EAOMDV WITH CONGESTION METRIC AND LOAD BALANCING SCHEME IN WIRELESS MESH NETWORK

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Abstract

In this paper we propose reactive routing protocol EAOMDV. The protocol computes more than one path to the destination and uses efficient scheme to balance the load. The scheme to balance the load uses queue utilization information also. The use of this scheme improves the efficiency of the network and reduces congestion almost to zero. We achieve zero network congestion with the help of load balancing scheme and ACA metric. EAOMDV is an extension of AOMDV. By using "NS-2" Simulation it can be proved that EAOMDV is much more effective than AOMDV.

Index Terms: Congestion, Load Balancing, Wireless Mesh Network.

I. INTRODUCTION

Routing using more than one path can be used to improve the effectiveness of "MANET".

Features "Mobile Ad Hoc Networks"

- Each mobile devices act as network.
- These devices collaboratively provide functionalities of routers, switches and servers.
- Each node act as both host and router.
- These networks have lower capacity than wired network.
- Nodes in these networks are portable hand held devices with limited battery power.

Protocols in "MANET" are classified as follows.

- Proactive
- Reactive
- Hybrid

A. Proactive routing protocol

If the routing operations need to be performed periodically, developers tend to choose proactive routing protocols. An added advantage of these protocols is the lower latency. Sending packets periodically even if it is not needed leads to the wasting of bandwidth.

Examples are

- OLSR
- FSR
- DSDV

B. Reactive routing protocols

These protocols reduce routing overhead. These protocols discover the route only when necessary. Whenever source required sending data packets to the destination and path is unknown, then this protocol starts the process of route discovery. This protocol comes out with one drawback that is flooding. Then also these protocols are preferred because of bandwidth advantage and scalability, compared to other routing protocols.

Examples are

- AODV.
- AOMDV.

- EAOMDV.
- DSR.
- TOR.

C. Hybrid Protocols

These protocols combines the above two approaches.

Example

Zone Routing Protocol (ZRP)

II. LITERATURE SURVEY

[1]Main challenge of MANET is to design algorithms for frequently changing network topology. AOMDV is an extension of AODV. Author has compared and evaluated performance of two routing protocols AODV and AOMDV. In AOMDV, we have to face more routing problems and delay than AODV. But AOMDV has better efficiency in terms of number of packets ignored and packet delivery. The focus is to minimize energy utilization and to minimize packet loss of WSN. Therefore AOMDV is used. A MANET is highly efficient wireless network which can be established without any requirement of preexisting infrastructure. AOMDV is carefully designed for highly efficient MANET. The issues related to link failures and route breaks are carefully addressed in this protocol.

[2] The author says that the nodes send data by using omnidirectional antenna. The node which gets the data can set its antenna in a particular direction. This kind of transmission has some advantages.

They are

- Power used is less
- Other nodes can use the area around it and can transmit data in any other direction.

"Multi beam adaptive array" can use multiple beams for concurrent transmission and reception.

If we require QoS in this protocol there is a need to construct multicast trees. The main focus is on bandwidth because it is the major requirement in for real time application.

[3]Author says that the node behaves as a router and also as host. Node sends the packet instead of other nodes which are outside the communication range. It has application in disaster recovery and defense etc. the WMN includes "wireless static mesh routers" also called nodes. The author proposed "Gateway Load Balancing Algorithm" where gateways interchange data about network conditions. The traffic will be carried out through those nodes which are not used much. Load balancing algorithms can be effectively used in reactive routing protocols. The traffic in each path can be effectively minimized in these load balancing schemes. One of the ways to include load balancing is to use more than one path in routing. Author says that the control messages can be modified according to the convenience of the developer.

[4]Author mainly focuses on decreasing energy consumption and avoiding packet loss in WSN. Therefore AOMDV Protocol has been used. AOMDV Protocol is an improved version of AODV Protocol. AOMDV Protocol does not have inter-nodal coordination overhead. AOMDV ensures disjointness alternative routes. AOMDV computes alternative paths with minimal overhead. To obtain reliability of a routing protocol one can use multipath routing. In single path routing the link can be broken easily due unpredictable link condition and mobility of nodes. In order to enhance the performance of routing protocols AOMDV has been used as an enhanced version of AODV. Energy consumption can be greatly reduced using AOMDV. All the drawbacks of AODV are addressed in AOMDV.

III. LOAD BALANCING SCHEME AND ACA METRIC

A. Review

In distributed load balancing protocol, traffic flow is carried through underutilized gateways. If more traffic is flowing through frequently used gateways, then that traffic is rerouted through underutilized gateways. In congestion aware load balancing strategy, a technique called as "WCETT-LB" is used is used. In this technique queue utilization is computed frequently. If it is greater than the threshold, then this technique re-computes it.

B. Calculation of ACA Metric

ACA is based on the following

- "Air time link cost metric"
- "Round trip time"

"Air time link cost" is calculated using

$$Aq_l = [Pca + Xp + Nt/r]\ 1/\ (1-e_f)$$

Pca, Xp and Nt are constants.
r : Data Rate
ef:Frame Error Rate

Constants of Airtime Metric

	802.11a	802.11b/g
Pca	75µs	335µs
Xp	110 µs	364µs
Nt	8192 bits	8224 bits

ACA is calculated using

$$ACA(p) = (1-\alpha)\sum_{link \in p} Aq^{1} + \alpha \sum_{link \in p} RTT$$

α is a parameter whose value is 0.3, which can be changed.

C. Load Balancing Scheme

In any particular path if the load increases then the efficiency of transmission decreases. In the proposed scheme, the "metric cost" of each path is computed periodically. The source node measures cost of all interested paths periodically and compares the cost of current path with other paths. If the current path's cost is found less than the metric cost of all other paths, then the current path is considered as load balanced. Otherwise the path with the least metric cost is preferred for transmission.

If any path to destination already exists then select the one with minimum queue utilization and send RREP. Otherwise the source node broadcasts RREQ to neighboring nodes. This is done to obtain path to the destination. Otherwise following activities are carried out

- Send RREQ to all neighbor
- Calculate ACA of each link
- Add new path with smaller ACA
- Send RREP
- Update path metric cost periodically

If ACA of current path is greater than the other, switch to other path with minimum ACA. Otherwise the current path is load balanced.

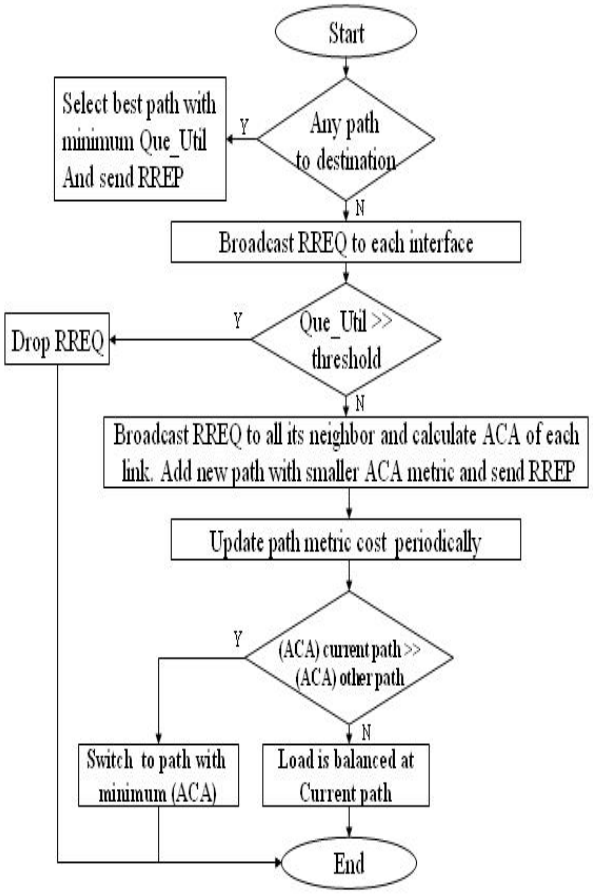


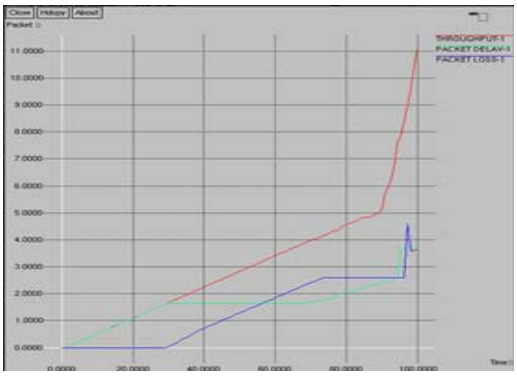
Figure: Flowchart to balance the load using ACA metric

IV. SIMULATION PAREMETERS

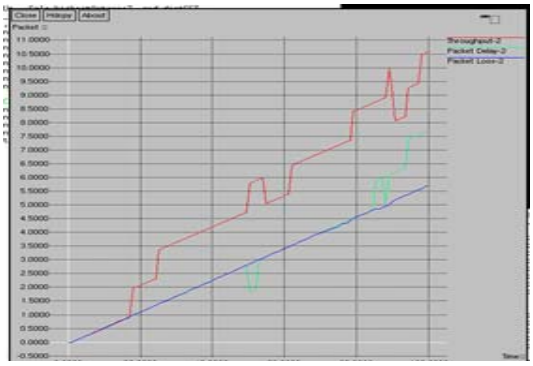
Simulation is conducted using NS-2 to carry out the proposed work for 802.11b network.

Parameter	Values
Topology	Random
Scenario Size	1220 x 644 m
MAC protocol	IEEE 802.11b
Traffic type	CBR
Number of Nodes	33

V. RESULT



EAOMDV: Graph showing throughput better than AOMDV.



AOMDV throughput, packet delay and packet loss

VI. CONCLUSION

By utilizing all network resources the routing protocols need to find the optimal path with no possibility of congestion. In our proposed work better load balancing scheme has been used. In this project EAOMDV calculates more paths using ACA and balances the load by using QUE. In these method packets transmission is carried out using efficient path. The performance of AOMDV and EAOMDV is obtained using NS-2.

As an enhancement for the future one can write new metric and compare that with other metrics which are available. Another work could be to design a new scheme for load balancing which could be efficient enough than the available schemes. One can think of discovering multiple paths in a different manner than the existing method.

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