Performance Enhancement of AODV with Distributed-DSR Routing Protocol in Manet

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Abstract

The proposed system introduces a Distributed Dynamic Source Routing (D-DSR) protocol to secure the network effectively which can inhibit the attacker from copying response of the packets. A multi-path secured routing scheme is used in the work. Reliability and performance of the protocol is measured through packet delivery ratio, attack prevention efficiency, path optimality and routing packet overhead. The results obtained exhibits high security and low false alarm rate.

Keywords: Adhoc on Demand Distance Vector Routing, Distributed - DSR, Mobile Adhoc Networks, Performance Enhancement Routing

1. Introduction

The significance of MANET is its dynamically varying topology; the nodes are predictable to be power-aware due to the bandwidth controlled network. Alternative problem in such networks is safety or security. Each node in the network stimulates to detect the presence of malicious nodes in the surroundings. Comparison of AODV and DDSR is done to understand the applicability of routing protocols.

Ad hoc On Demand Distance Vector (AODV) routing algorithm is a routing protocol intended for ad hoc mobile routing. AODV is capable for both i.e. unicast and multicast networks. It is an on Demand routing algorithm, which provides routes among nodes only as anticipated by source nodes. It preserves these routes as long as they are required.

DSR permits the network to be entirely self-organizing and self-configuring. The protocol is designed on the basis of two principles i.e. route discovery and route preservation. The purpose behind combining both principles together is to search for the shortest path and similarly to maintain source route to random destination in the Mobile ad hoc network. In the proposed work, enhanced routing protocol in Mobile Ad hoc Network (MANET) is defined. The optimization is done on Dynamic Source Routing (DSR) protocols using Distributed (DSR) algorithm.

Such a network defined above is presented in Figure 1, there are no base stations and each node co-operates with other nodes to forward packets in the network.

Figure 1. A mobile ad hoc network.
In MANET, each node acts as a router which is different from a Wireless LAN's, where the central device acts as the router between the nodes.

Rest of the paper includes literature review, problem statement, proposed scheme and algorithm following results.

2. Conventional Protocols

Khelifa et al.\(^1\) examined the practicality of M-AODV and AODV. The experiential route discovery of M-AODV recovers the presentation of AODV in terms of metrics, packet delivery ratio, end to end delay, and energy consumption. In future, they deliberate upon the application of Energy aware AODV protocol to preserve further energy.

Maurya et al.\(^2\) proposes Related on-demand routing protocols that works on sensitive and active routing. Their experiment revealed that related on-demand routing protocol deals quickly to Mobile networks with low dispensation and low bandwidth operation.

Das et al.\(^3\) worked upon two on-demand routing protocols which are DSR and AODV. The pros of both the techniques are merged and calibrated in this technique. This lead to invention of a new routing technique containing features of AODV and DSR.

Thanthry et al.\(^4\) describes a new protocol ‘EMAODV’ which is a subset of AODV. The results gained from the simulation prove that EMAODV achieves better outcomes than AODV in terms of throughput, sum of route discoveries, and switch overhead but, the average end-to-end delay of EM-AODV is higher than that of AODV.

Yang et al.\(^5\) related the AODV, R-AODV and SR-AODV in the discussion. After imitation it is concluded that SR-AODV exhibits better properties than R-AODV in terms of metrics, packet delivery ratio, end to end delay, and power consumption.

Li et al.\(^6\) assessed the TRP with S–AODV and it is experiential that TRP is an energy efficient protocol which not only saves energy as well as works on the reduction of the routing delay.

Yang et al.\(^7\) examined the enactments of AODV and M-AODV. It is proven that on demand protocol not only saves energy of the tiny battery source but also avoids unnecessary traffic congestion on the communication line as well as make a way for efficient utilization of Bandwidth.

Sharma et al.\(^8\) appraised the results of dissimilar development algorithms for AODV and adapted AODV. Their experimental results declare that delay between the nodes has been decreased.

Wei et al.\(^9\) is based on Demand Distance Vector (IPODV) routing protocol. The work carried out by them is based on the routing preservation instrument and the national bench system of the AODV routing Protocol.

Chaurasia et al.\(^10\) inspected on OLSR, DSDV, DSR, AODV, and TORA protocols. Outcome of their study states that protocol security and power consciousness is problematic to achieve in Mobile ad hoc networks. Their next aim is to work on core problems of security and power consumption in MANET routing protocols.

Singh et al.\(^11\) proposed a technique to lay down the network node in an optimized manner. Bacterial Foraging optimization technique is used to find out the coordinates where the nodes can be placed to eradicate the side effects of poorly distributed network. Results of the paper revealed that BFO can be used to lay down the nodes at optimized places thus leading to enhanced network lifetime.

Gupta et al.\(^12\) examined the vulnerability in MANET’s. Their survey states that MANET’s are prone to attacks like Black-hole etc. To make more reliable MANET’s, author has proposed a trust based approach whose performance is measured by throughput, drop packets, speed and simulation time and packet delivery ratio. Their simulation results demonstrate that outcome is better than existing techniques.

Upadhyay et al.\(^13\) found that MANET’s are battery sensitive networks. The primary work carried out by the authors is the finding of a technique which can help to reduce the power consumption. The proposed technique elaborates a routing protocol which uses route discovery method to find the optimized path for data transmission. The result of this paper seems fascinating as the result of the proposed work is better than the DSR.

Mukherjee et al.\(^14\) stated that majority of the work in routing protocol has been carried out while using route discovery and trust calculation. Further they discovered that these parameters are not sufficient for finding the routes when MANET’s nodes are mobile. To ensure proper path and to add security, they proposed direct trust scheme with average encounter rate. Proposed technique has produced better results as compared with the AODV and TAODV.
3 Problem Statement

On-demand Route Maintenance results in delayed awareness of mobility: a node is not notified when a cached route breaks until it uses the route to send packets. DSR has some problems concerning the cache usage: The advantage of multiple routes becomes a disadvantage with high mobility (lack of good criteria for choosing one particular of the possible routes). In bigger networks, the problem is even more severe.

4 Proposed Scheme

- Normal AODV, DDSR (Distributed DSR) with different node speeds and different percentages of selfish nodes are assumed. When a node changes position, it transmits RREQ packet, to fetch the path of transmission.
- If Route Reply RREP is received from the crossover searching layer then link status will update the success route as in confidentiality and show remaining pending network Nodes.
- If normal Node ID is included in crossover searching layer then advance node would take over the normal node in cluster which would be helpful for node stability.
- A network of 100 nodes with different percentages of selfish nodes, from 0% up to 30%, and moving at different speeds. This mobility would be helpful in reducing end to end delay.
- In case that there are no selfish nodes in the mobile ad hoc network, both AODV and DDSR have almost identical network throughput values.

5. Proposed Algorithm

5.1 Assumptions

\( S_d \) = Distance based node sequence  
\( F_{RREQ} \) = First Route Request  
\( NODE_{PRV} \) = Previous Node  

**Broadcasts RREQ packet**: This protocol works in the route reply phase only.  
If RREP packet received then  
Sends data packets;  
Otherwise  
\( N_t \) = Link Status for Next Hop Then RREQ = 0;  
// where \( N_t \) = Intermediate Nodes  
End  
If  
while (prev)  
{  
if (Node_id > \( N_t \))  
{  
prev = \( N_{prev} \) \( \rightarrow \) \( NA_{prev} \);  
if (\( (new \ node > next = prev > next) \))  
new node \( \rightarrow \) next > prev  
else  
tail = new node; prev > next = new node; return  
end;  
end;  
}  
End;  
If RREP packet received from suspected node then  
Initiates a route to next node;  
If \( [T_{min} = \text{no. of nodes ( )}] \) // minimum Threshold  
\( T_{min} \)  
\( S_{dst} = > S \),  
//Reverse of source destination route must meet the trust.  
// Non-Repudiated.  
//qualified route is greater than the requirement of the data packet.  
//If such routes are found, Next hop = \( S \),  
Hop count=1  
Send FRREQ packet to next node.  
end;  
End;  
If FRREP packet received then  
Extract FRREP packet information  
while (prev)  
{  
if (then Node_id > \( N_{sort} < prev > Node_{id} > N_{sort} \))  
{  
prev = prev > prev; // Go up the queue  
}  
else  
{  
new node > prev = prev1;  
if ((\( new \ node > next = prev > next) \))  
novel node > next > prev = new node;  
else  
tail = new node;  
prev > next = new node;  
Return;
Figure 2 demonstrates the path selection criteria adopted by AODV protocol in MANET. It is an on-demand routing protocol that builds routes only when desired by nodes. AODV forms trees which connect group members. Two kinds of paths are established in AODV which is forward and backward (indicated in bold and dotted lines). Forward propagation is done for route setup (RREQ) and backward propagation is carrying route itself (RREP).

Figure 2. AODV route discovery.

Figure 3 illustrates the route discovery mechanism of DDSR. DDSR is a routing protocol for wireless mesh networks. It works very similar to AODV except it uses source routing instead of relying on the routing table at each intermediate device.

Figure 3. DDSR route discovery.

6. Results

AODV and DDSR algorithm was tested on a virtual platform. We assessed the AODV and DDSR protocol by measuring the number of broadcasts aimed at 100 percent network attention of the MANET. Moreover, we restrained the performance time of the procedure for diverse network dimensions and different nodes. Parameters like network coverage, setup time, recovering time is also assessed.

Figure 4. Attack prevention efficiency (end to end).

To increase efficiency, it is important to classify the performance of existing protocols. In order to do so, comparison of the performance of AODV and DDSR routing protocols in terms of Removed Attack Efficiency (End to End) is carried out and results are being clearly indicated in Figure 4. DDSR provides a higher security from attacks as compared to AODV routing protocol.

Figure 5. Packet delivery ratio of AODV and DDSR.

The larger value of DDSR in Figure 5 indicates that the more data packets are positively delivered to destination.
It is pointing towards a fact that DDSR has higher packet delivery ratio than AODV. It does not mean that AODV protocol does not have any worth. Since AODV is table driven in nature, it saves bandwidth and later increases performance of network.

The strength of any protocol lies on the quality of the work carried out. The quality of the routing protocol can be found through its path optimality factor. Figure 6 reveals the path optimality attributes of both the techniques. It is found from the study that AODV provides optimal path than DDSR.

Efficient utilization of the resources is the key factor to judge the performance of a protocol. This is the last parameter chosen to find the best protocol out of AODV and DDSR. Figure 7 indicates a broad picture of Routing packet overhead parameter. Overheads are additional information which is sent along the actual information. This value should be as less as possible. It is clearly visible from the Figure 7 that in AODV overhead is quite less as compared to DDSR.

Table 1 is citing the best algorithm in different sections of the performance assessment criteria.

| Performance Assessment Parameters | Optimized Technique |
|-----------------------------------|---------------------|
| Attack Prevention Efficiency      | DDSR                |
| Packet Delivery Ratio             | DDSR                |
| Path optimality                   | AODV                |
| Routing Packet Overhead           | AODV                |

7. Conclusions

The proposed work deals with the problem of unstable route for MANETs and presents a new route protocol Distributed-DSR. A make before break concept is proposed in the route repair mechanism of Distributed-DSR. In the proposed routing protocol, a new route is found, as far as possible, before a route break occurs instead of initiating a new source route discovery request as it is done in AODV routing protocol. These provisions lead to an improvement in AODV routing protocol thereby reducing the loss of packets during transmission which further reduces retransmissions. Reductions in the transmissions indirectly save energy of the MANET nodes. Thus, proposed algorithm has widened the scope of MANET and its applications.

8. References

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