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Quality of Service Effect and Energy Analysis under AODV in MANET

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ABSTRACT: A mobile ad hoc network (MANET) consists of mobile wireless nodes. The communication between mobile nodes is carried out without any central control. Conventional routing protocols may not suffice for real time communications it depends upon the conditions and our requirements. Though there has been significant research in this field. In this paper, we are analyzing the performance of reactive routing protocol (using AODV) and observing its effect on Quality of Service (QoS) of Mobile Ad-hoc Network and we identify the quality of service dependent parameter in mobile ad-hoc network in energy base routing approach, and in that we shows initial energy of each node in joule (unit), in our approach initially all the node configure with initial energy and on the bases of utilization each node energy are discharge Apart from this we also observe quality of service parameter like throughput analysis, packet delivery ratio analysis etc

1. INTRODUCTION

A mobile ad hoc network (MANET) consists of mobile wireless nodes. MANET stands for Mobile Ad hoc Network. It is a decentralized independent wireless system which contains nodes free in nature. MANET sometimes called mobile mesh network, is a self organizable wireless network. The ease of deployment and the infrastructure less nature of Mobile Ad hoc Networks (MANETs) make them highly desirable for the present day multimedia communications [1].

Each node in the network also works as a router, forwarding data packets to other nodes. Many routing protocols are used to manage the ad-hoc networks. These protocols are categorized into three categories: hierarchical, flat, and geographic position assisted routing [2]. There are two types of flat routing protocols: reactive and proactive. The Ad-hoc On-Demand Distance Vector (AODV) protocol is a reactive protocol designed for ad-hoc networks [3]. AODV uses a broadcast route discovery mechanism which relies on dynamically established routing table entries at intermediate nodes. AODV floods the whole network with Route Request packets (RREQ) and Route Reply (RREP) packets. This flooding leads to high overhead.

Multipath on-demand protocols try to improve these problems by computing and caching multiple paths obtained during a single route discovery process. The link failures in the primary path, through which data transmission is essentially taking place, cause the source to switch to another path instead of initiating a different route discovery. A fresh route discovery occurs only when all pre-computed paths break. This approach can result in reduced delay since packets do not need to be buffered at the source when an alternate path is available.

Current protocol provides multipath route discovery and path maintenance mechanism on the basis of a calculated cumulative metric value only on signal strength between two nodes in a path. This metric only address strength of link of the current path, does not address the durability of the path; which fully depends on the residual energy of node .Also does not consider the consistency of node through the previous behaviour. Since it does not consider node's behaviour and energy, it cannot be applied in heterogeneous MANETS having high mobility nature.

A. Quality of Service (QoS)

Quality of Service (QoS) is a set of mechanisms able to share fairly various resources offered by the network to each application as needed, to provide, if possible, to every application the desired quality (the network's ability to provide a service) [4].

AODV presently does not support enrich Quality of Service (QoS) and has no load balancing or minimum load balancing mechanism. The QoS routing feature is important in a stand-alone multi hop mobile network for real-time applications and also for a mobile network to interconnect wired networks with QoS support.

The QoS is characterized by a certain number of parameters (throughput, latency, jitter and loss, etc.) and it is defined as the grade of user contentment. QoS model defines as structural design that will provide the probable best service. This model have to take into deliberation all

challenges imposed by Ad-hoc networks, like network topology alter due to the mobility of its nodes, constraints of dependability and energy consumption, so it describes a set of services that permit users to select a number of safeguards (guarantees) that govern such properties as time, reliability, etc.. [5][6]. Classical models like Intserv / RSVP [7] and DiffServ [8] proposed in first wired network types are not suitable (adapted) for MANETs. Various solutions or models [9] [10] namely: 2LqoS (Two-Layered Quality), FQMM (Flexible QoS Model for MANET), CEDAR, noise, SWAN (Service Differentiation in Wireless Ad-hoc Networks) and INSIGNIA have been proposed for the Ad-hoc networks. Each of these models attempts (tries) to improve one or numerous QoS parameters, as they may be part of one or numerous network layers architecture.

B. QoS Routing

New requirements (needs) for multimedia and real-time applications require few delay and very high data rates which require (oblige) the use of new routing protocols supporting QoS [11] [12].

The QoS support must take in consideration a number of Ad-hoc networks constraints (energy, mobility, scale, etc.). QoS can be introduced into different layers network if there is need (channel access functions at MAC layer, routing protocols at network layer, etc.).[13].

Routing operation consists to find routes between communicating entities (transmitter / receiver) able to convey data packets continuously using less bandwidth and less packets control. Routing in MANETs must also supervise constraints of nodes energy problems, topology recurrent changes due to nodes mobility and communication channel nature. QoS routing can be defined as the research for routes rewarding the desired QoS. To be as appropriate routes, they must convince a number of constraints (such that delay, bandwidth, reliability, etc.) [14]. Indeed, any path that satisfies a number of quantitative or qualitative criteria can be described as path providing (ensuring) certain QoS.

C. AODV Routing Protocol Description

Ad hoc On Demand Distance Vector (AODV) [15] is a reactive routing protocol which initiates a route discovery process only when it has data packets to transmit and it does not have any route path to the destination node, that is, route discovery in AODV is known as on-demand. AODV access sequence numbers maintained at each destination to decide freshness of routing information and to avoid the routing loops that may occur during the routing calculation process. These sequence numbers are carried out by all routing packets.

2. RELATED WORK

Several researchers have done the quantitative and qualitative analysis of Ad hoc Routing Protocols by means of different performance parameters. Also they have used different simulators for this purpose.

Mohamed Amnai et al [16] shows in their study that the impact of mobility models and the density of nodes on the performances like Throughput End-to-End Delay and Packet Delivery ratio of routing protocol OLSR by using in the first a real-time VBR (MPEG-4) and secondly the Constant Bit Rate (CBR) traffic. In addition, routing reliability is enlarged since a failure of one Cluster Head Gateway (CHG) does not break all routing to exterior the cluster due to use of Multiple CHG. AODV giving better performs under such types of circumstances, providing better QoS based on good throughput and acceptable End-End Delay, less data drops. One of the notable features of AODV protocol strategy is to reduce network load which can be responsible for congestion at the time of communication.

Sridhar Subramanian et al. [17] proposed a Trust Based Reliable AODV [TBRAODV] protocol is offered which implements a trust value for every node. For every node trust value is calculated and based trust value nodes are tolerable to contribute in routing or else identified to become a misbehaving node. This extends reliability in AODV routing and results in increase of Packet Delivery Ratio, decrease in delay and throughput is maintained. This trust based routing mechanism has proved to be rising the performance of the TBRAODV protocol and also shows good enhancement of QoS parameters like Packet Delivery Ratio and delay. Rather implementing reliability with trust alone some energy constraints on each node together with trust schemes for a node will provide improved reliability for MANET routing.

Punde et al [18] proposed an extension of AODV to support QoS, supercilious the accessibility of some stationary links in the network. Punde et al [18] introduced the notion of node stability, based on a node's history, which integrated both a node's mobility and packet processing ratio. Only stable nodes were considered for routing. Nevertheless, the authors did not consider the impact that unpredictable link failures would have on re-routing.

In [19] QoS routing has received attention recently for providing QoS in wireless ad hoc networks and some work has been carried out to address this critical issue. Here, we provide a brief review of existing work addressing the QoS routing issues in wireless ad hoc networks. In general, QoS routing can be classified into two basic paradigms: source QoS routing and hop-by-hop QoS routing. Hereafter, the term routing will refer to QoS routing unless otherwise specified. With source routing, the source node of a communication request locally computes the entire constrained path to the intended destination with the global state information that it nearby maintains. Congregation and maintaining global state information can commence excessive protocol overhead in dynamic networks and thus have the scalability issue. Moreover, the calculation of constraint(s)-based routes would be computationally intensive for the calculating nodes. The predictive location-based QoS routing protocol. This protocol is mainly to alleviate the scalability issue with respect to communication overhead in implementing source routing. Instead of disseminating the state of each link network wide, each node broadcasts its node status (including its current position, velocity, moving direction, and available resources on each of its outgoing links) across the network periodically or upon a significant change. With such type of information, at any instant each node can locally depict an instant view of the entire network. To accommodate a QoS request, the source locally computes a QoS satisfied route (if available) and route data packets along the calculated path. Moreover, the source can predict route break and predicatively compute a new route before the old route breaks by using the global condition it stores. This protocol is suitable for providing soft

QoS in small or medium-sized networks wherein mobile hosts are equipped with Global Positioning System (GPS) receivers and their moving behavior is predictable.

3. PROPOSED SCHEME

A. Problem Statement

Mobile Ad-hoc network work under dynamic nature and use dynamic protocol so in the field of mobile ad hoc networks routing protocols, there are several problems to be handled such as Quality of service, power awareness, routing optimization and security issues. That all issue resolve through quality of service parameter like throughput analysis, packet delivery ratio analysis and apply Transport layer and Network layer reliable mechanism for improving mobile ad-hoc network performance.

B. Performance Parameter

In our simulation we apply network simulator-2 and analyse the behaviour of the network through following parameter

- **Packet Delivery Ratio:** The ratio between the number of packets originated by the application layer CBR sources and the number of packets received by the CBR sink at the final destination.
- **Average End-to-end Delay**: This includes all the possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times.
- **Packet Dropped:** The routers might fail to deliver or drop some packets or data if they arrive when their buffer are already full. Some, none, or all the packets or data might be dropped, depending on the state of the network, and it is impossible to determine what will happen in advance.
- **Routing Load:** The total number of routing packets transmitted during the simulation. For packets sent over multiple hops, each transmission of the packet or each hop counts.

C. **Simulation Parameter**We get Simulator Parameter like Number of nodes, Dimension, Routing protocol, traffic etc. According to table 1 (shown below) we simulate our network.

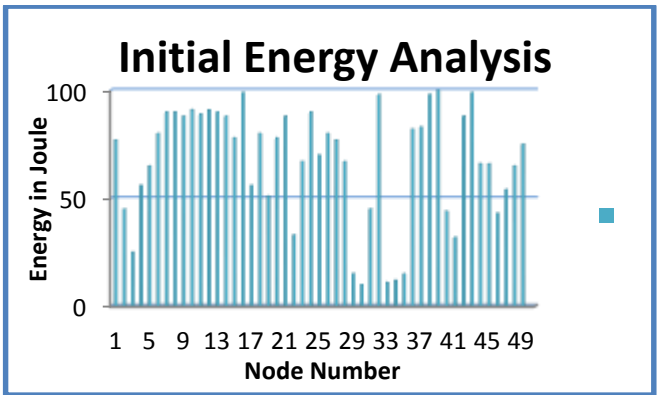
Table 1 Simulation Parameter

Number of nodes	50
Dimension of simulated area	800×600
Routing Protocol	AODV
Simulation time (seconds)	100
Transport Layer	TCP ,UDP
Traffic type	CBR , FTP
Packet size (bytes)	1000
Number of traffic connections	10
Maximum Speed (m/s)	Random

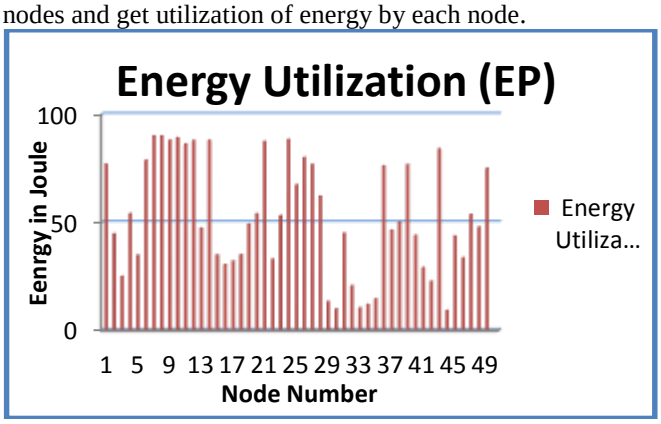
3. RESULT ANALYSIS

A. Energy Analysis

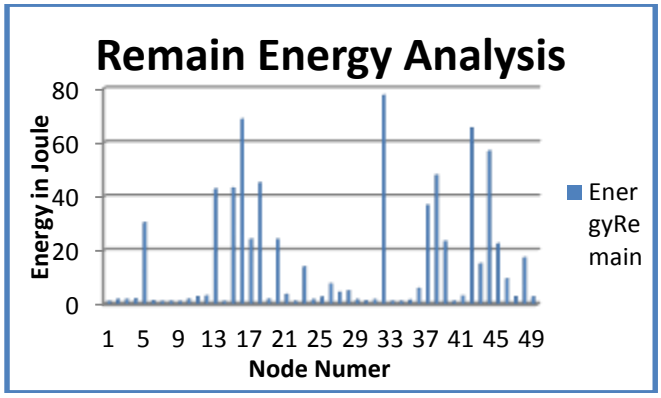
In this Graph we identify the quality of service dependent parameter in mobile ad-hoc network in energy base routing approach, and in that graph we shows initial energy of each node in joule (unit), in our approach initially all the node configure with initial energy and on the bases of utilization each node energy are discharge. In our simulation we get fifty mobile nodes with random initial energy that is deployed in graph.



The graph shows energy utilization of each node by the data transmission, receiving, sleeping and sensing case. Mobile ad-hoc nodes are energy constraint devices so our motive to utilize the energy of nodes in efficient manner, in our approach we select the higher energy based path between sender to receiver and identified with the help of graph what amount of energy total utilized by the node during communication. in our simulation we create fifty mobile nodes and get utilization of energy by each node.



Proposed approach minimized the energy utilization of the network using energy aware routing and most of nodes not participate in data communication because between senders to receiver we choose only energy efficient route that separate the west full participation from the network and also route broadcasting is minimum. In the given graph we show remaining energy of each node that conclude that our network total energy are remain after utilization and that energy utilized in future communication.



B. TCP Packet analysis

In this graph we show the analysis of TCP packets in case of fifty nodes. TCP provide relable communication between sender to recviver becuse reciver node sends acknowldemnent to sender node, in this graph we analyze five TCP conncetion that shows window size per seconds, through the graph maximum TCP packet receives at time 95th seconds.

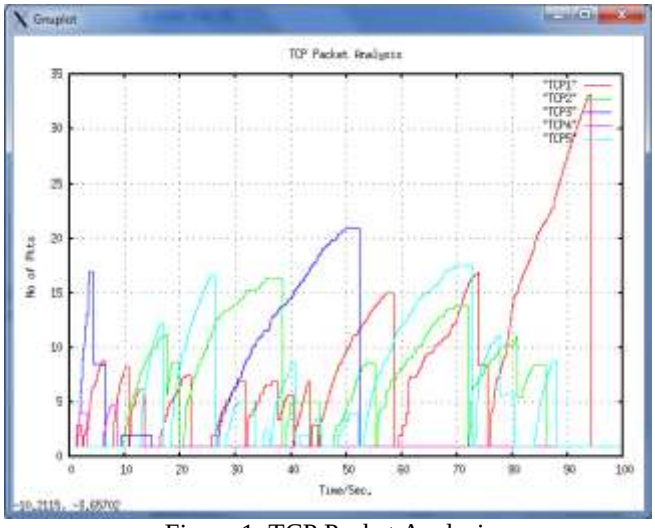


Figure 1: TCP Packet Analysis

C. UDP Packet Analysis

Here we show our result through gnuplot in this graph 4, x axis show simulation time in sec. and y axis shows total udp packet according to our representation red line show total number of udp packets transmitted with respect to time, green line shows total number of UDP packets receives by the receiver and blue line shows UDP packet loss, according to graph our loss percentage is nearly 50% that is very poor.

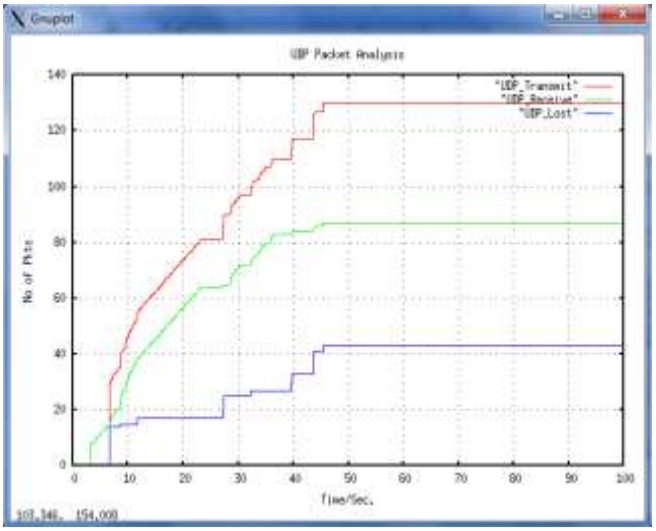


Figure 2: UDP Packet Analysis

D. Routing Load Analysis

Routing message overhead is calculated as the total number of control packets transmitted. The increase in the routing message overhead reduces the performance of the ad-hoc network as it consumes portions from the bandwidth available to transfer data between the nodes.

In our simulation 4000 routing packet flood into the network that decreases the network performance**.**

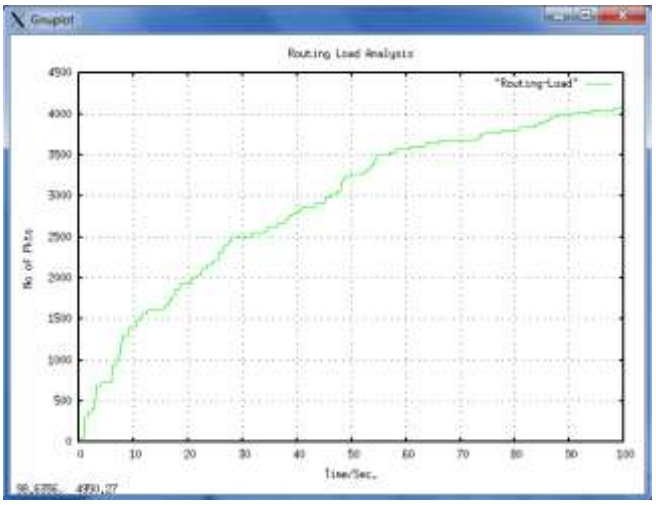


Figure 3: Routing Load Analysis

E. Gnuplot for Packet Delivery Ratio

Packet delivery ratio is a ratio of receives packets from packets sends at time unit.

According to formula if our PDR is best that means our performance is very good, here our result shows at the end of simulation PDR value is nearby 90%. And 10% data loss, that loss comes through congestion, out-of range etc. cases.

We formulize that:

$$PDF = \left(\frac{Rx}{Send}\right) * 100$$

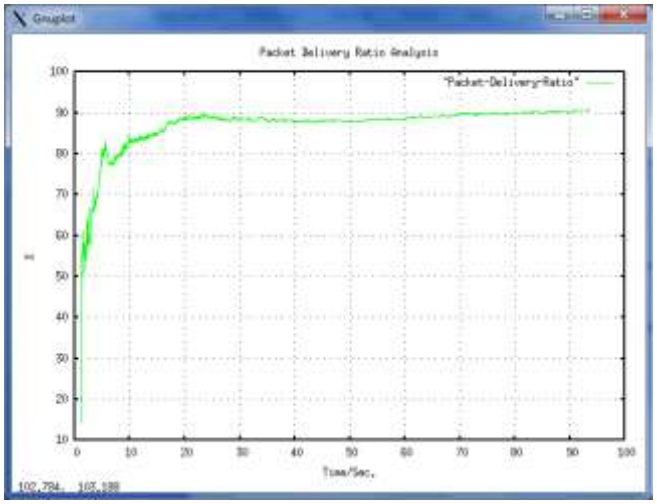


Figure 4: Packet Delivery Ratio Analysis

F: Packet Drop Analysis from all Reason

In our proposed scheme find out reason of performance degradation in mobile ad-hoc network and then next step eliminate these type of drop reason and improve the performance of the network so better quality of service gives the network. Here we deploy table and get various drop analysis and conclude that nearly 61.14% data drop through different reason and only 38.86% actual performance that are very poor.

ALL TYPE PACKET DROP ANALYSIS			
Drop from COL	=	10182	30.11%
Drop from ARP	=	11	0.03%
Drop from IFQ	=	17	0.05%
Drop from CBK	=	239	0.71%
Drop from TOT	=	0	0.00%
Drop from NRT	=	77	0.23%
Drop from END	=	3	0.01%
Drop from DUP	=	0	0.00%
Drop from RET	=	144	0.43%
Drop from BSY	=	3	0.01%
Drop from SAL	=	0	0.00%
Drop from ERR	=	0	0.00%
Total Drop Via Congestion	=	10000	29.57%
Total Drop	=	20676	61.14%
Actual Performance	=	13142	38.86%

Table 2: all type packet drop analysis

G: Summarize Analysis of simulation fifty Mobile node cases

Here we deploy summarize table and conclude that in our simulation we send nearly 4755 packet and receiver receives nearly 4302 packet means 90% data delivery and routing overhead is 4085 packet and total data drop nearly 10000 packet, that result conclude if we not apply any QoS parameter so maximum data drop and gives poor performance.

Overall Summery

Parameter		Value
SEND	=	4755
RECV	=	4302
ROUTINGPKTS	=	4085
PDF	=	90.47
NRL	=	0.95
DROPRTS		9547
No. of dropped data	=	453

Table 3: Summery Table

5. CONCLUSION

In this paper, we are trying to analyzing the performance of AODV reactive routing protocol and also observing its effect on Quality of Service (QoS) and Energy factor of Mobile Ad-hoc Network. We also observe quality of service parameter like routing load analysis, packet delivery ratio analysis etc. As per results obtained from simulation new AODV protocol gives poor results if we not apply any QoS improve technique. Its shows poor data transmission and maximum drop.

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