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Table Driven Approach against Flooding Attack in Ad-hoc Network

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Abstract— Broadcasting in MANET usually based on flooding in which source node broadcast a packet to its neighbours. Main problem with flooding is that it causes unproductive often result in harmful bandwidth congestion and causes redundant broadcasting of packets so it creates Broadcast Storm Problem. Our proposed algorithm Table Driven Approach against Flooding Attack (TDAFA) helps in reducing flooding attack by maintaining count of hello packets. Using simulation we proved that our algorithm results increase in packet delivery ratio, increase in throughput and decrease in packet loss ratio as compared to AODV protocol.

Keywords— MANET; Broadcasting; bandwidth: flooding; broadcast storm problem;

I. Introduction

In daily life people need to move and communicate with each other. So to satisfy their need, mobile network has been formed. MANET (Mobile Ad-Hoc network) is a group of autonomous mobile nodes. These mobile nodes worked as both host and router. MANET acts as light weighted terminal with less CPU processing capability, small memory size and less power storage. MANET is a dynamically self organized network with no central administrator and infrastructure support. Due to this litheness it can easily used in the military operation to maintain the information network between the solider.

MANET has some limitations like limited resources and physical security. MANET is hard to detect the malicious node because of its volatile network topology. There are some major issues which are involved in MANET such as broadcasting, mobility management, and power management. Our paper focuses on broadcasting where source node send same packet to its entire neighbor. Broadcasting is a basic operation in all type of network used to discover neighbor. Solution to broadcast is flooding where each node receives a broadcast packet and then it simply rebroadcast to its entire neighbor.

Broadcasting through flooding is very expensive method which gives the result in transmission redundancy and collision in the network. Such a situation is referred as broadcast storm problem. Many researchers have identified this problem by showing how severe is through simulation. Researchers proposed several suggestions based on counter-based where number of duplicate message received at node is less than threshold value .In some cases threshold value is based on local connectivity information [3]. Threshold based on neighbourhood information which divides according to the Average number of neighbours to decide the node region. In some research counter based scheme combine with other scheme such as position based scheme where two separate threshold value set for EAC (Expected additional Coverage). Also combine with Probability based scheme using rebroadcast probability value around 6.5 where node dynamically adjusts counter value using neighbourhood information to reduce problem.

To address these varying threshold values and reducing storm problem proposed algorithm used table driven approach against flooding attack [TDAFA] containing two phases where first phase counts number of neighbors of each node in the network and select its specific region. In second phase node maintains a hello packet transaction. If a node receives more number of hello packets from the specific node within a threshold time period then flooding attack is detected and reduced.

The paper is organized as follows. Section II briefly illustrates the related work. Section III explains the proposed algorithm. The design and implementation details are depicted in section IV and conclusion in section V.

II. Related Work

Many techniques in the literature have been deals with flooding attack in mobile ad-hoc network. In this section we present various major concept proposed in literature. Few recent proposals are as follows:

B. Williams, T. Camp *et al* [2] proposed different broadcast protocol scheme like probability based, counter based, area based, distance based, location based and neighbour knowledge scheme for mobile ad hoc networks. In the probabilistic scheme, when receiving a broadcast packet for the first time, a node rebroadcasts the packet with a probability p. In the distance-based scheme a node rebroadcasts the packet only if distance between the sender and the receiver is larger than a given threshold value. In the location-based, node rebroadcasts packet only when the additional coverage due to the new release is larger than certain bound and In Counter based scheme, c as counter are set to keep track of number of duplicate messages received, counter threshold C is chosen and Random Assessment Delay (RAD) timer is set. This method gives fixed threshold value so it scores high efficiency only when used with uniform density networks.

Y.-C. Tseng *et al* [2], proposed adaptive counter-based Scheme where threshold value is based on local connectivity information So it extends fixed threshold c into function threshold = C(n) where n is the number of neighbors . Thus, each host will use a threshold C (n) depending on its current values of n .It determines whether to rebroadcast or not. This method only maintains the records of a packet rebroadcast status for every node by considering threshold value.

M.Bani yassein *et al* [3] SCB Broadcast scheme used average number of neighbour to dynamically adjust the threshold value in either sparse or dense network. It based on a counter c that is used to keep track of the number of times the broadcast packet is received. A counter C threshold is decided based on neighboring information.

M.Bani yassein , A.Al-Dubai *et al* [4]Ultra smart Counter-Based broadcast algorithm allow a given node to dynamically adjust its counter based threshold value depending on whether it is located in sparse, medium or a dense network region..

M, M. Khaoua *et al* DPCB [5] proposed combination of counter and probability based broadcasting scheme to compute dynamically the forwarding probability at a given node using a probability function. This function uses the neighborhood information at a node together with the threshold value. This algorithm investing the performance of counter based flooding algorithm in real application only.

Xiaoman Wu *et al* [6] Proposed PCB scheme integrate position and counter based schemes where each node is able to make a local decision about whether to rebroadcast, according to its adaptive EAC threshold and counter threshold value. This scheme has high time overhead and high number of control messages exchanged to broadcast one packet.

III. PROPOSED METHOD

A. System flow:

Fig. 1 shows the system flow of the proposed system in two different phases: Neighbor Computation Phase and Reduce Flooding Attack phase.

1. Phase I: Neighbour Computation Phase

- Broadcast hello message

When network initialize, node broadcast hello message to its one hope neighbor. Initially time Tsec is fixed and it is incremented by T1sec time till it reaches the threshold time.

- Neighbor Counting

After every Tsec time each node counts number of neighbors and stores this value in Nodeneighborsarray. This process continues till time reaches to threshold time.

- Identify region

To identify the region Nodeneighborsarray compares with minimum lower threshold and maximum upper threshold neighbor for each node. If the nodeneighborsarray is less than the minimum lower threshold number of neighbor(Avg1) then node is in sparse region if it is in between(Avn1 and Avg2) then the node is in medium region and if it is in more than maximum upper threshold number of neighbor (Avg2) then node is in dense region.

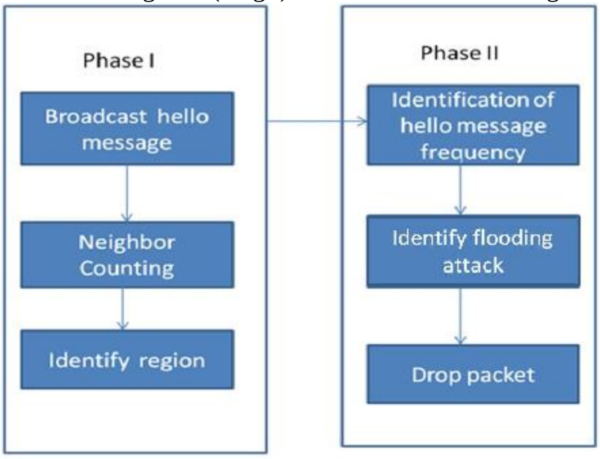

Fig. 1 System flow of Proposed System

2. Phase II: Reduce flooding attack phase

- Identification of hello message frequency

Receiver node checks the number of hello packets it has received from the particular sender node within a specific time slot (T_{sec}).

- Identify Flooding:

If number of hello packet received from the above process exceeds the value Avg2 and minimum to Avg1 then receiver identifies the flooding attack from the sender node.

- Drop packet:

After identifying the flooding attack receiver drops the packets received thereafter.

B. TDAFA Algorithm

Algorithm divides in Neighbor Computation phase and Reduces flooding attack phase

Neighbor computation phase computes the node neighbors and its neighborhood information after specifying the time interval of every T1sec till it completes threshold time. Afterward it maintains the region (sparse, medium and dense) of each node and decides to broadcast hello message.

Phase I of TDAFA: Neighbors Computation phase

Initialization: n→ Neighbor of a node.
th_{lu}→lower threshold value
th_{uv}→upper threshold value
Avg1→Average of min neighbor
Avg2→Average of max neighbor

1. Node Broadcast Hello message
2. Node Compute Neighbors'

2.1 **If** | currtime> th_{lu} && currtime< th_{uv} |

2.1.1 Node check no. of neighbor
2.1.2 Node stored no. of neighbor
2.2 N1 stored Minimum neighbor
2.3 N2 stored Maximum neighbor

3 Node Compute Avg1 (min)
4 Node Compute Avg2 (max)
5 **If** | n < Avg1 |
5.1 Node → Region $_{sparse}$
6 **Else**
6.1 **If** | n>=Avgn1 and n<=Avgn2 |
6.1.1 Node → Region $_{medium}$
7 **Else**
7.1 Node → Region $_{Dense}$

- Reduce flooding Attack phase maintains Sender Receiverarray which uses three variables {nd, index, SRtimer} where nd is source address, index is destination address or itself and SRtimer is used to check the expiration time. If the current time is equal to previous SRtimer then increased SRtimer by 2 and receive packet otherwise drop packet. Sender receiver table initialize Boolean value as 0.

Phase II of TDAFA: Reduces Flooding attack

Initialization: Index→node itself address
SRT→ sender Receiver table
SRTimer→ sender Receiver time
th→threshold time

1. **If** |SRT(Index, source)→0|
1.1 SRT (Index, source set → 1
1.2 TTR → currtime+th_{time}
1.3 SRTimer(Index, source)← TTR
1.4 Node Recv Hello packet
2 **If** |SRT(Index, source)→1|
2.1 **If** |currtime>= SRTimer(Index, source)|
2.1.1 TTR → currtime+th_{time}
2.1.2 SRTimer(Index, source)← TTR
2.1.3 Node Recv Hello packets
2.2 **Else**
2.2.1 If |SRC(index,source) < Avg N1 || SRC(index,source> Avg N2|
2.2.1.1 Node Discard Hello packets

IV. SIMULATION RESULT

This section illustrates the simulation environment used in our study and describes the result analysis in detail.

A. Simulation Environment

We have used ns-2 as simulation platform.NS-2 is the discrete event driven simulator. Density of the nodes is appropriate to maintain network connectivity point, where each node uses a communication of transmitting range and bandwidth. NS-2 helps in setting network topology by various parameters like range, routing algorithm, number of nodes, bandwidth etc. Simulation parameters are as follows

Parameter	Value
Transmitter range	250 meters
Bandwidth	2Mbps
IFQ Type Queue / Drop Tail / PriQueue	50 packets
Simulation time	250 seconds
‘Hello’ packet size	12 bytes
Topology size	600m × 600m, 800m× 800m and 1000m×1000m
Number of nodes	5, 10, 15, 20, 25
Maximum speed	2 and 20 m/s
Routing Protocol	AODV

B. Simulation Result

As per our neighbor computation phase we have varied the number of nodes (5, 10, 15, 20, 25) on a given network size and have measured the minimum and maximum number of neighbors over the whole nodes in the network. A high (low) a number of neighbors implies that the node in a dense (sparse) area. The higher is the number of neighbors, the denser the network area is. The lower the number of neighbors is sparser the network area is.

Our Proposed algorithm calculates minimum number of nodes and maximum number of nodes within 3 time period and set neighbors. Also check expiry time .This approach help to maintain reliable nodes for better communication hence packet sends are ultimately received by receiver which increases packet delivery ratio and decreases packet loss ratio. Packet delivery ratio is the quotient resulting from the number of successful delivered packets to those generated by sources within the simulation period. Higher PDR implies that packet loss rate is lower and protocol is more efficient from the view of data delivery.Fig.3 shows that for AODV, for minimum and maximum nodes of 5 and 25, the successful Packet Delivery Ratio 1.04 and 1.01. However, for TDAFA they are 1.08 and 1.98. Thus giving better output.

Packet loss ratio is a difference between the Number of Received Packets and Number of Sent Packets. Fig.4 shows that for AODV, for minimum and maximum nodes of 10 and 25, the Packet Lost Ratio 0.03 and 0.015. However, for TDAFA they are 0.003 and 0.003. Thus giving less output that means it’s a better result.

Packet delivery ratio is comparatively high as compare to AODV .Hence all the communication packets and routing packets delivered to the destination with optimum use of bandwidth which increases throughput. Throughput refers to how much data can be transferred from one location to another in a given amount of time.

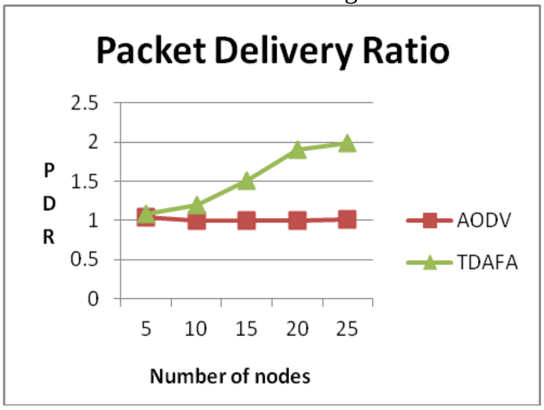

Fig.2 Packet Delivery Ratio

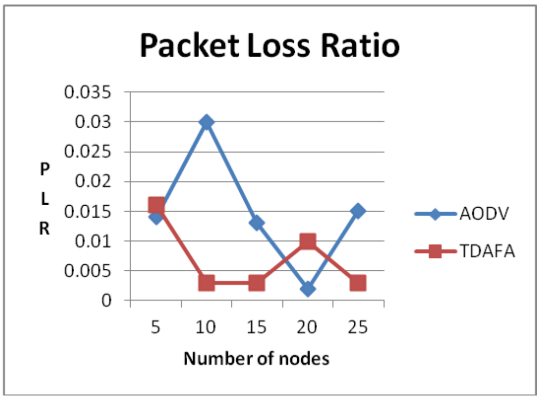

Fig.3 Packet Loss Ratio

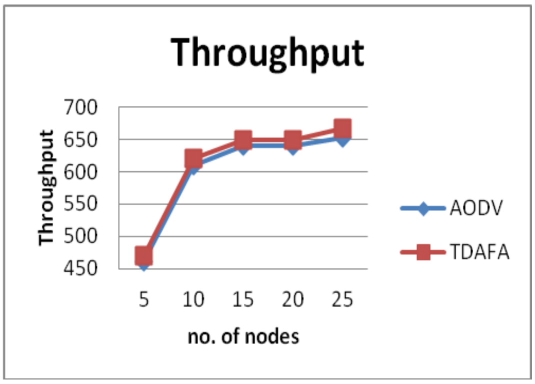

Fig.4 Throughput

The throughput index plotted in fig. 4 indicates that for AODV scheme for nodes of 10 and 25, the throughput is Approximately 610 and 652. Whereas for the TDAFA it is 620 and 667. This indicates that as the number of nodes increases it gives better throughput.

V. CONCLUSION

Different counter based broadcasting schemes are embedded in AODV to reduce the flooding attack. Our proposed algorithm TDAFA, improves the performance of counter based broadcasting scheme for MANET by computing nodes neighbor and its neighborhood information (as given in Phase-I of TDAFA algorithm). Our algorithm allows nodes to accept the hello packet only after their SRTimer expiration (as given in phase-II of TDAFA algorithm) and hence reduces the flooding attack The simulation results show that our proposed algorithm gives better performance in terms of successful delivery of packet ratio, packet loss ratio and throughput as compared to AODV protocol.

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