A FEASIBLE REBROADCAST SYSTEM FOR LESSENING ROUTING OVERHEAD IN MANETS
B.V.S. Umaprathyusha¹, Dr. K. Ramesh Babu²

Received on: 15.10.2016
Accepted on: 12.11.2016

Abstract:

MANET-Mobile Ad Hoc network is a standout amongst all the most vital wireless networks. The remarkable features of MANET incorporates - no fixed network infrastructure, each and every node goes about as a transceiver, self configuring ability and high mobility. Because of this high mobility MANETs are often defenseless against attacks. In this way, there is a requirement for an IDS-Intrusion Detection System to protect MANETs. One of such an IDS is Enhanced Adaptive Acknowledgment (EAACK) Technique which makes use of DSA-a digital signature scheme to keep away from false misbehavior report and forged acknowledgement packets. Yet, this EAACK plan encounters an issue of Routing Overhead (RO) when it is implemented with DSA.

Hence, we propose a Feasible Rebroadcast system (FRS) in this paper, which focuses on neighbor coverage information for decreasing the Routing Overhead.

Keywords: MANETs, neighbor coverage, EAACK, routing overhead, Probabilistic rebroadcast.

1. Introduction

In the recent trend wireless networks are more preferred than wired networks due to its reduced costs and improved technology.

MANET-Mobile Ad Hoc network is defined as a collection of nodes that are mobile equipped with both a transmitter and receiver that communicates using bidirectional wireless links.

Instead the communication in MANETs is limited to the range of transmitters, it can be able to create a self-configuring and self-maintaining network without using any centralized network. Also MANETs are very popular in critical mission applications, hence it is important to maintain the network security. But MANETs are vulnerable to various types of
attacks due to its open medium and mobility. Therefore it is necessary to develop a special intrusion detection system (IDS) for MANETs. But Routing Overhead (RO) is the common problem which is being faced by the existing IDS in MANETs. To overcome this, we propose a Feasible Rebroadcast System that makes use of neighbor coverage information for lessening the Routing overhead.

2. Existing IDS in MANETS

IDS are added to improve the security level of MANETs. The existing approaches are namely

1. Watchdog
2. TWOACK
3. Adaptive
   Acknowledgement (AACK)
4. Enhanced Adaptive
   Acknowledgement (EAACK)

All the above four schemes are Acknowledgement based schemes. But when compared to all the earlier schemes the later scheme i.e., EAACK is more preferable because it guarantees that the acknowledgement packets are valid and authentic by adopting a digital signature scheme which cannot be accomplished with the earlier schemes. However the drawback with this scheme is, though it can overcome the problems caused by Forged Acknowledgement, false misbehavior report and it may lead to more routing overhead when the number of nodes increases.

3. Problem Description:

When the IDS performance is tested against the False misbehavior report and forged acknowledgement packets, the EAACK scheme outperforms in all the considered scenarios, but it requires more computational power to be verified and it generates more RO’s when the number of nodes gets increased. The primary reason for RO’s in MANETs is, due to the mobility of nodes MANET results in persistent path failures followed by route discoveries, which occurs due to the frequent link breakages and so this would results in the increase of overhead of routing protocols, constriction in the packet delivery ratio and also increase in the end-to-end delay. Thus the essential problem to be considered is Routing Overhead which occurs in route discovery. But in order to discover the route after link failure a RREQ route request packet is to be broadcasted to the required networks which results in unnecessary retransmissions of RREQ packets.
results in broadcast storm problem. Thus the number of rebroadcasts should be limited so that the broadcasting can be effectively optimized. In order to perform this we propose a novel method for route discovery called Feasible probabilistic rebroadcast protocol (FPRP), such that it can be applied for route discovery in EAACK as a substitute in place of DSR protocol.

4. Scheme Description: In this section, a detailed description of the proposed scheme is given. The approach explained in this paper is based on the previous work. In this paper we improve the performance of MANETs by introducing FPRP instead of DSR in EAACK. EAACK is a hybrid scheme which consists of

1. ACK
2. S-ACK (Secure ACK)
3. MRA (Misbehavior report authentication)

The operation of EEACK is as follows:

1. ACK: This scheme follows an end to end acknowledgment which is shown below.
It sends an S-ACK packet to switch to S-ACK mode if the acknowledgement is not received by the source node.

2. S-ACK (Secure ACK): This scheme is an improved version of TWOACK whose working is depicted as follows.

The S-ACK scheme then switches to MRA mode to confirm the malicious nodes.

3. MRA (Misbehavior Report Authentication): The primary work of MRA scheme is to detect the misbehaving nodes with the presence of false misbehavior report which may be generated by the malicious attackers to report falsely the innocent nodes as malicious. This scheme should authenticate whether the receiver node has received the reported missing packet. This can be done choosing an alternative route. For choosing such an alternative route the source node starts the FPRP for sending the routing request to the neighbor nodes.

The working of FPRP is as follows: Our proposed scheme is based on probabilistic broadcasting which utilizes the coverage area and neighbor confirmation.

Metrics used:

1. **Additional coverage ratio**: To adequately gain the knowledge about neighbor coverage, a rebroadcast delay is applied to figure the rebroadcast order so that more factual additional coverage ratio is obtained i.e., coverage area is used to determine the rebroadcast probability.

2. **Connectivity factor**: This metric is used to retain the network connectivity and to reduce the unnecessary retransmissions.

**Algorithm Description**: The general description of the FPRP applied for the reduction of routing overhead in MANETs is as follows:

**Definitions**:

- **RREQ_v**: It is defined as the route request packet that can be received from node v

- **R_v:id**: for the RREQ it is an unique identifier.

- **N(u)**: Neighbor set of node u.

- **Timer(u,x)**: x is the id node u for which the timer is set for sending the route request.
For node $u,x$ is the id to set the uncovered neighbors set for RREQ.

Algorithm:

1. If the new RREQs is received by the node from node $s$ then the initially uncovered neighbors set $U(n_{i}\text{,}_R_{s}\text{,}_id)$ for RREQs is computed as

   $$U(n_{i}\text{,}_R_{s}\text{,}_id)=N(n_{i})-[N(n_{i})\cap N(s)]-[s]$$

2. Then the rebroadcast delay is computed as

   $$Td(n_{i})=Max\text{Dealy} \times Tp(n_{i})$$

   Where $Tp(n_{i})=1$-

3. A timer is to be set as $\text{Timer}(n_{i},R_{s}\text{,}_id)$

4. end if

5. while a duplicate RREQj is received by $n_{i}$ from $n_{j}$ before the $\text{Timer}(n_{i},R_{s}\text{,}_id)$ expires do

6. $U(n_{i}\text{,}_R_{s}\text{,}_id)=U(n_{i}\text{,}_R_{s}\text{,}_id)-[U(n_{i}\text{,}_R_{s}\text{,}_id)\cap N(n_{j})]$ 

   ie...,adjust the uncovered neighbor set.

7. then discard (RREQj)

8. end while

9. if the $\text{Timer}(n_{i},R_{s}\text{,}_id)$ expires then

   $$R_{a}(n_{i}) = \frac{|U(n_{i},R_{s}\text{,}_id)|}{|N(n_{i})|}$$

   $$F_{c}(n_{i}) = \frac{N_{c}}{|N(n_{i})|}$$

   $$P_{re}(n_{i}) = F_{c}(n_{i}) \cdot R_{a}(n_{i})$$

   the rebroadcast probability is computed as $P_{re}(n_{i})$

10. if $\text{Random}(0,1)\leq P_{re}(n_{i})$ then broadcast RREQs

11. else discard(RREQs)

12. end if

13. end if

Performance Evaluation: In order to evaluate the performance of the FPRP, we make a comparison of this protocol with DSR protocol using the simulator NS-2.
The simulation parameters are considered as follows:

Simulation parameters are to be considered as shown in the table.

<table>
<thead>
<tr>
<th>Simulation Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulator</td>
<td>NS-2 (v2.30)</td>
</tr>
<tr>
<td>Topology Size</td>
<td>1000m × 1000m</td>
</tr>
<tr>
<td>Number of Nodes</td>
<td>50, 100, 150, ..., 300</td>
</tr>
<tr>
<td>Transmission Range</td>
<td>250m</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>2Mbps</td>
</tr>
<tr>
<td>Interface Queue Length</td>
<td>50</td>
</tr>
<tr>
<td>Traffic Type</td>
<td>CBR</td>
</tr>
<tr>
<td>Number of CBR Connections</td>
<td>10, 12, 14, ..., 20</td>
</tr>
<tr>
<td>Packet Size</td>
<td>512 bytes</td>
</tr>
<tr>
<td>Packet Rate</td>
<td>4 packets/sec</td>
</tr>
<tr>
<td>Pause Time</td>
<td>0s</td>
</tr>
<tr>
<td>Min Speed</td>
<td>1 m/s</td>
</tr>
<tr>
<td>Max Speed</td>
<td>5 m/s</td>
</tr>
</tbody>
</table>

The performance results are based on the following metrics:

1. **MAC collision rate**: at the MAC layer the average no of packets dropped due to the collision

2. **Normalized routing overhead**: It is the ratio of control packets total packet size to the data packets total packet size delivered to the destinations.

3. **Packet delivery ratio**: (PDR) it is the ratio of no of packets received by the receiver node to the no of packets sent by the sender node.

4. **Average end-to-end delay**: It includes the possible delays from source node to receiver node.

The experiment is carried out by considering

1. Number of nodes that varies from 50 to 300 to evaluate the impact of different network density.

2. Normalized routing overhead whose range is from 0 to 3.

By considering these factors the simulation results are as follows:

Fig: Normalized Routing overhead with number of nodes varying.
The above figure reflects the Standardized Routing overhead with various network density. From the above results it is shown that the FPRP reduces the routing overhead that occurs at the time of route discovery by about 30.8% when compared to the DSR protocol. This indicates that the proposed FPRP is most efficient than the DSR protocol to be used in EAACK for Route discovery in the MRA scheme, so that an efficient IDS with limited routing overhead can be implemented in MANETs.

**Conclusion:**

In this paper, we proposed a more effective Feasible Rebroadcast Probabilistic Protocol for viewing the overhead caused due to the Routing in MANETs while implanting the EEACK scheme. The proposed scheme maintains the route discovery by considering the factors like connectivity factor and additional coverage ratio. Also Simulation results sight that the proposed FPRP induces less rebroadcast traffic, less redundant rebroadcast, less network contention and collision to reduce the network overhead and to upgrade the packet delivery ratio. Also our proposed scheme yields a good performance when there is high network density or traffic.

**References:**


