Performance evaluation of MAODV and compare it to AODV, DSDV, DSR and OLSR with various node density for MANET Environment

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ABSTRACT

Mobile Ad-Hoc Network or MANET is a technology that uses moving nodes in a network to create a mobile network. MANET moves each performing nodes into a wireless router or node, mainly the involvement of interest to MANETs but the information diverges. Rather than moving at random, nodes tend to move in an institutionalized fashion. In this paper network scenario created for AODV, DSDV, DSR, OLSR and MAODV in MANET environment with varying node density i.e. 10 nodes, 40 nodes, 92 nodes, 128 nodes and the performance has been evaluated on the basis of packet delivery ratio, Throughput and end to end delay.

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INTRODUCTION:

Wireless communication systems are engineered to service independent mobile users. These networks are connected through wireless link to build a hybrid network consisting of MANETs and infrastructure network. Nodes should collaborate with each other so that they can function as source, destination or access points. Network transmission path is not important for transmission of data. Maintaining QoS for hybrid network is complex task due to dynamic behavior of network topology. QoS for network is measured in terms of guaranteed amount of data which a network transfers from one place to another during a certain time. QoS is identified as a set of measurable pre specified service requirements such as delay, bandwidth, and probability of packet loss, throughput and delay variance. QoS is referred as the capabilities to provide resource assurance in a network, which is a critical requirement in order that new wireless network services.

Impact of Network Density

Ideally, with an increase in network density, the throughput of the network is expected to increase. However, when this increase in network density is very large, the protocol performance degrades. It is concluded that an increase in network density drastically affects the performance of MANETs because of various factors like increased path length, additional burden on intermediate nodes and increased packet collisions; it also complicates the protocol routing activity.

In a sparsely-populated network, the nodes are highly distributed reducing the number of possible connections between any two nodes. This distributed nature of nodes results in the formation of lengthy routes thus creating unstable links. The higher the distance between the nodes forming a link, the greater is the possibility of packet loss. It also causes a high end-to-end delay and increases the possibility of 0link disconnections.

EFFECT ON MANET QOS

The effect of mobility on the performance of practical ad-hoc wireless networks has been proven deleterious [1, 2, 4]. The unpredictable movement of intermediate nodes in a MANET environment dynamically changes the network topology thereby causing a disruption in the established communication links. As the links break, a large amount of data packets that were being transmitted through those links, are dropped. This reduces the overall throughput of the network.

Once the link disconnects, the network forces the underlying protocol to repair the broken links or initiate search for new routing paths resulting in a continuous reconfiguration of the network[5]. The reconfiguration of the network for a routing protocol denotes route maintenance.

ROUTING IN AD HOC NETWORK

In the latest years, research has been conducted on improving the performance of the MANET routing protocols. To deal with the complexity of the routing protocols, MANET has become a vital issue for The Internet Engineering Task Force (IETF) and therefore a MANET working group (WG) is established by IETF.

Destination-Sequenced Distance-Vector Routing (DSDV)

The Destination-Sequenced Distance-Vector Routing protocol (DSDV) described in is a table-driven algorithm based on the classical Bellman-Ford routing mechanism [3, 10]. The improvements made to the Bellman-Ford algorithm include freedom from loops in routing tables. Every mobile node in the network maintains a routing table in which all of the possible destinations within the network and the number of hops to each destination are recorded. Each entry is marked with a sequence number assigned by the destination node. The sequence numbers enable the mobile nodes to distinguish stale routes from new ones, thereby avoiding the formation of routing loops. Routing table updates are periodically transmitted throughout the network in order to maintain table consistency.

Ad Hoc on Demand Distance Vector Routing (AODV)

The Ad Hoc On-Demand Distance Vector (AODV) routing protocol described in [11] builds on the DSDV algorithm previously described. AODV is an improvement on DSDV because it typically minimizes the number of required broadcasts by creating routes on a demand basis, as opposed to maintaining a complete list of routes as in the DSDV algorithm. The authors of AODV classify it as a pure on demand route acquisition system, since nodes that are not on a selected path do not maintain routing information or participate in routing table exchanges [12]. When a source node desires to send a message to some destination node and does not already have a valid route to that destination, it initiates a path discovery process to locate the other node. It broadcasts a route request (RREQ) packet to its neighbors, which then forward the request to their neighbors, and so on, until either the destination or an intermediate node with a " fresh enough" route to the destination is located.

Optimized Link State Routing (OLSR)

The Optimized Link State Routing (OLSR) is operated as a proactive (table-driven) routing protocol i.e. frequently exchanges topology information with other nodes of the network [13]. This protocol is basically an optimization of traditional link state protocol developed for mobile ad-hoc network. The responsibilities of OLSR protocol are to minimize the required number of control packets transmission and also to shorten the size of control packets. On top of that, OLSR trims down the control traffic overhead in the network with the help of Multipoint Relays (MPRs) [14]. The MPR concept is the key idea behind OLSR protocol which is basically a node's one-hop neighbors in the network

Dynamic Source Routing (DSR)

Dynamic Source Routing (DSR) is a widely used reactive (on-demand) routing protocol which is designed particularly for the mobile ad-hoc networks. DSR permits the network to run without any existing network infrastructure and thus the network becomes as a self-organized and self-configured network. This protocol maintains an on-demand approach and hence extinguishes the periodic table-update messages needed in the table-driven approach [15].

Modified ad hoc on demand distance vector Routing (MAODV)

In this work, we make some assumptions and establish the network model of MAODV. We also argue why we focus our security solution on routing protocol in the network layer.

Mobile nodes in MANETs often communicate with one another through an error-prone, bandwidth-limited, and insecure wireless channel. We do not concern the security problem introduced by the instability of physical layer or link layer. We only assume that: (1) Each node in the network has the ability to recover all of its neighbors; (2) Each node in the network can broadcast some essential messages to its neighbors with high reliability; (3) Each node in the network possesses a unique ID, the physical network interface address for example, that can be distinguished from others.

In the MAODV, we also assume that the system is equipped with some monitor mechanisms or intrusion detection units either in the network layer or the application layer so that one node can observe the behaviors of its one-hop neighbours. These mechanisms have been proposed in some previous work, such as intrusion detection system in [16] and watchdog technique in [17].

SIMULATION RESULTS

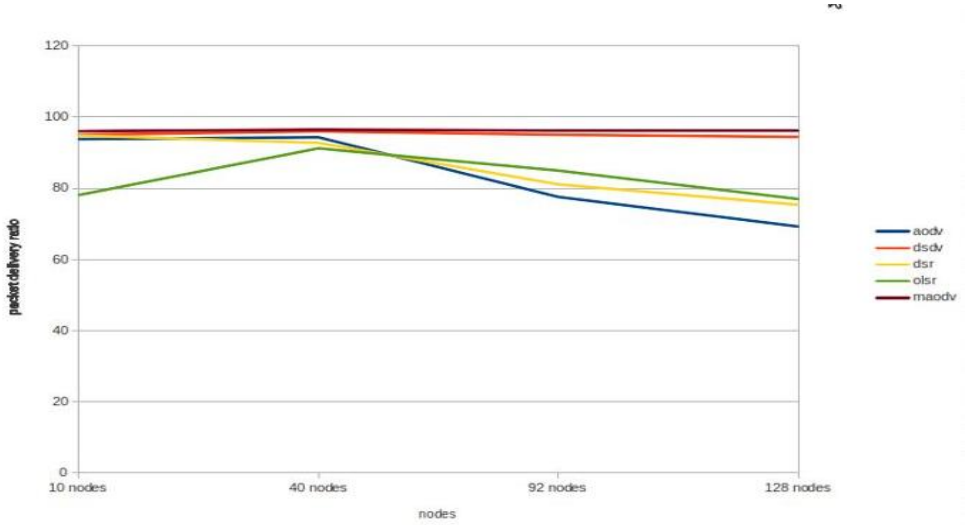
We have implemented our work i.e. Creation of MANET Scenario for NS-2 and then to create Different routing protocols with the use of Various performance matrices Like Packet Delivery Ratio, End to End delay and Overall Throughput. In our case firstly we have created scenario file for IEEE 802.11 standard which has to be used along with our TCL Script than we have created a TCL script consist of various routing protocols in our case these are AODV, DSDV, DSR, OLSR and MAODV than a particular MANET scenario or topology in our case it consist of 10nodes, 40 nodes, 92 nodes and 128 nodes with 30sec simulation time.

a. Packet Delivery Ratio

This is the fraction of the data packets generated by the sources to those delivered to the destination. This evaluates the ability of the protocol to discover routes.

Figure shows the PDR under various protocols i.e. AODV, DSDV, DSR, OLSR and MAODV for the 10 nodes, 40 nodes, 92 nodes and 128 nodes.

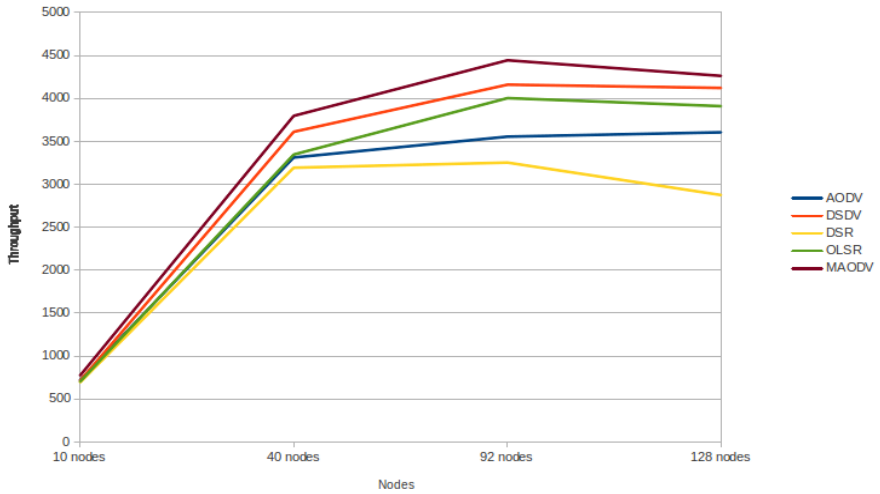
FIGURE 1: Packet Delivery Ratio for AODV, DSDV, DSR, OLSR and MAODV



b. Throughput

There are two representations of throughput; one is the amount of data transferred over the period of time expressed in kilobits per second (Kbps). The other is the packet delivery percentage obtained from a ratio of the number of data packets sent and the number of data packets received.

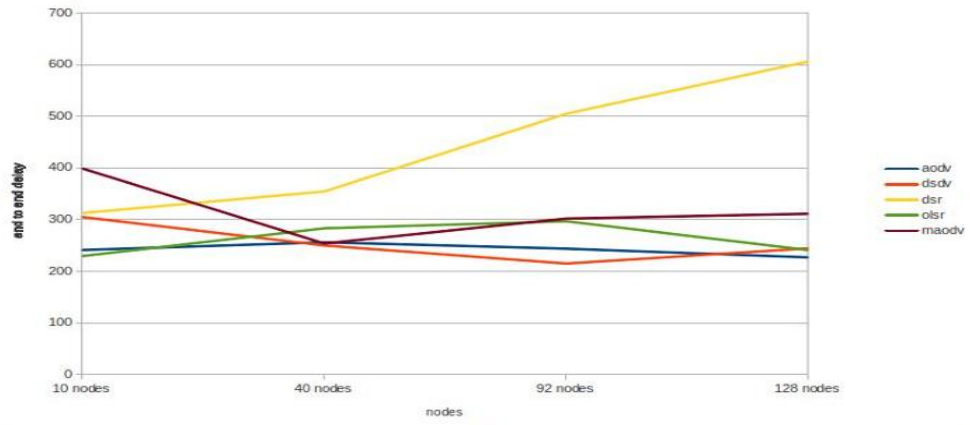
FIGURE 2: Overall Throughput for AODV, DSDV, DSR, OLSR and MAODV



c. End to End Delay

This is the average delay between the sending of the data packet by the source and its receipt at the corresponding receiver. This includes all the delays caused during route acquisition, buffering and processing at intermediate nodes.

FIGURE 3: End to End Delay for AODV, DSDV, DSR, OLSR and MAODV



CONCLUSION

In this work we analyzed parameter like Packet Delivery Ratio, End to End Delay and Overall Throughput and concluded that the MAODV routing protocol gives the better performance which is near to the performance of AODV for each traffic type i.e. 10 nodes, 40 nodes, 92 nodes and 128 nodes with 20 sec simulation time for two ray ground propagation in IEEE 802.11 scenario for omni directional antenna.

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