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Improving Effective Data Rate in Lossy MANETs with Delay Constraint

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Abstract—Mobile Ad-Hoc Network (MANET) is an infrastructure less wireless network of autonomous collection of mobile nodes (Smart phones, Laptops, iPads, PDAs etc). Network is self-configured to reconstruct its topology and routing table information for theexchange of data packets on the joining and leaving of each node on ad-hoc basis. Withthe development of mobile ad-hoc networks (MANETs), there is a growing requirement ofquality of service (QoS) in terms of delay. In lossy Mobile Ad-hoc Networks (MANETs)the data rate of a given ow becomes lower and lower along its routing path. One of themain challenges in lossy Mobile Ad-hoc Networks is how to achieve the contradicting goal ofincreased network utility and reduced power consumption. To address this problem, wepropose a new protocol SAODV by modifying the existing AODV (Standard) protocol.In this research the performance analysis of AODV and SAODV are analysed based on following parameters namely Average End to End Delay and Average Throughput. Simulations are performed by Network Simulator (NS-2) and the results are analysed for bothAODV and SAODV in lossy and lossless Mobile Ad-hoc networks. Results demonstratethat SAODV produces better results compared to AODV in terms of Average Throughputand Average Delay.

Index Terms—MANETs,End to End Delay,Packet loss,AODV,NS2,NAM,Energy Consumption.

1 Introduction

Mobile AdHoc system is self-arranging and foundation less sortof system. Because of itsspecial usefulness like portability, dynamic system topology, self-arranging and decentralized organization various issues emerges. Congestion is one of them. At the point whenexcessively numerous packets are trying for the comparative connection, the line oddsand packets must be dropped. At the point when such drops wind up noticeably basicoccasions, the system is said to be congested. In AdHoc organizes, there are no differentarrange components called switches and subsequently the versatile nodes themselves goabout as the switches.Congestion occurs in MANETs with restricted assets. Because of unreservedly developments of versatile nodes toward any path cause clog issue in the system [1].

Clog prompts packet losses, data transmission degradation and delay. It is also responsible for linkfailure problem and degrade transmission rate. It has been discussed that the main congestion control issue in MANET is when the number of nodes in the system increases, causing the delay and hence lowering the effectivepacket delivery ratio and the effective rate reached at the destination, thereby loweringthe overall performance of the system[2][3]. Thus in order to solve this problem we proposed a new protocol which is SAODV which gives better performance in terms of packet delivery ratio, average end to end delay and also improves the effective rate reached at thedestination[4].

The new protocol we proposed is the modification of Ad Hoc On Demand Distance vector (AODV) routing protocol which makes use of feedback based mechanism. Earlierin the existing protocol when a node wishes to transfer data to the destination node, itfirstly initiates the route request message and that request message is transmitted to the neighbouring nodes, if the source node receives any route reply message it then transmits the data and so on the process is repeated till the data reaches the destination, but if the source node receives any route error message it stops transmittingdata to thedestination. The main problem in that was when the link breakage occurs or when thecongestion occurs most of the packets while transmission gets lost thereby the problemof packet drop occurs [5]. The adhoc networks like MANETs are usually dynamic, i.e, the nodes of such networksare always in motion. Due to this continuous change in position of mobile adhoc nodescompletely topology of nodes get disturbed, so it is the duty of routing protocol, to adapt itself with the changing network topology and update itself accordingly[6]. A novel techniqueis proposed to overcome the problem of congestion in AODV.

In the new framework the source node firstly sends the RREEQ Route request message to the neighbouring nodes based on the positive response it starts transferring the packets and in the network performance feedbackbased mechanism is used in which when the congestion occurs in the network or when thelink failure occurs the message is transmitted to the source nodes, based on the sourcenode lowers the transfer rate or limits transferring the packets to the neighbouring nodesbecause of which the packet loss is reduced hence the packet delivery ratio is achieved[7].

As the problem of congestion is resolved by sending the messages to the source there would be performanceagreat chance for improvement in effective transfer rate hence overall performance of thenetwork is achieved. The simulation parameters and the achieved results are shown inthe next section.

2 Performance Evolution Parameters

Throughput: Throughput is the proportion of packets come to be at the receiver end tothe packets sent by the source. It is

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characterized as the add up to number of packets conveyedover the aggregate recreation time. Throughput is specifically corresponding to Packet Delivery Ratio (PDR) and conversely corresponding to Packet Loss, End-to-Endsuspension and Energy Consumption (or) Throughput metric speaks to the aggregatenumber of bits sent to higher layers every second. It is measured in Kbps. It can likewisebe characterized as the aggregate sum of information a beneficiary really gets from sender separated when taken by the collector to acquire the last packet. It is the normal rate offruitful message transportation over a communicationchannel [10].Throughput is directly proportional to the packet delivery ratio (PDR) and is inverselyproportional to the packet loss, End to End Delay and the energy consumption.

Average Delay: The normal time it takes an information message to achieve the goal [11].This incorporates all conceivable suspensions brought about by buering amongst courserevelation inertness, lining at the interface line. Normal postponement is spoken to inmilliseconds (or seconds) also, throughput is spoken to in bits every seconds (bps). Thelower estimation of end to end postpone implies the better execution of the convention.

Normal Delay= aggregate of the time spent to convey packets for every goal / numberof packets got by the all destination nodes.

Average delay is inversely proportional toaverage throughput, Packet delivery ratio (PDR) and energy spent.

Packet DeliveryRatio (PDR): Packet Delivery Ratio is characterized as the proportion of informationpackets received by the destination to those created by the sources [8]. For instance if anactivity generator sends 10 packets and another application sends packets. In the eventthat in both situations got 100 percent of the packets is received, then the PDR is 1[9].

3. Experimental Evaluation

3.1 Introduction

NS-2 or Network Simulator [12] is a discrete-time assessment system whose usage wasbegun by 1989 with the advancement of the Real Network Simulator. Prior imitation of wired revolution was finished by NS-2, and afterward the Monarch gather from theBranch of Computer Science at the University of Rice built up the product for remote portable nodes. This commitment from the University of Rice is generally acknowledgedeverywhere throughout the world.

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The primary goal of NS-2 is to demonstrate the systemconventions which incorporates wired system, remote system Satellite, TCP, UDP, web,telnet, FTP, multicast, unicast, specially appointed directing and sensor systems. NS-2 [13] [14] utilizes two languages C++ and Object Tool CommandLanguage(OTCL).

C++ is quick to run yet slower to change, making it appropriate for simulation execution. OTCL runs much slower when contrasted with C++ however alterationshould be possible extremely rapidly (and intuitively), making it perfect for imitationdesign. In NS-2, the front end of the program is composed in TCL (Tool Command Language) and the backend of NS-2 test system is composed in C++ language. At the point when the TCL program is accumulated, two records that is follow document andNAM record are made that characterizes the development example of the nodes and furthermore monitors the number of information packets sent by the source node, number of least bounces between versatile nodes, association sort at each case of time and so on.[15] Also, a situation record is made which characterizes the goal of portable nodes alongside their paces and an association design document (CBR record) or (TCP record) characterizing the example of correspondence, node topology and furthermore the informationpacket sort are additionally used to make the two records that is follow documents andNAM documents which are then utilized by the test system to mimic the system.NAM, the Network Animator is a Graphical User Interface and is utilized to picture ns

Table 3.1: Simulation Parameters

Simulator	Network Simulator-2 (2.35)
Number of Mobile Nodes	Variable (5 to 25)
Simulation Period	10 Seconds
Traffic Type	CBR
Routing Protocol	AODV,SAODV
Antenna Type	Omni-directional
MAC Type	802.11 MAC layer
Mobility	Variable(5m/s to 20m/s)

yield and the follow record is utilized for post handling work. By utilizing these followrecords AWK scripts can be composed and utilizing these AWK scripts different execution easurements like Average Throughput, End to End Delay, Packet Loss, PacketDelivery Fraction, Packet Delivery Ratio, Normalized Overhead Directing and so forthcan be figured. The graphs are plotted using Microsoft Excel 2013, which is an interactive

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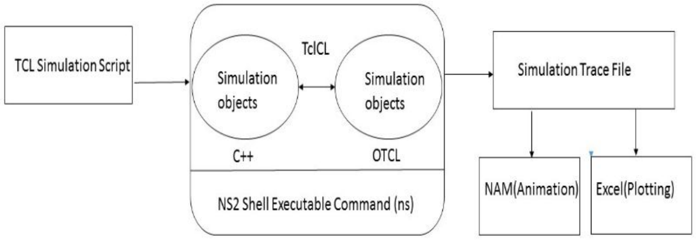

Fig. 3.1 Network Simulator(NS2) Architecture

We have constructed a MANET and configured the SAODV as the routing protocol.The proposed routing protocol has been implemented by modifying the already existingAODV code. In order to test the performance of the proposed routing protocol, wehave used end to end delay, packet delivery ratio and energy spent as a matric and compared it with AODV and SAODV. The accompanying table 3.1 section demonstrates thegeneral parameters of simulation with AODV and SAODV as protocols.

3.2 Simulation Results

Simulation results are performed utilizing Network Simulator (NS-2). To begin with weproduce a wireless system with various number of mobile nodes. Utilizing NS-2 after that pick source node and destination node among the all nodes. In the wake of pickingsource node and goal node exchange the information between sources to goal by utilizing most limited way directing calculations. Here the comparison is made among the AODVand SAODV conventions. Here three execution measurements are considered to assess the execution of the newconvention that are Average Delay, Packet Delivery Ratio and Energy Spent. The threeparameters are performed both in AODV and SAODV. In order to improve the performance

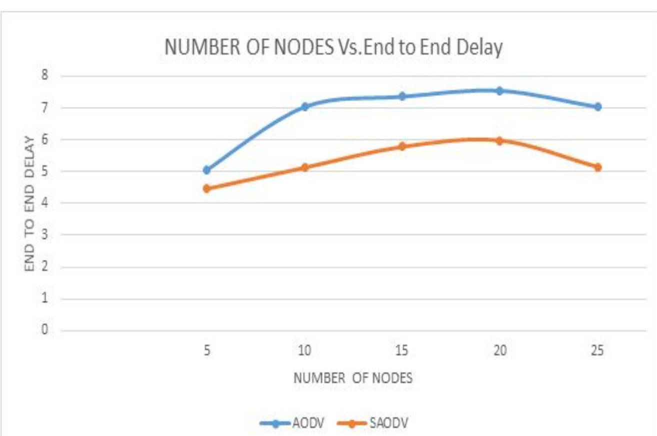

Fig. 3.2 Average End to End Delay of nodes for AODV and SOADV as Routing protocol

we have created a Mobile AdHoc networkwith variable number of nodes from 5 to 25.Also to prove that the proposed protocol ise-cient than the other standard routing protocols, we have compared the performanceof SAODV with the performance of AODV routing protocol. As shown in the figure 3.2,it is clear that as the number of mobile nodes increases, the average end to end delayreduces. Also the throughput increases with the increase in the number of mobile nodes whencompared with the AODV as shown in the figure 3.3. From these results we can say that the proposed protocol is better than the standard routing protocol AODV.

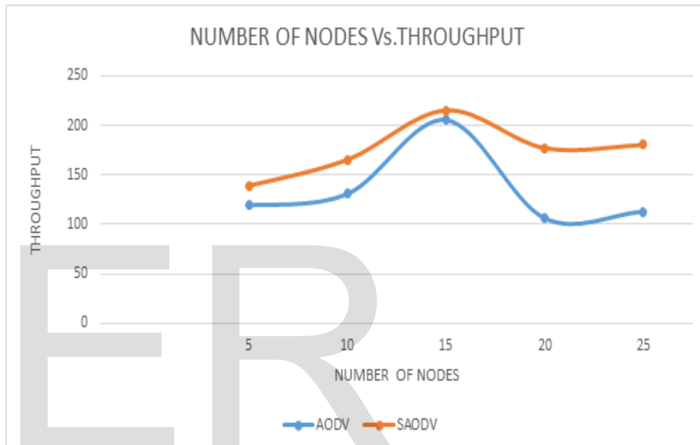

Figure 3.3: Average Throughput of nodes for AODV and SAODV as Routing Protocol.

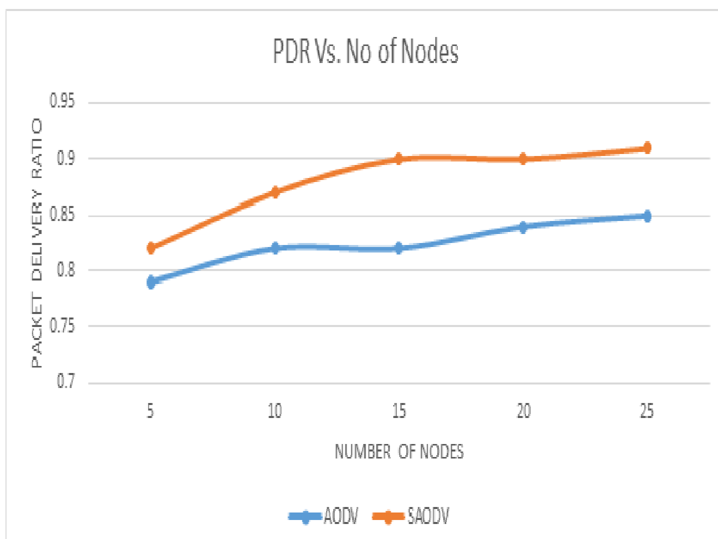

Figure 3.4: Packet Delivery Ratio for AODV and SAODV as

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Routing Protocol

CONCLUSION

MANET is the emerging technology but it has some challenges that must be covered fore-cient results. One of the most important challenge in lossy mobile AdHoc networks ishow to improve the effective data rate of the mobile AdHoc networks. In order to improvethe effective data-rate, we work on limiting the delay in the mobile AdHoc networks. Asthe average end to end delay between the nodes is inversely proportional to the packetdelivery ratio (PDR), it is found that most of the packets that we lost during mobilecommunication could be improved by reducing the delay. Also the throughput found inthe network is improved, as the throughput is increased it means that we getting mostof the packets at the destination that were sent by the destination. The simulation wasperformed using network simulator 2 and the results shows that our work satisfies all theQuality of service parameters in terms of End to End Delay and throughput.

4 FUTURE WORK

This work on mobile AdHoc networks can be extended to work with power control to reduce the amount of power a node uses and to analyse its effect combining with congestion control on several Quality of service parameters.

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