Efficient MAC Based AODV Routing Protocol to improve the efficiency of MANET

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Abstract

Currently, multimedia and real-time applications use much network resources and so, need high flow rates and very small transfer delay. The present ad hoc networks , in their original state, are not able to satisfy the requirements of quality of service (QoS). Researches for improving QoS in these networks are main topics and a subject of intensive researches. In Adhoc networks, the routing phase plays an important role for improving QoS. Numerous routing protocols (proactive, reactive and hybrid) were proposed. AODV (Adhoc On demand Distance Vector) is probably the more treated in literature In this article, we propose a new variant based on the AODV which gives better results than the original AODV protocol with respect of a set of QoS parameters and under different constraints, taking into account the limited resources of mobile environments (bandwidth, energy, etc…). The proposed variant (EMAODV) suggests that the discovering operation for paths reconstruction should be done from the source. It also defines a new mechanism for determining multiple disjoint routes.

Keywords: AODV, MAC, Routing Protocol, Throughput, Packet Loss,MANET

I.INTRODUCTION

As wireless networks provide access computing and communication services on the move regardless of user‘s location. The one type of wireless network is Infrastructure less networks, that is knows as Mobile Ad-hoc Networks (MANET) [1]. It is a self-configuring infrastructure less devices connected by wireless and equipped with networking capability. In these networks hosts movement are frequent. All nodes are capable to move and can be connected dynamically in arbitrary manner means topology change frequently. These devices can communicate with other nodes that immediately within their radio range or one that is outside their radio range. The responsibilities for organizing and controlling the network are distributed among the terminals themselves.

Ad-hoc nodes and devices are able to detect the presence of other such devices and to perform the necessary handshaking to allow communications and the sharing of information of services. The Ad-hoc nodes may be of different forms located in or on airplanes, ships, trucks, cars, perhaps even on people or very small devices. Ad-hoc devices indentify type of device and their attributes.

Ad-hoc Networks are supposed to be used for disaster recovery, battlefield communications, and rescue operations when the wired network is not available [2]. Some of the applications of MANETs are military or police exercises, disaster relief operations; mine cite operations and urgent business meetings. Figure I Mobile Adhoc Networks In MAC Layer, wireless broadcast medium is used and therefore multiple transmissions can result in garbled data, making communication impossible. A medium access control (MAC) protocol moderates access to the shared medium by implementing some rules that allow these devices to communicate in orderly and efficient manner with each other.

II. RELATED WORK

This section is an exhaustive scientific study on energy efficient protocols published in different journals, conferences proceedings and book chapters. Since energy conservation is an open issue to all layer of the network protocols stack, so different techniques were suggested by different study and focus has been given on different layer design to conserve energy more effectively. Here efforts are made to classify these works in different category such as power management based, power control based, and topology control based.

A. Power Management Based Protocols.

IEEE 802.11[2] standard protocols have two types of power managements. First type is known as power save (PS) mode for infrastructure based wireless network and the second type is known as IBSS PS mode, which is for infrastructure-less networks. In the former method nodes in PS mode consume less power compare to active mode operation. The access point buffered the MAC service date unit (MSDU) and transmits them at designated time by the help of traffic indication map (TIM) and delayed traffic indication map (DTIM).

This type of power saving mechanism is not suitable for ad hoc network environment as there is no central coordinator like access point[3]. On the other hand IBSS PS mode is applicable to fully connected single hop network where all the nodes are in the radio range to each other[4]. Synchronized beacon interval is established by the node which initiates the IBSS and is maintained in a distributed fashion. All the nodes wake at the beginning of the beacon interval and wake till the end of the traffic window[5][6].

B. Power Control Based Protocol

Power control MAC (PCM) [7] achieves energy saving without causing throughput degradation by implementing different type of transmission power. DATA and ACK packets are transmitted using minimum power while RTS/CTS packets are transmitted using maximum power. Receiver calculates the minimum power required by the sender to send data, depending upon the surrounding noise and interference. When the transmission takes place the neighbouring node defers their transmission. During data transmission same procedure are used for finding minimum required power level that should be enough for the transmission of DATA as well as ACK. PCM require an accurate estimation signal strength based upon which its power control works. Also factors like multipath propagation, fading and shadowing effects may degrade its performance.

Sahoo et al. [9] propose a distributed transmission power control protocol for wireless network to achieve energy conservation in the node level. The protocol uses distributed algorithm to build the power saving tree topologies without taking the local information of the nodes and provide a simple way to maintain network by changing the transmission power.

C. Topology Control Based Protocol

SPAN [8] is a distributed power saving protocol adaptively elects coordinator from all nodes in the network. Coordinator nodes stay awake continuously and perform multi-hop packet routing. Other nodes remain in power save mode to conserve energy. SPAN achieves four goals such as, it elects enough coordinator nodes, rotates the coordinator nodes to balance residual energy, attempts to minimize the numbers of coordinator and elects the coordinator using local information in a decentralize manner. SPAN gives guarantee of network connectivity by ensuring that every node has at least one active node in its radio range. Fairness among the nodes is based on the amount of residual energy and the additional neighbor pairs that a node can connect. It balances both fairness and network connectivity.

III.VARIOUS ROUTING PROTOCOLS IN MANET

1. Table-driven (proactive) routing

This type of protocols maintains fresh lists of destinations and their routes by periodically distributing routing tables throughout the network. The main disadvantages of such algorithms are:

1. Respective amount of data for maintenance.

Slow reaction on restructuring and failures. Examples of proactive algorithms are:

- Optimized Link State Routing Protocol (OLSR)
- Destination Sequence Distance Vector (DSDV)

2. On-demand (reactive) routing

This type of protocols finds a route on demand by flooding the network with Route Request packets.

The main disadvantages of such algorithms are:

1. High latency time in route finding.
2. Excessive flooding can lead to network clogging.

Examples of on-demand algorithms are:

- Ad hoc on demand distance vector(AODV)
- Dynamic Source Routing
- Flow State in the Dynamic Source Routing
- Power-Aware DSR-based

3. Hybrid (both proactive and reactive) routing

This type of protocol combines the advantages of proactive and reactive routing. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. The choice of one or the other method requires predetermination for typical cases.

The main disadvantages of such algorithms are:

1. Advantage depends on number of other nodes activated.

2. Reaction to traffic demand depends on gradient of traffic volume.

Examples of hybrid algorithms are:

- ZRP (Zone Routing Protocol)

4. Hierarchical routing protocols

This type of protocol the choice of proactive and of reactive routing depends on the hierarchic level in which a node resides. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding on the lower levels. The choice for one or the other method requires proper attributation for respective levels.

The main disadvantages of such algorithms are:

1. Advantage depends on depth of nesting and addressing scheme.

2. Reaction to traffic demand depends on meshing parameters.

Examples of hierarchical routing algorithms are:

- CBRP (Cluster Based Routing Protocol)
- FSR (Fisheye State Routing protocol)

IV.ROUTING BASED ON WIRELESS MAC PROTOCOL PERCEPTUAL COGNITION

Wireless Mesh network routing perception is one of the key problems. Router perception for prolonging the survival time of the network, reducing the interference of communications, to improve the efficiency of C and routing protocols is important[10]. Routing based on perception of wireless Mesh network MAC protocol study is an interesting topic, most of the previous studies is a independent research, or research network layer, or layer of MAC, emergence of cross layer research, most of the studies are focused on the MAC layer extracts some state parameters information as routing criterion, study of multi-channel MAC protocol based on, for on-demand distance vector (AODV) routing protocol of wireless Mesh network, routing protocol MAC based on perception of the routing layer, some thought into the MAC layer, so that the original only for single size of MAC protocol, with multi-path function, based on the multipath routing protocol multi next hop MAC protocol MNH MMAC protocol, accordingly improve AODV, put forward no connection limit NDL AODV protocol, and with the original MMAC protocol for analysis and comparison, in the frequency resource more nervous condition, to improve network performance[11].

Router perception classification

Router can be divided into multi criteria multi channel routing, routing, multipath routing, hierarchical routing, routing, routing and QoS routing based on geographic location information according to the routing system to points. Many routing protocols are used as the criterion of minimum hop count routing on several typical routing criterion: expected transmission times, round trip time, data on the delay time were studied, the results show that: for the two node to meet minimum hop criterion, in the majority of cases are not effective; and a single routing criteria are difficult to reflect the quality of the link to each the impact of

performance index, that can be drawn through the multi routing criterion to solve this contradiction.

In wireless Mesh networks, using multiple channels are single transceiver multi channel, multi transceiver multiple channel, that can improve the throughput of network greatly through experimental and theoretical analysis. In wireless Mesh networks, all nodes through sharing cyber source routing protocol, routing protocol must satisfy the requirement of load balancing this requirement. Multipath routing technology can avoid single path routing network shocks well, and also can make full use of bandwidth and other cyber source at the same time, to realize load balance routing fault-tolerant.

Along with the network scale increasing, the traditional use of broadcast mechanism for routing lookup will consume a lot of cyber source. Through the hierarchical routing thought, in between intra cluster and inter-cluster routing using different classification techniques and play a variety of routing advantages respectively in order to achieve large-scale wireless Mesh network routing. Routing protocol of wireless Mesh network cross layer design can also be called routing protocol adaptive routing protocol design, cross layer design to break the existing hierarchical design philosophy and to dig out some of the potential advantages of wireless Mesh network the maximum possible, so as to find more reliable, efficient and excellent performance of the path. To provide users with a QoS guarantee is a hotspot of current routing, QoS route 's main idea is to choose to meet user requirements of QoS arrive at the destination node in the path.

Key problem

In wireless Mesh networks, network topology is dynamic and need adopts distributed control method, network expandability is poor and with a unidirectional wireless channel and short survival time. Therefore, the wireless Mesh network needs to use some special methods to solve the routing technology in wireless Mesh network, the routing technology is the key problem of: In wireless Mesh networks, nodes exchange information is limited; there is no uniform management center, so the routing protocol should adopt distributed operation.

1. Loop avoidance If we don't take any measures, there will be data packets in the network of endless forwarded. The survival time (TTL, Time TO live) can solve this problem to some extent, but the wireless Mesh network routing must consider loop avoidance problem.

2. On-demand routing Wireless Mesh network is not between any two nodes at any time will the packet transmission demand, therefore, there is no need to maintain each node to other nodes in the routing, and should according to the actual flow demand for route discovery and establishment reasonably. In the bandwidth resource, energy of nodes under the condition of limited especially should adopt ondemand routing.

3. Proactive routing On-demand routing instead, in this case, the data on time delay request is very high, too late to find the building routing data, if the bandwidth and power allow, each node maintains routing information to all other nodes, so that it can fast forward packets. In addition, because the AODV protocol uses a routing packet priority queuing rule, congested nodes can be promptly forwarded the RREQ package, so that the high load node may be the best route to an intermediate node, in the NDL AODV protocol, through the queue size, as the network load measure, high load in the middle node RREQ discarded after high load, reduce intermediate node negative routing. For each set of nodes of a monitor, monitoring of each node in the received RREQ queuing number length IFQ_length, set a threshold Tq, if the queue length is less than the Tq normal processing of RREQ, if the queue length greater than or equal to Tq, received RREQ packet discarding.

V.PROPOSED SOLUTION

In MANET as node are mobile and they rely on batteries and if battery of node let down it also cause link breakage or link instability. This leads to the problem of delay in transmission resulting in more packet loss and lesser overall throughput. In our proposed work we modify the existing MAC based AODV route discovery mechanism in such a way that it will show give greater performance than existing AODV protocol It will not only reduce the end to end delay but also gives the link more life. We take into account the energy of the nodes during route discovery and route establishment.

Route Selection mechanism

When a source node initiates a route discovery procedure by flooding RREQ messages, each node that receives the RREQ looks in its routing table to see if it has a fresh route to the

destination. If it doesn't have the route it calculates its remaining energy and adds calculated value in RREQ and broadcasts it further. The process is repeated till either the destination is reached or no destination is found.

VI. IMPLEMENTATION AND ANALYSIS

We implemented basic and our Enhanced MAC based AODV Protocol in NS2 [24]. NS2 is discrete event simulator for the simulation of wireless ad hoc networks. It Simulate both wired and wireless network. We use the following matrices to evaluate the performance of our enhanced protocol against basic AODV.

Performance Metrics

- Average throughput

Throughput is the total number of packets received successfully in given time.

- Packet delivery Ratio It is the ratio of the number of packets received successfully to the total number of packets transmitted.

- Packet loss

It is the packet loss ratio of the transmission.

VII.SIMULATIONS

The results are compared and presented in graphical form after implementing Enhanced AODV protocol. We simulate the result in NS2 by taking parameters (pause time) on X axis and performance metrics (delivery ratio, packet loss, throughput) on Y-axis. The pause time is the time interval during which different parameters are calculated.

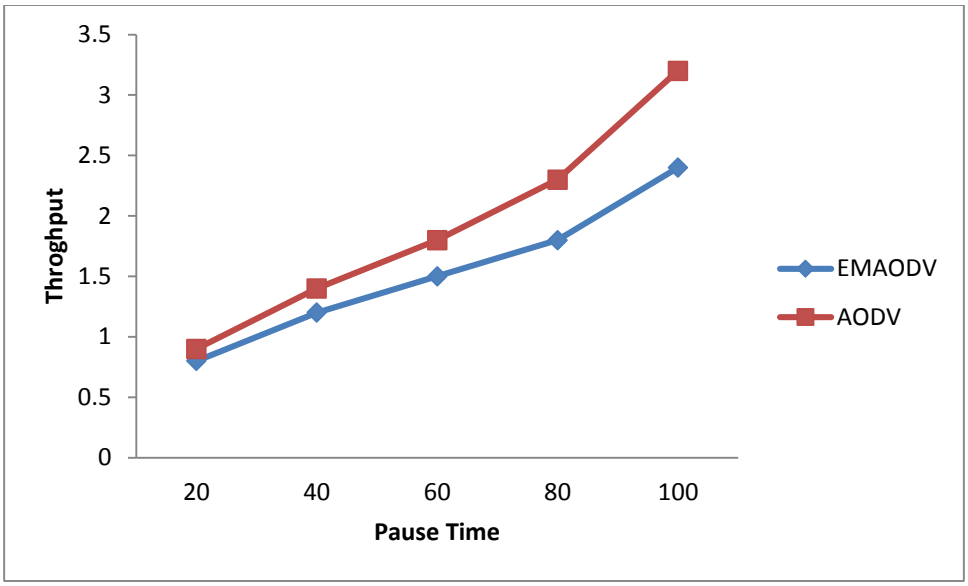

Figure 1: Throughput vs. pause time of AODV & EMAODV

In figure 1 the throughput comparison between AODV and EMAODV is given and it is clear that the throughput of EMAODV is greater than basic AODV as indicated by blue line in Graph.

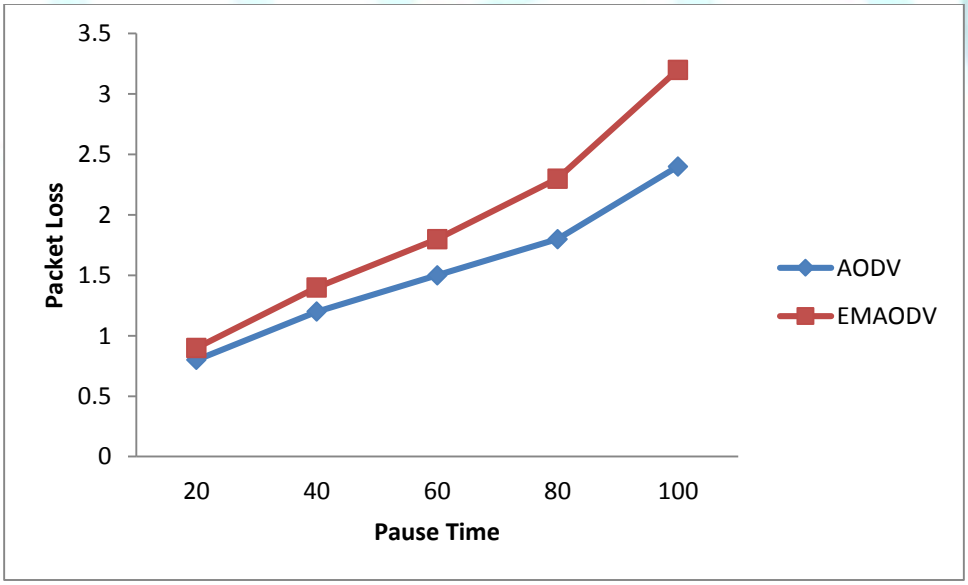

Figure 2: packet loss vs. pause time of AODV & EMAODV

The packet loss ratio of Basic AODV and EMAODV is compared in the above graph. The packet loss rate of both protocols is calculated at fixed interval of time. Packet loss rate for the EAODV is smaller than AODV.

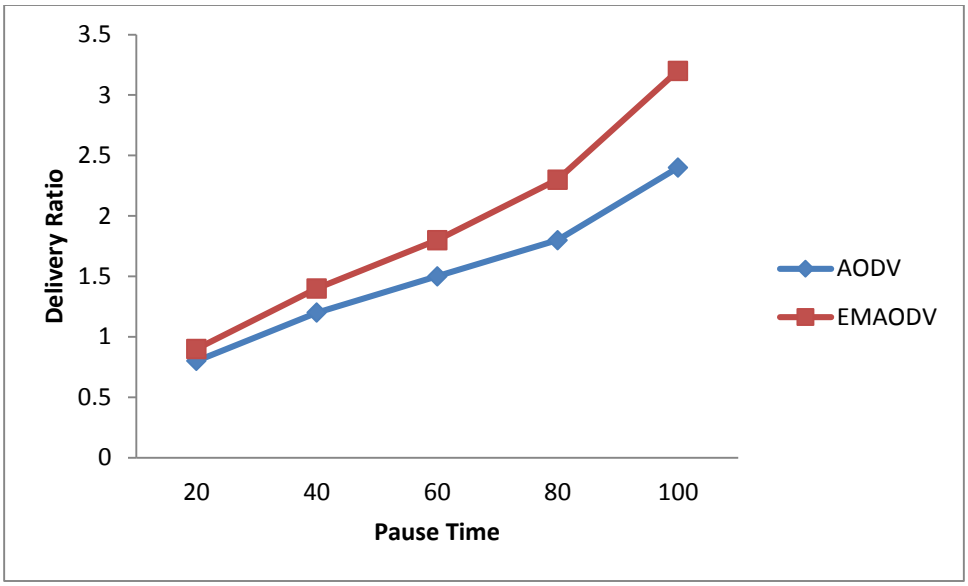

Figure 3: Delivery ratio vs. pause time of AODV & EMAODV

Figure 3 shows delivery ratio of both the protocols. Red line is indicating the delivery ratio of AODV and Blue line indicate the delivery ratio of basic AODV and the delivery ratio of EMAODV is Greater than AODV.

VIII.CONCLUSION

It is proposed a protocol with an enhanced MAC based route discovery mechanism that reduce the transmission delay In EMAODV we modified the RREQ message and in the RREQ message a field is reserved for remaining energy. The average remaining energy is calculated and value is added in the reserved field and at the destination the reserved field is divided with number of hops .This will give average remaining energy and route will be selected which has greater average remaining energy we implement this protocol in NS2 and the results show that the throughput and delivery ratio of EMAODV increase as compared to AODV and EMAODV show less packet loss then AODV. Hence through results it is proved that the EMAODV routing protocol is better than basic AODV protocol for mobile adhoc networks.

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