Novel Approach to enhance quality of service by distributing the load of traffic in manets

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Abstract: The load balancing techniques focus on how to find a path with less traffic load; and the data packets can be routed with a small delay. Our contribution is to improve the performances of routing protocols by the load balancing in MANET to improve the quality of service. Each mobile node in this network that receives a request RREQ calculating the number of packets in its queue and compares it with the value of the cost if it exceeds: the node is overloaded reflecting the load independently of other nodes in the network and this node will be avoided.. In this work, we integrated load of information in MANET in the most used protocol AODV and a function to calculate the cost that is based on the number of queued packets of all nodes participating in the establishment of the path by changing the routing strategy during the route discovery and in the choice of the path that will be based on the minimum cost and the shorter route selected by destination node in this way the overloaded nodes and the least congested path will be chosen. after the implementation of this new process,the results of the simulation shows the effectiveness of this method by minimizing delays to satisfy users who are interested in packet transmission delays.

Key–Words: MANET, AODV,quality of service, load balancing, RREQ, cost.

1 Introduction

An ad hoc network consists of a set of mobile units communicating via a radio medium and requires no fixed infrastructure or administration centralized. Ad-hoc networks have the characteristic of self-creating, self-organizing and self-administer. The autonomy and mobility are of great influence on the flow of data management process (routing). The goal of QoS [2][3]routing in MANET is to select routes with sufficient resources for data packets with QoS requirements to increase possibility that network will be capable of supporting and maintaining them. A critical challenge in the design of Ad hoc networks is the development of efficient routing protocols that provide high quality communication. The nodes in MANET have limited communication resources such as bandwidth, buffer space, battery power etc. Resource constraints in MANET require the traffic to be properly distributed among the mobile host. A routing protocol in MANET should fairly distribute the routing tasks among the mobile host.
AODV routing protocol[1] adopts a purely reactive strategy: it sets up a route on demand at the start of a communication session, and uses it till it breaks, after which a new route setup is initiated. It is based on the principle of distance vector routing. Given its characteristics, this protocol has become widely known and has been a lot of research. AODV uses Route Request (RREQ), Route Reply (RREP) control messages in Route Discovery phase and Route Error(RERR) control message in Route Maintenance phase . In general, the nodes participating in the communication can be classified as source node, an intermediate node or a destination node. With each role, the behavior of a node actually varies. Mechanism of AODV protocol consists of 3 phases, the route discovery and maintenance of road connectivity management [1]. it must establish and maintain and the chosen path is the shortest path with a minimum number of hops as the optimal path without any consideration of the traffic that leads to degradation performance of the network. to improve the quality of service and optimal routing is essential to take into account the distribution of the traffic load in the routing mechanism. The load balancing is a model of quality of service, where a routing protocol is enhanced to meet the requirements of user applications sensitive to a parameter such as delay, bandwidth and jitter. In our work, we are taken to improve quality of service while minimizing delays to satisfy users, who are interested in packet

transmission delay, In this paper we propose a scheme to optimize the AODV protocol which is based on the distribution of traffic load by changing the discovery process and to consider the load of the node and the introduction of a new cost that reflects the size of the queue; the path selection will be based on the minimum cost and also according to the number of hops. This paper is organized as follows. Section2 summarizes the previous work. In section3 implementation. In section4, we study performance evaluation and simulation.

2 Previous Work

The load-balancing technique in ad hoc network can be generally divided into two types. The first type is ”Traffic-size” based [17-18], in which the load is balanced by attempting to distribute the traffic evenly among the network nodes. The second type is the ”Delay” based [20], in which the load is balanced by attempting to avoid nodes with high delay. ”review of load balanced routing protocol” [7], different load balanced ad hoc routing protocols use different load metrics:

Traffic size:This refers to the traffic load present at a node and its associated neighbors .

Channel Access probability This refers to the like lihood of successful access to the wireless media. It is Also related to the degree of channel contention with neighboring nodes [8].

Active path This refers to the number of active routing paths supported by a node.

Packets in interface queue This refers to the total number of packets buffered at both the incoming wireless interfaces.

Node delay This refers to the delays incurred for packet queuing, processing, and successful transmission.

Nodal activitynumber of active paths passing through the node [4, 8.6].

Existing load balanced ad hoc routing protocols use the above-mentioned load metrics to model load. In a broader context, the term load can be interpreted as:[24]

Channel load: Represents the load on the channel where multiple nodes contend to access the shared media.

Nodal load: Relates to a node’s activity. Specifically, it refers to how busy a node is in processing, computation, and so on.

Neighboring load: Represents the load generated by communication activities among neighboring nodes.

Work Load-Based Adaptive Load-Balancing technology [11] that uses the load of the node that will be compared to a threshold to determine whether a node is overloaded or not at the end to avoid; the value of this threshold dynamically changes depending on the charge status of the node and its workload within a specified period.

DLAR [9]: in this protocol is the destination sends the information of the load attached to the RREP packet to the source; after receipt of the packet by the source, the route less overloaded will be chosen as the active path.

In ”load balanced ad hoc wireless routing” Audrey Zhou [4] defined a new metric for routing ”the degree of nodal activity ’for the selection of the least congested routes; its algorithm includes route discovery, route maintenance, connectivity management and the cost.

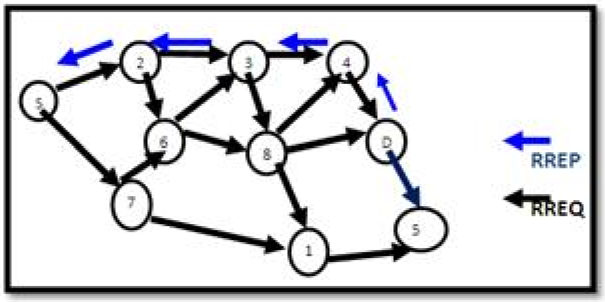
LARA [24]is another hybrid load balanced routing protocol. LARA requires each node to maintain a record of the latest traffic queue estimation of its neighbors. The traffic queue is defined as the average value of the interface queue length measured over a period of time. Traffic density, on the other hand, refers to the sum of traffic queues at a node plus the traffic queues of all the node’s neighbors.

The scheme proposed in CLAR [19] considers traffic load at a node and its neighboring nodes before selecting a suitable route. Traffic load is shared among neighboring nodes by either exchanging periodic hello messages .

The approach used in LSR [10] also requires nodes to share path and route load promiscuously.

3 The implementation:

In this paper we present a new scheme of distribution of the traffic load for the AODV protocol is implemented at the route discovery process that modifies the RREQ and RREP and adds another cost that is based on the number of packets queued all nodes participating in the establishment of the road . The route selection will be based on the minimum cost and the shortest path to destination. The load balancing is a model of quality of service, where a routing protocol is enhanced to meet the requirements of user applications sensitive to a parameter such as delay, bandwidth and jitter. In our work, we are taken to improve quality of service while minimizing delays to satisfy users, who are interested in packet transmission delay, The AODV protocol does not take into account the distribution of the load, we will add a function that will calculate the cost based on the metric load node and modify the process of route discovery and route selection will according to the minimum cost and the number of hops and we have the rout least congested and shorter.



For the load of a node i
L (i) = $\sum$the packets in the queue of node i.
Cost =$\sum$ L (i) of the nodes traversed by the RREQ.
Cost (D) =$\min$(cost).
Best (cost) = $\min$ (hop) and $\min$ (cost)
The destination chosen the least congested path and the path that has fewer hops and sends the RREP to the source for to establish the road and the routing of data packets.
the algorithm:
It changes the structure of RREQ request, RREP, even the routing table creates a new field: rq cost ,rp cost,rt cost.
Request RREQ:

@ source	Numb.seq. source	Broad ID	@ DEST	Numb .Seq. DEST	Numb. hop	cost

Request RREP

@ source	@ DEST	Numb.seq. DEST	Numbr. hop	LIFE TIME	cost

changes have been added to the source code of AODV (Elizabeth Perkins Royers)
Algorithm for source node:
1-If the node source don't have a route to a certain destination .
then it broadcasts a RREQ message to all nodes (with a cost)
$Rq\_cost = rq\_cost + l(s)$, $rq\_cost = 0$ intial value of rq_cost.
else it sends parquet data
2-If the node S receives several RREP after waiting a period of time
Then
chooses the one with the minimum cost (rp_cost) and minimal hop
transmitted data paquets.
3-else if the S node don't receives any message RREP after waiting a period of time
Then he repeated the steps 1.2.3

Algorithm for intermediate nodes
if node (i) receive RREQ
then it checks whether it has received the identifier of the broadcast before. creating the reverse route.
if this is the case
id broadcast recorded
then RREQ message is deleted
(we verified load status of node i)
if $rq\_cost < l(i)$
then RREQ message is deleted
else
$rq\_cost = rq\_cost + l(i)$.
rt0 $\rightarrow$ rt_cost=rq_cost.
If there is a fresh new route taking into consideration the load
if ((($rq \rightarrow$rq_src_seqno $>$ rt0 $\rightarrow$ rt_seqno) $||$
(rq $\rightarrow$rq_src_seqno == rt0 $\rightarrow$ rt_seqno) and
((rq $\rightarrow$ rq_cost $<$ rt0 $\rightarrow$rt_cost) and (rq $\rightarrow$rq_hop_count $<$ rt0 $\rightarrow$rt_hops))).

Update the routing table.
if the intermidiere node is the destination
Then see algorithm for destination node
else if a new route
then
send Reply Insert nexthops to RREQ source and RRE.
Insert nexthops to RREQ source and RREQ destination in the precursor lists of destination and source respectively forward the Route Request .

Algorithm for destination node
If the node receives RREQ and verifies the destination address of the message with t the node and is identical to it.
Then
it save the road with its cost.
After the expiration of the timer it chosen from the route with the least cost (load) and the shortest path.
Final cost = minimum cost minimum hop number.
Sends RREP to the destination.
If the node D receives notification route error.
Then
the route maintenance mechanism is launched Another way will be selected by the destination and will be sent to the source.

We modify the source mac.cc to transmit queue length to the upper layer
$mymac = (Mac802\_11*)TclObject :: lookup(argv[2])$
Mymac$\rightarrow$getqlen ().

4 Simulation

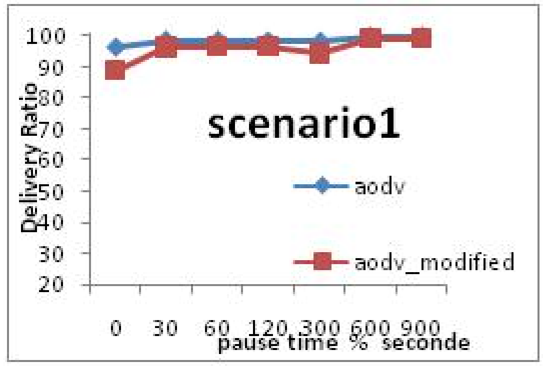
In this section the performance of the improved version of the protocol is evaluated and compared with the basic version of the protocol. The simulation environment is described and simulation results are presented and discussed.

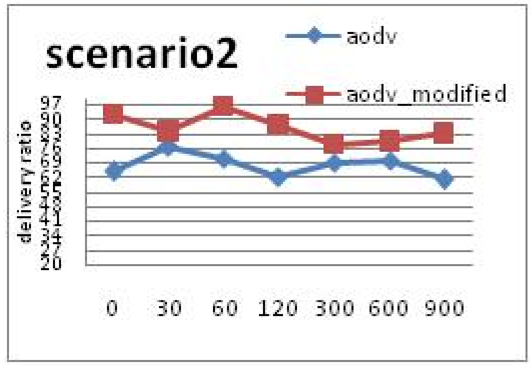
Time of simulation	900seconds
Packets size	512 bytes
rate	4 packets/second
maximum packet in the queue	50 packets
Number of nodes	50 nodes
simulator	Ns2
Mobility model	waypoint mobility model
surface	1500mx300m
Pause time	0s, 30s, 60s, 120s, 300s, 600s,900s
MAC	IEEE802.11
Type of file	drop Tail (FIFO)
application	CBR
Protocol	AODV, AODV_MODIFIED

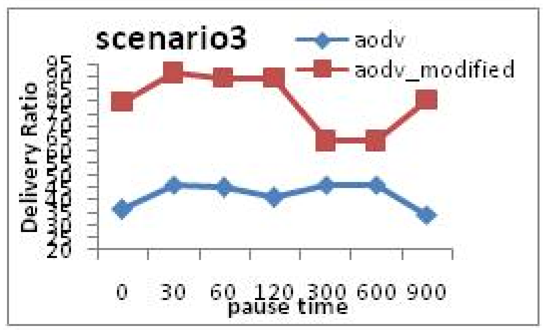
For each scenario we varied the main parameter that can influence the behavior and the simulation results is that the pause time for each node representing the immobility time before moving again.

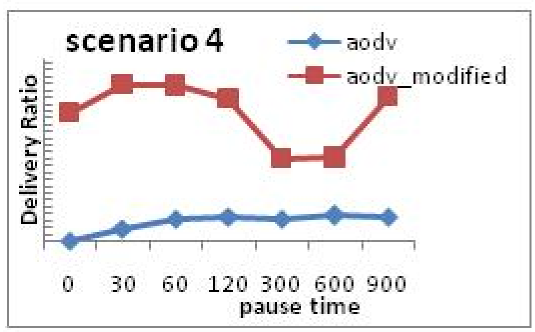
Performance metrics describe variables or simulation input data such as mobility or overload. These metrics are cited: [22]
- Mobility: It indicates the movement of nodes. It may be weak or strong. The calculation is done by measuring the relative movement of a node relative to the other.
- Pause time: it shows the average time in which the nodes are not moving.
Delivery ratio: This rate is calculated by dividing the number of packets received by the packets sent by the sources of applications.
End to end delay: is the average time needed to deliver data packets from the source to the destination successfully including latencies in queues storage time in buffer.
Normalized Routing: The overhead is calculated by dividing the number of data packets received by the control packets.

Delivery ratio:
The results of each scenario for this metric based on Pause- Time are shown in the following graph:





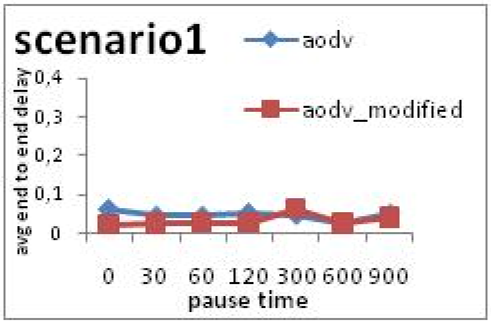


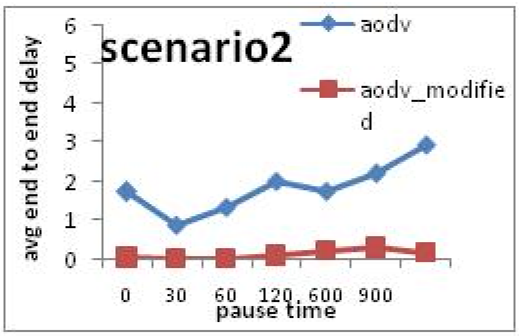


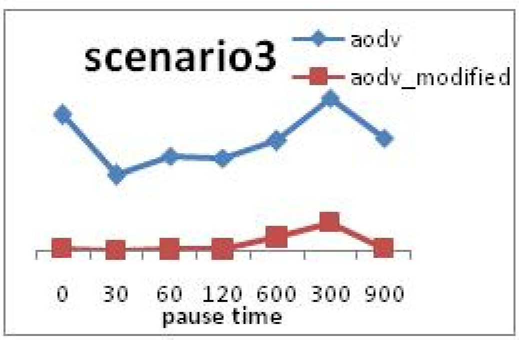
In the first scenario we have 10 nodes communicate less control packets; then the rate reached 100 % at pause time 600 sec. For AODV et AODV_MODIFIED but For scenarios 2,3 and 4 AODV_MODIFIED achieves the highest packet delivery fraction for al1 pause time values. This factor is influenced by the removal of packets at the queue if it reached the maximum number. In our simulation, the maximum number is 50 packets. The modified protocol is more efficient than AODV because the verification process of the size of the queue. the value of the size is compared with the cost of the request at each receiving the request , if it is higher, the node is considered overloaded, the request RREQ will be deleted , the queue will never reach the maximum size so fewer packages lost, and the rate of delivery will be better for modified AODV.

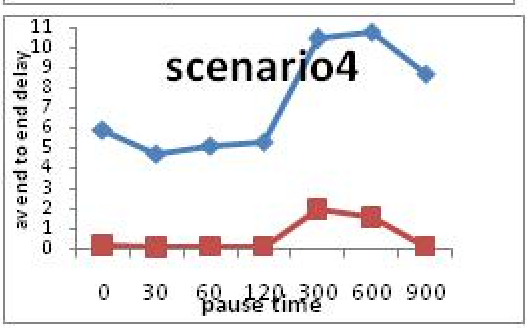
End to end delay:

The results of each scenario for this metric based on Pause- Time are shown in the following graph:









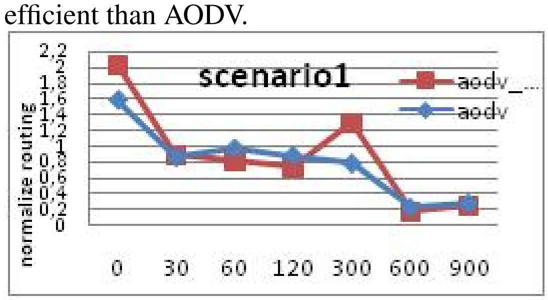
AODV_modified has a better average end to end delay than AODV, For 30 and 40 sources, AODV_modified achieves significantly lower delay than AODV. The modified AODV is more efficient than AODV. It carries a lower delay than the AODV in scenarios 3 and 4 we have less load on the nodes in the network and the waiting time at each node has decreased.

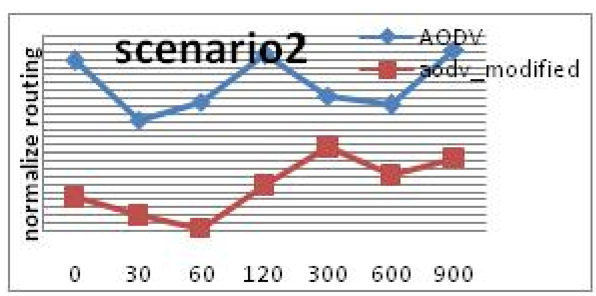
When there is less mobility AODV is better than AODV modified because the number of communicating nodes is limited, there have less control packets; delay decrease .time of latencies is lower in AODV modified compared AODV.

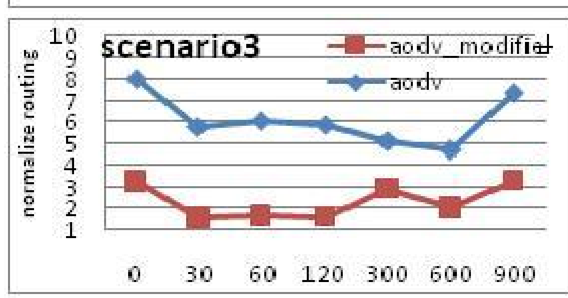
Overhead :

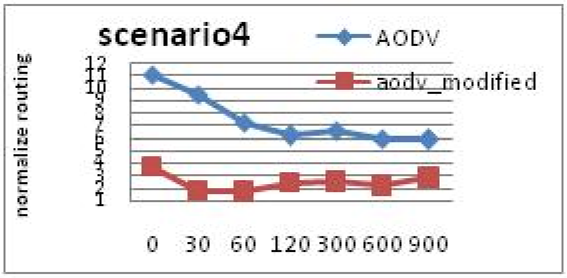
We note from the results of the simulation that as the number of nodes communicating in 20.30.40 scenarios increase, the network is less congested;This is because the increase in the number of source nodes causes a greater number of request messages flooding. In contrast, AODV_modified adopts a mechanism for load balancing, which tries to route packets along a less congested path to avoid overloading some nodes. but in the scenario1 AODV modified don't shows its effectiveness against AODV. Concernant mobility, in high mobility (0 ... 120) we have a load increase.

In terms of overload AODV modified is more efficient than AODV.









5 Conclusion

We introduced a new load balancing mechanism that has been applied to AODV and has been evaluated through various simulation scenarios. The simulation results show that our protocol has a better end to end delay and a higher rate of delivery than AODV. In terms of load, it is more efficient in large ad hoc networks.
As perspective, we propose to combine our approach with that limit the number of active paths to improve the performance of AODV protocol.

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