POWER CONTROL AND PERFORMANCE IMPROVEMENT IN WIRELESS MESH NETWORK THROUGH MULTIPATH AODV

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ABSTRACT

Wireless Ad Hoc Network is a self-organized, decentralized and infrastructure-less mobile network. Wireless Mesh Networks is self-configurable, self-healing, and low cost Ad Hoc network organized in mesh topology. Ad-hoc On-demand Distance Vector (AODV), in MANETs is an on-demand variation of the distance vector routing protocol. This protocol initiate route discovery only when a route is needed and maintain active routes only when they are in use. Unused routes are deleted. We proposed an approach to control power and improve the performance in Wireless mesh multipath network in AODV. The proposed approach in the paper that may improve the packet delivery percentage, Throughput, and the Average latency of the network etc and also provide reliable gratuitous routes.

Keywords: *Power Control, Ad Hoc Networks, Wireless Mesh Network, AODV, Throughput.*

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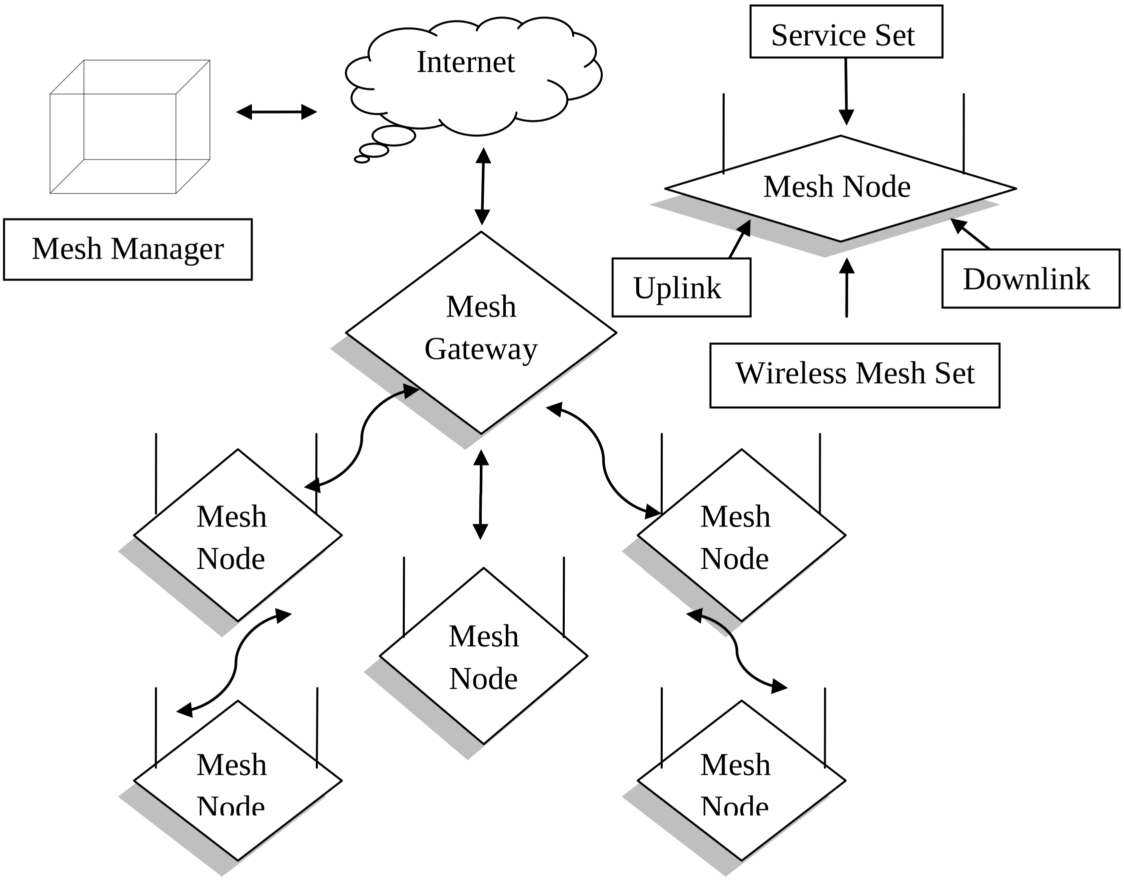
1. INTRODUCTION

Designing an effective **Power Control** strategy to reduce network energy consumption is very important. Power Control can reduce power consumption and interferences in wireless Ad hoc networks, where a set of nodes access a shared medium to communicate with each other without battery life, any mobile node will become useless. Hence, how to extend the battery power is an important issue [3]. Many power control algorithms and approaches have been presented for wireless Ad hoc network [3], [4], [5], [7], [8] for increasing throughput and capacity with a use of minimum power level of nodes.

A Wireless mesh network is a, self-configuring, self-healing communication network and has routing ability to deal with hidden terminal problems without the use of any existing network infrastructure or centralized administration. This feature brings many advantages to WMNs such as low up-front cost, easy network maintenance, robustness, and reliable service coverage. A wireless mesh network (WMN) is a communications network made up of radio nodes organized in a mesh topology. Wireless mesh networks often consist of mesh clients, mesh routers and gateways. Each node operates not only as a host but also as a router, forwarding packets on behalf of other nodes that may not be within direct wireless transmission range of their destinations. WMNs can be classified into three main types - Infrastructure mesh, client mesh and hybrid mesh.



Wireless Mesh Network

Mobile Ad Hoc Network (MANET) is a self-organized and infrastructure-less movable network without the use of any existing network infrastructure or centralized administration. The representation of MANET network mainly depends on its routing protocols which are divided as proactive and re-active routing protocols. One of the reactive routing protocol is Ad hoc On-demand distance vector (AODV) routing protocol that provide Route discovery and Route maintenance from DSR and hop-by-hop routing sequence numbers from DSDV protocol [2]. There is an important issue handled in MANET that is to provide energies in battery path to route the packet giving a consideration towards limited resources as bandwidth, energy etc [1], [3]. To achieve optimal performance [6] routing protocols must generate minimized control traffic. But it gives a restriction to energies in battery. The aim of this paper is to control power by below given approach and performance improvement in wireless mesh network using AODV.

This paper has been organized in sections as follows. In the below given section 2 we give short description of the related work focusing on power control. Section 3 we explain our proposed methodology. Finally we conclude this paper in section 4**.**

2. RELATED WORK

In [1], a new routing method for improved quality of service in mobile ad hoc networks is presented. The routing approach guarantees the shortest feasible data transmission subject to the accuracy of estimating energy related functions. Due to the limited amount of energy on the nodes of an adhoc network, some paths do not ensure a reliable data transmission. We presented a polynomial time algorithm that finds a path along which a given amount of data is transmitted in minimum amount of time. We have also extended the algorithm to take into consideration the displacement function of each mobile node in the network.

Jin Jong [3] this article, propose that the enhanced AODV routing protocol which is improve the networks lifetime in MANET. One improvement in AODV protocol is to maximize the network lifetime by applying an Energy Mean Value algorithm which considerate node energy-aware. We attempted to extend the entire network lifetime by adjusting RREQ delay time according to the data acquired from comparison between node's energy states and the entire network's Energy Mean Value.

In [4] paper, an on-demand routing algorithm based on cross-layer power control termed as CPC-AODV. This algorithm builds different routing entries according to the node power levels on demand, and selects the minimum power level routing for data delivery. In addition, CPC-AODV uses different power control policies to transmit data packets, as well as control packets of network layer and MAC layer. Simulation results show that our algorithm can not only reduce the average communication energy consumption, thus prolong the network lifetime, but also improve average end-to-end delay and packet delivery ratio.

In [5] paper, the related energy control mechanisms for adhoc and sensor networks are introduced. Considering the QoS requirement such as maximum network capacity, minimum network radius and guaranteed network connectivity, a distributed non-cooperative game algorithm to power control for ad hoc & sensor networks is presented. The existing and uniqueness of Nash equilibrium for the algorithm is also proved in this paper. Simulation results show that using minimum transmitting power can get high energy efficiency at the cost of longer average latency, lower network capacity and higher interference.

In [6], a comprehensive attempt has been made to compare the performance of two on-demand reactive routing protocols DSR and AODV, along with the proactive DSDV protocol. A simulation model with MAC and physical layer models have been used to study interlayer interactions and their performance implications. The general observation from the simulation is that, for application-oriented metrics such as packet delivery fraction and delay, DSR performs higher than the DSDV and AODV. DSR consistently generates less routing load than AODV.

In [7] paper, it introduced transmission power optimization algorithm based on various nearest neighbor distances algorithm. Transmission node is informed of neighbor node locations in its maximum transmission range through network location management or other means. Then it measures node density and calculates the optimal transmission power in current network with free space model and two way propagation model. NS2 simulation results show that this algorithm increases network throughput, and increase packet delay time and it reduces network power consumption in dense region, as well as the proportion of isolated nodes and network fragmentation in sparse region.

In [8], controlling ambient noise and optimizing the performance of DSR and AODV routing protocols as the received signal strength determined if the transmitted packet is valid or treated as noise based on the pre-defined received signal threshold. The technique was simulated using random way point mobility model with 40 CBR sources each generating 4 packets per second with a simulation time of 900 seconds. The results showed that AODV and DSR routing protocols were optimized to obtain a higher throughput, lower end-to-end delay and lower network load compared to the previous related research works[3],[6].

In [9], simulation study of the impact of wireless channel on Dynamic Source Routing (DSR) protocol performance at microwave carrier frequencies above 2 GHz. Simulation results show that at microwave carrier frequencies above 2 GHz, when the two-slope path loss model is used for channel modeling, the breakpoint distance affect the end-to-end throughput of the DSR protocol in Mobile Wireless Ad Hoc Network (MANET), whilst at frequencies below 2 GHz the end-to-end throughput for the free space and the two-slope path loss model was the same.

In paper [10], consider power control as network layer problem in wireless mesh networks. The network connectivity between nodes is determined by their communication range which in turn can be controlled by adjusting the transmit power level. We showed that when the links are TDM scheduled, increasing power levels of nodes results into increased throughput in case of many representative topologies and traffic pattern.

3. PROPOSED METHODOLOGY

We proposed an approach to control power and improve the performance in Wireless mesh multipath network in AODV.

Step 1: Firstly create a new data structure local information table which includes nearest node ID, distance between nodes, and the interference power in neighbor node at time t.

Step 2: In order to save the value of node interference power, a new field is added to HELLO message. Each node adds its interference power value in HELLO message and send HELLO message to its neighbors period.

Step 3: When a node receives HELLO message from its neighbors, it will refresh its local information table and compute its payoff value according to equation

$$u_i (p_{i,} p_{-i}) = \mu \log_2(1+SIR_i) – c(p_i)$$

Step 4: When a node wants to send message, it will search its local information table and select maximum payoff to compute a transmit power according to equation.

$$p_i = \mu h_{ik}/\ln 2 – \sigma(t)^2 + p^i_{infer}(t)/h_{ik}(t)$$

to transmit the message.

To implement the proposed model, we are planning to use NS-3 simulator in a physical topology area of 600m x 400m using a random way point mobility model.

Our simulation provides the following performance metrics.

1) **Packet Loss -** This is the number of packets t hat were lost due to unavailable or incorrect routes, MAC layer collisions or through the saturation of Interface Queues.
2) **Packet Delivery Percentage** - It is the ratio between the numbers of packets received by the application layer of destination nodes to the number of packets sent by the application layer of source nodes.
3) **Routing Packet Overhead** - This is the ratio between the total numbers of control packets generated to the total number of data packets received during the simulation time.
4) **Average Latency -** The mean time (in seconds) taken by the data packets to reach their destinations.
5) **Path Optimality -** The ratio between the numbers of hops of the shortest path to the number of hops in the actual path taken by the packets.
6) **Throughput -** This is the total number of successful received bits at the destination nodes for the entire simulation period.
7) **Network Load -** The total traffic (bits/sec) received by the network layer from the higher MAC that is accepted and queued for transmission.
8) **End-to-End Delay -** This includes all possible delays caused by buffering during route discovery time, queuing at the interface queue, retransmission, and processing time.
9) **Aggregate Goodput -** It is the total amount of application layer data in bps that is successfully transmitted in the network.

Our proposed approach may improve the packet delivery ratio and lower the latency of the network and also provide reliable gratuitous routes. It may control the power of multipath WMN network.

4. CONCLUSIONS

Wireless Mesh Networks are becoming future of wireless multihop networking and network deployment. They are becoming popular as a new broadband Internet access technology through multihop transmission nowadays. Wireless Mesh Network (WMN) has become an important edge network to provide Internet access to remote areas and wireless connections in a metropolitan scale. AODV is a routing protocol used for routing in this network. AODV mixes the properties of DSR and DSDV. Routes are discovered as on-demand basis and are maintained as long as they are required. We proposed an approach to control power and improve the performance in Wireless mesh multipath network in AODV. Our proposed approach may improve the packet delivery ratio and lower the latency of the network and also provide reliable gratuitous routes.

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