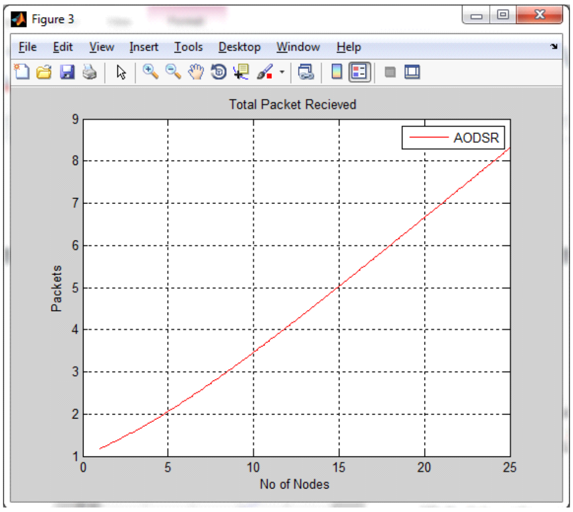

Figure 3.4 Total packet received of AODSR with respect to total number of nodes

VI.CONCLUSION

This paper evaluates the performance of AODSR. A simple hybrid AODSR algorithm is developed to find the shortest path routing in a dynamic ad-hoc network. This algorithm uses an efficient coding scheme. The malicious nodes length depends on the number of nodes in the network. The MATLAB environment searches the shortest path using random way point mobility model as the default one. The algorithm is simulated to solve the network of 5 nodes for the first one as the source node. The developed AODSR is simulated to find the solution for the same problem. The obtained results affirmed the potential of the proposed algorithm that gave the same results as Dijkstra's algorithm.

In the future, the developed AODSR will be investigated to decrease the shortest path length especially for network with a large number of nodes.

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