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Implementation of topology control mechanism for AODV routing protocol using NS-2

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Abstract: Topology Control is an essential technique in a wireless adhoc network to extend the operational time of the adhoc nodes. The goal of this technique is to maintain network connectivity and optimize performance metrics such as network lifetime and throughput. In this paper we presented a new method for controlling and maintaining topology in wireless adhoc networks that show some improvement over the state of art methods. The results are analyzed based on objective criteria. The tools which we used for the work.

Keywords: Wireless Adhoc Networks, ENR, Topology Control, Topology Construction, Topology Maintenance

1. INTRODUCTION

A wireless adhoc network is a reliant collection of nodes that communicate over relatively bandwidth constrained wireless links. In general, topology control in adhoc networks adjusts their transmission ranges to conserve energy and reduce interference. In case of wireless adhoc networks the aspects which need to be considered while controlling topology are operation in hostile environments, Data processing and scalability. A significant amount of research works [1-4] have been done using non homogenous approaches such as location based, neighbor based and direction based.

In this paper we devised a new method called ENR which stands for Energy-Neighbour-Range to control and maintain topology in wireless adhoc networks. Our approach is fully distributed, asynchronous and generates a connected topology. The method is based on the principle of maintaining the number of physical neighbours, transmission range and energy levels at each node while constructing topology in order to improve the efficiency of the network.

The rest of the paper is organized as follows. Section 2 briefly describes the taxonomy of topology control methods. Section 3 presents our working principle. Section 4 presents the simulation environment and experimental results. Finally conclusions are drawn in Section 5.

2. TAXONOMY OF TOPOLOGY CONTROL

Topology control is an essential technique in Wireless adhoc network which leads to reorganizing and managing of certain node parameters and modes of operation from time to time to modify the topology of the network with the goal of extending its lifetime while preserving important characteristics such as connectivity and coverage. Topology control is an iterative process which consists of two phases those are topology construction and topology maintenance.

During the topology construction phase, each node builds a new topology based on the best parent node. Nodes can extend the network lifetime by adjusting transmission power to control the topology. In the topology maintenance phase, each node monitors the energy status of neighbors and triggers topology construction as needed. The framework of topology control approaches as shown in figure below:

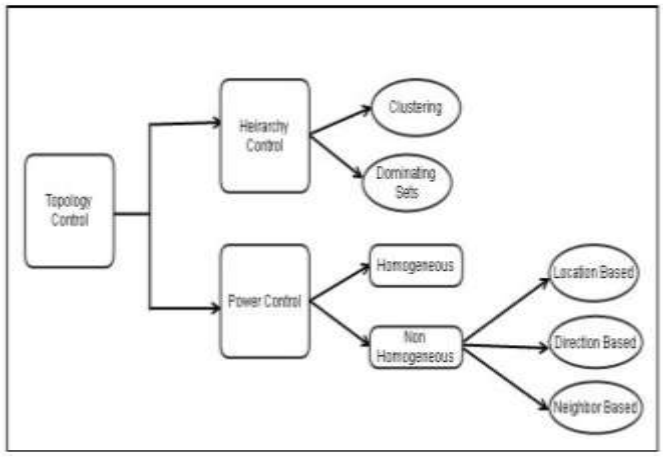

Fig. 1. Taxonomy of Topology Control[5]

In homogeneous topology control, the transmitting range of the nodes is the critical transmitting range that produces communicating graphs that are connected with high probability. Determining the critical transmission range using homogeneous topology control has been considered analytically as well as practically. In No homogeneous approach the transmitting range of the nodes varies and is classified into three categories, depending on the type of information that is used to compute the topology. In location based approaches, exact node positions are known. In direction-based approaches, it is assumed that nodes do not know their position, but they can estimate the relative direction of each of their neighbors. Finally, in neighbor-based techniques, nodes are assumed to know only the ID of the neighbors and are able to order them according to some criterion.

3. PROPOSED SCHEME

We propose a solution that is an enhancement of the basic AODV routing protocol, which will be able to control topologies. To reduce the probability of data losses it is proposed to wait and check the replies from all the neighboring nodes to find a safe and early route. According to this proposed solution the requesting node without sending the DATA packets to the reply node at once, it has to wait till other replies with next hop details from the other neighboring nodes. After receiving the first request it sets timer in the 'Timer Expired Table', for collecting the further requests from different nodes that having hop count equals to 2. It will store the 'sequence number', and the time at which the packet arrives, from those nodes to check which node is replying. The time for which every node will wait is proportional to its distance from the source. It calculates the 'timeout' value based on arriving time of the first route request. According to Topology Based AODV the requesting node transmit request to the node having hop count 2, then calculate the ratio of their total reply and time taken by all reply and generate trust value between 0 to 10, for those the neighboring nodes who reply for the request will have trust value greater than 5, the neighboring node that are reply for some of the request will have reply ratio less than those neighbor who are good to reply, and these neighbor have trust value less than 5, based on these trust values we find neighbors who have trust value minimum and remove its entry from the routing table, and based on trust values a safe route to the destination to reduce the probability of Black Hole Attack is generated. After the trust value calculation, it first checks in Routing Table whether there is any entry for the node and its trust value for hop node. If any entry to next hop node is present in the reply paths it assumes the paths are correct or the chance of malicious paths is limited.

4. SIMULATION AND RESULT

4.1 Simulation Environment: In our scenario we take 30 nodes .The simulation is done using NS-2, to analyze the performance of the network by varying the nodes mobility. The protocols parameters used to evaluate the performance are given below:

i) Packet Delivery ratio: It is the ratio between sending to the receive packet.

ii) Throughput: Throughput is the average rate of successful message delivery over a communication channel.

iii) End to end Delay: It can be defined as the time a packet takes to travel from source to destination.

4.2 Simulation Parameter:

Table 1: Simulation Parameters Considered

Parameters	Values
Simulator	NS-2.35
Mobility Model	Random Way Point
Antenna type	Omni directional
Area of Map	800*800
PHY/MAC	IEEE 802.11
Routing Protocol	AODV, TAODV
Network Traffic	TCP
Simulation Time	200sec

4.3 Simulation results of AODV and TAODV:

Packet Delivery Ratio: The graph shows the Simulation result between AODV and TAODV PDR.

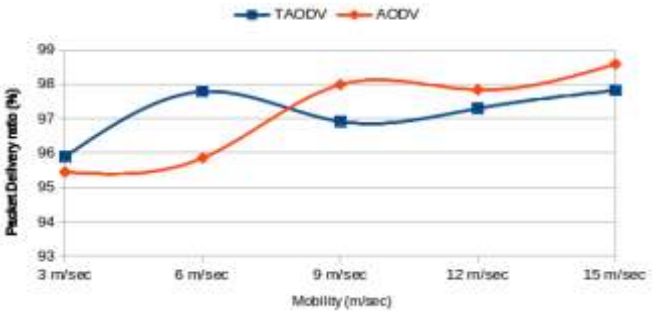

Fig.1 Packet Delivery ratio of TAODV and AODV

End to end delay: The graph shows the Simulation result between AODV and TAODV end to end delay.

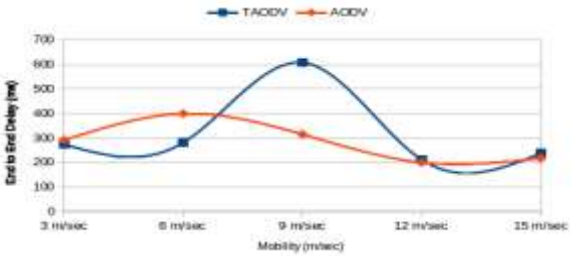

Fig .2 End to End delay of TAODV and AODV

Throughput: The graph shows the Simulation result between AODV and TAODV throughput.

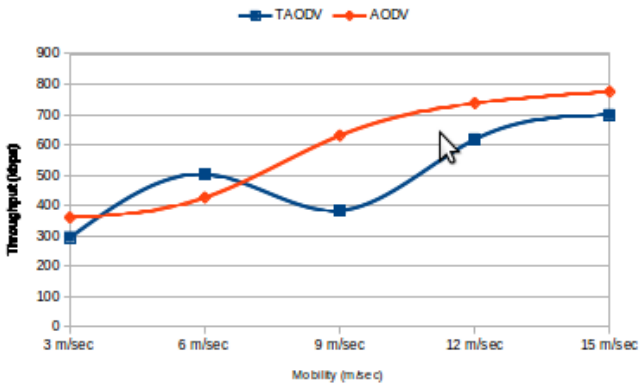

Fig .3 Throughput of TAODV and AODV

5. CONCLUSION

In this work, we focused on the node movement and topology control in mobile ad-hoc networks. We have presented an simulation study to AODV and TAODV using a variety of workloads such as packet delivery ratio, End to End Delay and Throughput According to practical results, it is clearly that the PDR in TAODV are increases as compare to AODV but it is not possible to say clearly that the Throughput and End to End delay decreases or increases with respect to various node mobility.

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