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Shortest Path Routing Over Ad-hoc on demand dynamic randomized source routing protocol in Scalable Mobile Ad Hoc Networks

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ABSTRACT

Increase number of nodes in the wireless and mobile ad hoc network environment leads to different issues like power, data security, QoS (quality of service), simulators and security. Between these security is the peak issue faced by most of the wireless and mobile ad hoc networks. Especially networks without having a centralized system (MANETS) is facing severe security issues. One of the major security issues is the malicious nodes while finding the shortest path. In our proposed, randomized based distance vector for dynamic route having hybridized with AODV protocol which generated with AODSR that concentrated on analyze the impact of scalability over the mobile ad hoc network and the behavior of shortest path routing algorithm. 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

With the advance of the 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).While the infrastructure cellular system is a traditional model for mobile wireless network, here we focus on a network that does not rely on a fixed infrastructure and works in a shared wireless media. Such a network, called a mobile ad hoc network (MANET) [1], is a self-organizing and self-configuring multi-hop wireless network, where the network structure changes dynamically due to member mobility.

Ad hoc networks are very attractive for tactical communication in military and law enforcement. They are also expected to play an important role in civilian forums such as convention centers, conferences, and electronic classrooms. Nodes in this network model share the same random access wireless channel.

They cooperate friendly to engage in multiple-hop forwarding. Each node functions not only as 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. Routing in ad hoc networks faces extreme challenges from node mobility/dynamics, potentially very large number of nodes, and limited communication resources (e.g., bandwidth and energy). The routing protocols for ad hoc wireless networks have to adapt quickly to frequent and unpredictable topology changes and must be parsimonious of communications and processing resources.

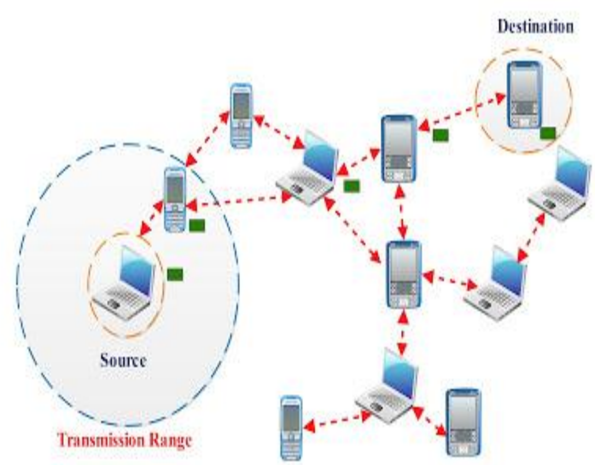

Figure 1: A mobile ad-hoc network

Due to the fact that bandwidth is scarce in MANET nodes and that the population in a MANET is small, as compared to the wire line Internet, 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 concern in MANETs because large routing tables imply large control packet size hence large link overhead. Routing protocols generally use either distance-vector or link-state routing algorithms [2].

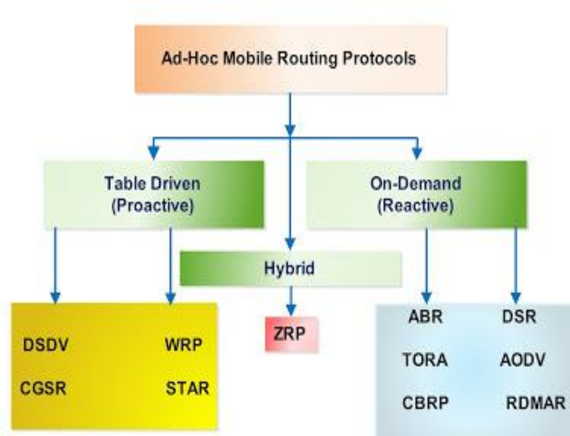

Figure 2:Routing Protocol Classification

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 and exchanged at each node. DV protocols are generally known to suffer from slow 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.

II.PROBLEM STATEMENT

Consider a routing path from a source node A to a destination node I as shown in Figure 3(a). This 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. A packet takes eight hops while getting routed from A to I.

During the course 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. However, because of the usage of route caches and the validity of the existing routing information, the routing table entries are not updated.

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 goal of this paper is to identify such situations and self-heal and optimize the paths dynamically by modifying the entries of the routing tables.

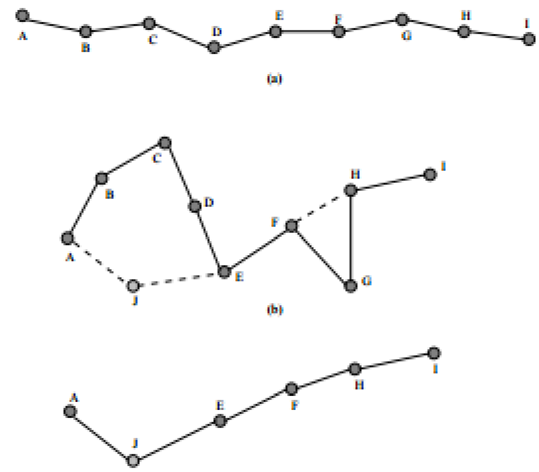

Figure 3: An example of the changes in routing paths

The primary goal of the solution approach is to discover short-cut routing paths as and when feasible. The basic scenarios of the short-cut discovery process are shown in Figure 3. In Figure 3(a), the path A-B-C can be reduced to A-C as C is within the transmission range of A. This short-cut path formation is termed as (2, 1) reduction.

Figure 3(b) 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 theproposed SHORT algorithms.

Intuitively, higher the differencebetween *n* and *k*, the better will be the performance ofSHORT.SHORT is applicable in conjunction with any underlying ad hoc routing protocol that formulates the entries of therouting tables. The underlying routing protocol need nothave to be very efficient or optimal. It could be very simpleand adequate enough to ensure a reachable path from asource to the destination. SHORT can self-heal the path foroptimization.

IV. SYSTEM MODEL

Random waypoint function for shortest path routing

This paper studies random waypoint movement in a one– or two–dimensional system space A. In one dimension we consider a line segment; in two dimensions we consider a rectangular area of size a × b or a circular area with radius a. For proper nomenclature, several random variables must be defined. These variables are written in upper case letters, whereas specific outcomes are written in lower case.

Multi–dimensional variables (e.g., random coordinates in an area) are written in bold face; scalar variables (e.g., random lengths) are in normal font. The parameter j identifies a particular node, and the discrete time parameter i denotes the movement period of this node. The random variable representing the Cartesian coordinates of the waypoint that a node j chooses in its movement period i is denoted by the vector P(j) i . With this definition, the movement trace of an RWP node j can be formally described as a discrete–time stochastic process, given by selecting a random waypoint P(j) i for each movement period i:

$$\{P^{(j)}_{i}\}_{i\in No}= P^{(j)}_{o}, P^{(j)}_{i,}P^{(j)}_{2,}P^{(j)}_{3} \dots \text{ . (1)}$$

These waypoints are independently and identically distributed (i.i.d.) using a uniform random distribution over the system space A. Since each node moves independently of other nodes, it is sufficient to study the movement process of a single node. Thus, we often omit the index j. Let us now consider the case that a node randomly chooses a new speed Vi for movement from Pi−1 to Pi and a pause time Tp,i at waypoint Pi. The complete movement process of a node is then given by

$$\{(P_i,Vi,Tp,i)\}_{i\in N}=(P_1,V_1,T_{p,1}),(P_2,V_2,T_{p,2}),(P_3,V_3,T_{p,3})..(2)$$

Where an additional waypoint P0 is needed for initialization. A sample of this process is denoted by {(pi, vi, τp,i)}i∈N . A movement period i can be completely described by the vector (pi−1, pi, vi, τp,i). When we just refer to a single random variable of a process, we omit the index i and just write P, V, or Tp.

The values for the pause time are chosen from a bounded random distribution fTp (τp) in the interval [0, τp,max] with τp,max < ∞ and a well–defined expected value E {Tp}. In general the speed is also chosen from a random distribution

f_V (v) within the interval [v_{min}, v_{max}] with $v_{min} > 0$ and $v_{max} < \infty$.

V. PROPOSED METHOD

5.1 AODV ROUTING PROTOCOL

In this section, a trust based management framework for securing Ad hoc On Demand Distance Vector Routing Protocol has been presented. In this mechanism, Constant trust factor is used to evaluate the trusted and shortest path for communication in the network.

1. To prevent the attack by malicious node, the identity information like IP address and Trust factor value has been used. This identity information is assigned to each node in initialization phase or when the node will be configured.

2. In the proposed scheme, 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. If the current node is final destination 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 appends its own trust value to the trust accumulator on this route discovery phase.

6. Each node also updates its own routing table. The following formula can be used to evaluate the trusted and shortest path.

Sum of trust values * √No of hops/ No of hops

Where,

Sum of trust value = $\sum$ trustvalue (i)

5.2 HYBRID AODSR PROTOCOL

1. In the Ad-hoc Dynamic Source Routing (AODSR) protocol for ad hoc networks, due to the rapidly changing network topology, a route discovery is used to dynamically discover a route to any other node in the network in an “on demand” manner. 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 alreadyprocessed 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 anAd-hoc dynamic source routing technique for ad hoc networks combined with Random way point network location awareness. Every time a node has a packet to transmit] it computes from its location table obtained through the dissemination mechanism, the graph G representing the “current” network topology.

4. Then, it applies to G, locally, a (centralized) 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 and the overall needed bandwidth. 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 simple and easy to implement] relying only on a bandwidth and energy efficient dissemination mechanism, rather than on the route request and reply control packets required by DSR. As well, our protocol does not require any complex route caching schemes, nor any route maintenance to be performed, without which DSR would not be a competitive routing protocol.

VI.IMPLEMENTATIONRESULT

An MATLAB simulator has been used to simulate the results. In this section, the performance metric and implementation details of the proposed protocol has been presented

Three performances metric are evaluated in our simulation:

1. Numberof packetsdropped – It is the number of packets dropped by the routers at the network layer due to the capacity of the buffer.

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

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

5.3 Working of Random way point mobility model in our work

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.

After getting the values of each performance metric according to each protocol, the graph has been plotted to show the comparison between AODV and AODSR. The simulation parameter in this work is shown in table-1.

Simulation environment	**MATLAB-2012a**
No. of Nodes	**25**
protocol	**AODV,AODSR**
Packet of size	**1000**
Packet dropped ratio of AODV	**0.998**
Packet dropped ratio of AODSR	**0.995**
Packet received of AODSR	**7**
End to end of AODV	**23**
End to end of AODSR	**8**

In this section, the results have been analyzed using the three performances metric 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.

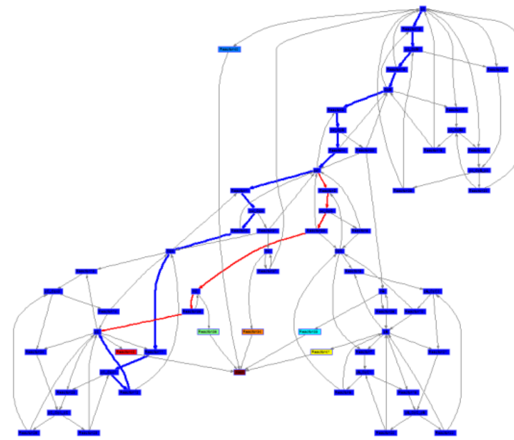

Figure6.1 Network topology for simulation

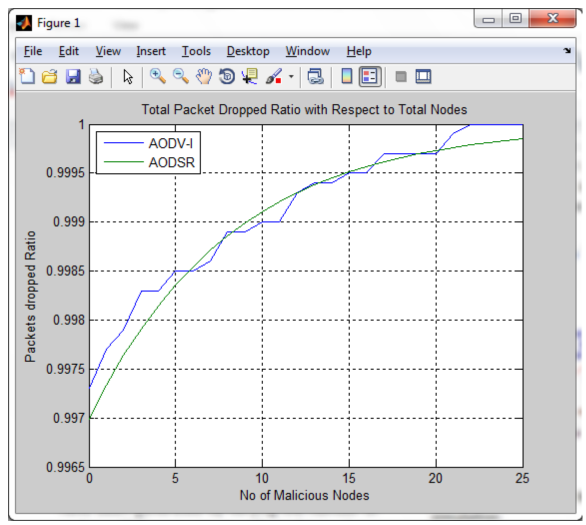

Figure 6.2 Total packet dropped with respect to no. of malicious nodes

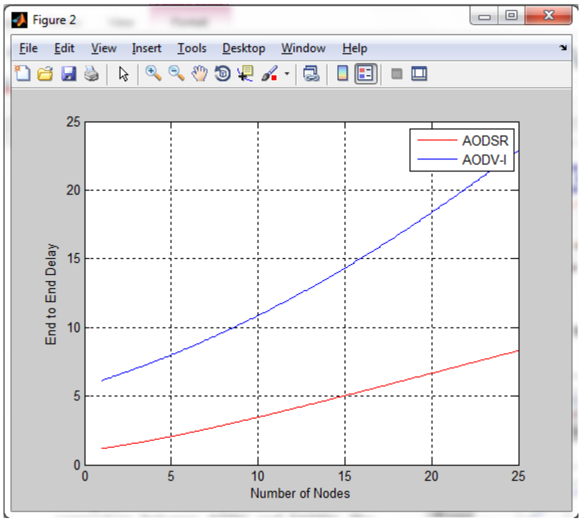

Figure 6.3End to end delay with respect to total number of nodes

The results of simulation show that the AO-DSR works more proper 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.

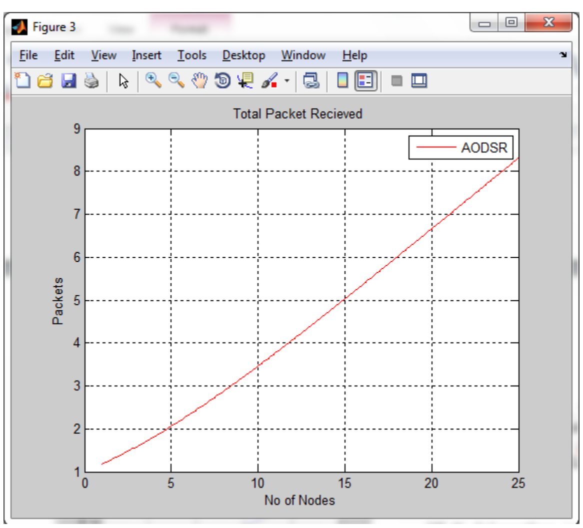

Figure 6.2 Total packet received of AODSR with respect to total number of nodes

VII.CONCLUSION

A simple hybrid AODSR algorithm is developed to find the shortest path routing in a dynamic network. The developed 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. Also, 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'a algorithm.

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

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