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Scalability Study of AOMDV Protocol in MANETs

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ABSTRACT

With the availability of low cost laptops & mobile phones, the need to connect large number of wireless devices will become more prevalent. On-demand routing protocols outperform compared to table-driven routing protocols. Here we have considered an on-demand multipath routing protocol AOMDV for scalability study. A network as large as 1000 nodes is considered through NS-2 simulations.

Keywords: AOMDV, NS-2

I. INTRODUCTION

Recent advances in the portability, power, and capabilities of wireless devices and applications have resulted in the proliferation and increased popularity of these devices. As the number of users continues to grow, wireless routing protocols will be required to scale to increasingly larger populations of nodes. Conference networking scenarios can require the formation of networks on the order of tens to hundreds of nodes, while many military applications can involve thousands to tens of thousands of nodes. Furthermore, as the deployment of wireless networks becomes more widespread, new applications may encourage the formation of large ad hoc networks.

Many publications by researchers include simulations and studies evaluating the performance of the protocols for relatively small numbers of nodes (i.e., 50 nodes), they do not show how any of the protocols scales to larger node populations. Routing is an important parameter in adhoc networks. Reactive routing protocol like AODV, AOMDV outperform the proactive routing protocol like DSR, DSDV. AOMDV is an on-demand multipath distance vector routing protocol, it is an extension of AODV protocol which is a single path routing protocol.

II. ADHOC ON DEMAND MULTIPATH DISTANCE VECTOR (AOMDV) ROUTING PROTOCOL

AOMDV [1] shares several characteristics with AODV [2][4][5]. It is based on the distance vector concept and uses hop-by-hop routing approach. Moreover, AOMDV also finds routes on demand using a route discovery procedure. The main difference lies in the number of routes found in each route discovery. In AOMDV, RREQ propagation from the source towards the destination establishes multiple reverse paths both at intermediate nodes as well as the destination. Multiple RREPs traverse these reverse paths back to form multiple forward paths to the destination at the source and intermediate nodes. Note that AOMDV also provides intermediate nodes with alternate paths as they are found to be useful in reducing route discovery frequency. The core of the AOMDV protocol lies in ensuring that multiple paths discovered are loop-free and disjoint, and in efficiently finding such paths using a flood-based route discovery. AOMDV route update rules, applied locally at each node, play a key role in maintaining loop-freedom and disjointness properties. Here we discuss the main ideas to achieve these two desired properties. Next subsection deals with incorporating those ideas into the AOMDV protocol including detailed description of route update rules used at each node and the multipath route discovery procedure. AOMDV relies as much as possible on the routing information already available in the underlying AODV protocol, thereby limiting the overhead incurred in discovering multiple paths. In particular, it does not employ any special control packets. In fact, extra RREPs and RERRs for multipath discovery and maintenance along with a few extra fields in routing control packets (i.e., RREQs, RREPs, and RERRs) constitute the only additional overhead in AOMDV relative to AODV.

III. MOBILITY MODELS

Random Waypoint Mobiliy Model (RWay)

RWay [3] is the most widely used entity mobility model in MANET research. In RWay, each mobile node randomly chooses a destination inside the simulation area and a speed uniformly distributed between [*MinSpeed, MaxSpeed*]. Then the mobile node travels toward the destination with the selected speed. Upon arriving, the mobile node pauses for a certain period of time and then, starts the selection process again.

IV. SIMULATION ENVIRONMENT

Network simulator NS-2.35[7] is being used to carry out network simulations for adhoc network. The inbuilt tool cbrgen in ns2 is used for generating traffic file having 512 bytes data packet and data send rate of 4 packets/sec. On more inbuilt tool setdest in ns2 is used for generating scenario file with random waypoint mobility model. Following table shows the parameters used for carrying out simulation.

Table 1: Simulation Parameters

Simulation parameter	Value
Simulation time	300s
Transmission range	250m
Mobile nodes and Simulation area	50(1000m*1000m), 100(1500m*1500m), 500(3500m*3500m), 1000(5000m*5000m)
Pause time	0s
Traffic pairs	20
Speed of mobile nodes	10m/s

V. PERFORMANCE METRICS

Following are the performance metrics

1. Packet delivery ratio: It is the total number of data packets received by all destination nodes over the total number of data packets sent by all source nodes in network.

2. Normalized routing overhead: It is the total number of non-data packets transmitted at the IP layer over the total data packets received during the simulation.

3. Average end to end delay: It is the time the packet generated at the source and the time the packet arrived at the destination

VI. SIMULATION RESULTS

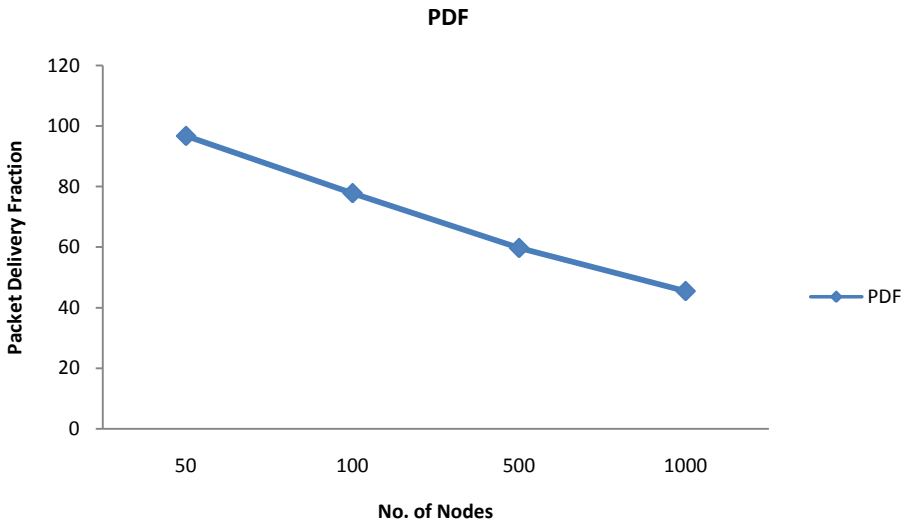

Fig. 1. PDF Vs Number of nodes

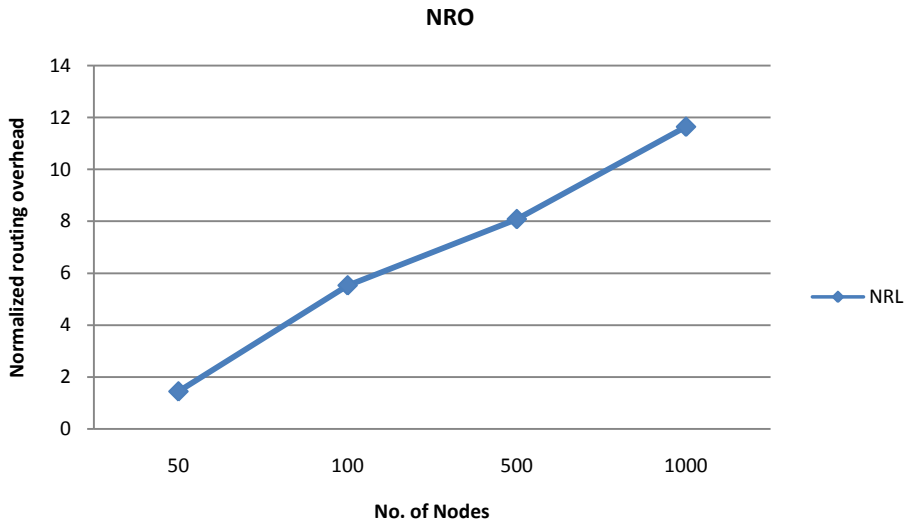

Fig. 2. Normalized routing overhead vs Number of nodes.

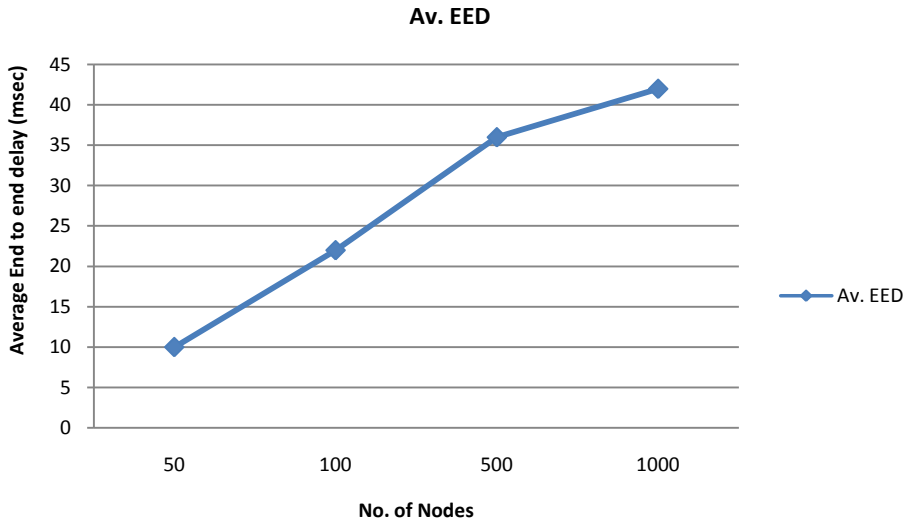

Fig.3. Average End to end delay vs Number of nodes

VII. Conclusions

Packet delivery fraction degrades and Normalized routing overhead, Average end to end delay increases in larger networks because of longer path lengths. Scaling routing protocols in ad hoc networks is inherently difficult due to the mobility of the nodes

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