

Enduring and Enhancing A New Adaptive priority based algorithm to maintain QoS for real time data communications in wireless mesh networking

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Abstract

Wireless Mesh Network currently playing an important role in the networks, due its specific dynamic nature which enables fast communication of information globally. But Wireless Mesh Network faces many problems due to increase in end to end delay over multiple hops in wireless link connectivity. In this paper a Novel Enhanced Adaptive Fidelity Weighted Fair Queue with Priority algorithm was designed to dissipate energy and to maintain QoS (Quality of Service) in the wireless mesh networking. By comparing two algorithms namely Adaptive Fidelity, and Weighted Fair Scheduling with Priority, a new algorithm was proposed at different levels in the mesh networks. In each level preemptive data i.e. Real time data is given higher priority. Adaptive Duty Cycle is applied in each level for selecting data in each level for transmission, to consume transmission power and to avoid delay in the mesh network. EAFWFQP (Enhanced Adaptive Fidelity Weighted Fair Queue with Priority scheme) is an optimal novel based algorithm is developed for energy consumption by reducing time delay in transmission, to reduce buffer overloading, to improve high throughput with QoS to maintain the wireless network lifetime faster in the real-time applications in wireless mesh networking. The Proposed EAFWFQP scheme achieves 70% of good performance when compared with the existing work.

Keywords

Wireless Mesh Networking; Adaptive Fidelity; Weighted Fair Scheduling; Priority Queue; Time delay; Qos,

1. Introduction

At present scenario in the computer networks the best communication network in the wireless networking is the wireless mesh networking . It is also a form of wireless ad hoc network. The ad-hoc networks in WMN transfer data from source to base station through an Access Point which is linked to the wireless network. WMN has decentralized working, cost less infrastructure, more reliable, scalable, providing optimal coverage [1].Both Ad hoc and Mesh routing nodes communicate with each other in peer-to-peer connection. Nodes in wireless networking have dynamic feature [2]. Most applications in mesh networking are similar to wireless ad hoc networks. Node in the Ad hoc Networks enter and leave the communication range and the

intermediate nodes act like host and router [3].

In future to competent networking field the Mesh net has to maintain Qos by energy consumption, data security, transmission delay, and load balance In Mobile Ad hoc networks, nodes are linked within wireless mode and are highly dynamic in nature..Wireless mesh applications are widely used in many real time applications as well as in industrial areas like hospitals, military, company automation, banking, traffic controlling, as well as in multimedia applications like VOIP applications.In the proposed scheme real time data that mentioned are used in VOIP.VOIP applications makes the e-city more sensible for the public in future.In the Meshnet

transmission of information is carried out from the source to the destination node reaches with many obstacles like time delay, buffer over loading, packet loss, queue delay .

In our proposed scheme data are transmitted in the mesh network, Node with limited distance, with less time and having more weight has given first priority for transmission. Because emergency data are given higher priority normally such as real time data are given higher priority in all levels. Data in the weighted fair queue is considered as Real Time data packets which is used in the Voip. This real time data packets have been sent from source to the destination with minimum delay. more energy consumption to maintain better network lifetime in mesh network. Application related to the emergency events need to be delivered with the allotted time to avoid the expiry of the deadline in the network. So Real time packets are given higher priority for delivering data in the networks is best suitable for future generation.

Literature survey

In ad hoc networks two routing protocols are proactive and reactive protocols while reactive protocols maintain their route on demand base [4]. Reactive protocol performs better packet delivery ratio than proactive protocol [5]. As data transfer in ad hoc networks is the same as this, existing ad hoc routing protocols like DSR and AODV [6] can be used. But they assume some properties of ad hoc networks which do not hold good for WMN [7, 8]. In the referred presentation, [9] the author proposed a TDMA scheduling scheme to avoid congestion and energy management in the networks. In this work [10], the performance of Weighted Fair Queuing (WFQ) scheduling algorithm is evaluated to attain Quality of Service (QoS). The weight is assigned for a different service which depends on the percentage of bandwidth utilization and priority of services.

The research work [11] mainly focuses on the energy aware Geographic Adaptive Fidelity (GAF) routing protocol. GAF is highly scalable and saves the energy of nodes by turning off the radio. Only necessary nodes participate in transmission others enter into sleep mode to increase the lifetime of network. This paper [12] has focused on the adaptive queue with required bandwidth not mentioning about energy consumption. This Paper [13] provides a new scheme to maintain QoS in real time data. So WFQ is taken for lower bandwidth utilization in network transmission to maintain QoS. The research finding referred [14] provide a new scheme for low communication overhead data transmission and optimal duty cycle which enables sleeping nodes participate in the network transmission for energy saving. So, duty cycle is considered in the proposed EAFWFQP to save energy. The research paper [15] quoted that data is delivered with the time interval for security purpose. This concept is also considered in the algorithm to maintain QoS. In this paper [16] critical and private data are given first preference this concept is used in the algorithm. Reconstruction of data are used to avoid overlapping of data, is referred in the algorithm [17]. Low cost concept is most significant in the algorithm to manage the budget [18]. This paper focuses on the rectification of network traffic by hierarchical prediction method and this method is considered in the proposed algorithm to maintain QoS in wireless mesh networking [20].

2. Enhanced adaptive fidelity weighted fair queue with priority scheme

In this EAFWFQP (Enhanced Adaptive Fidelity Weighted Fair Queue with Priority scheme) only real-time data are considered for routing. All the real time data packets arrived at the queue with different sizes. Nodes are

assumed to be situated at different levels on the basis of the number of hops from Base Station. Time Division Multiple Access scheme is being employed to allot timeslots to nodes at various levels. Weight of the nodes in each level is calculated.

Nodes having weighted fair queue with adaptive fidelity is given higher priority are consider as a relay for routing in each level. Figure 1 shows the system model of the EAFWFQP scheme is represented below, shows working principle of the proposed scheme. In a longer transmission range from source to the destination how the information is transmitted quickly is illustrated shortly, Before Transmission starts a node travelling in the network node having minimum distance in the active condition with highest weight has given first priority with more energy is selected for transmitting the messages. That selected node is considered as superior node or relay node in the network. After selecting the superior node or relay node in each level transmission starts from source to destination.

Divide the transmission range into different levels nodes are deployed randomly in all levels before transmitting the information from source to destination node select the nodes for transmission by allocating adaptive fidelity algorithm time is allotted to each level nodes having weighted fair queue is selected and give priority to the node in all levels and apply TDMA scheme for the weighted node and have given priority to that node. Select all the In a longer transmission area are divide the transmission range into number of levels then deploy nodes randomly in all levels. Before start routing node in the source sent information to the deployed nodes in all levels nodes having in the transmission area from

source to the destination check whether transmission path is ready for transmission

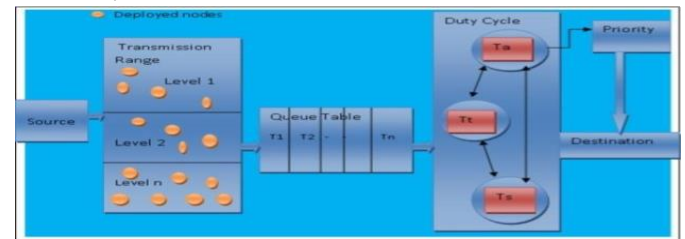


Fig 1 System Model

3.1 Working principle

This proposed scheme selects the maximum transmission range for routing. Divide the maximum range by equal levels. Allocates TDMA, transmission time intervals to all slots in all levels. The distance between each node is calculated by rate based. Adaptive fidelity transmission is applied in each node running in all levels equally. Nodes receiving data, act as an active state the data relieved from node act as sleep node and node possessing weighted fair queue with real time data as given higher priority in all levels. Consider the node having higher priority with weighted fair queue as a relay node in all levels. Relieving data in the nodes in the levels act as a sleep node so automatically radio is turn off. By turning of the radio in the data relieving node less battery power is utilized so energy is consumed highly in the sleep state.

The relay node from all levels having real time data is selected for transmission from source to the destination ie., Tt nodes given higher priority other node in the sleep node are deleted in the slots to avoid buffer overloading so average energy consumption is high. The motivation of this proposed scheme is, Real-time emergency packets with highest priority to accomplish the higher life time in Wireless Networks. Remaining nodes which are not in the transmission time is deleted in the slot to avoid conjunction. Delay node is less because average energy consumption is higher.

Formula for calculating Weighted Fair Queue is SN-Represents the packets with minimum sequence number among all queues and also WFQ uses a modified "tail-drop" algorithm which takes into account the SN value before discarding packets. The below formula for

calculating the packet size

$$SN = \text{Previous_SN} + (w \times d)$$

Previous_SN represents the SN of the previous packet,

w represents the cost (weight)..The below formula

$$w = 32348 / Ipp + 1$$

Ipp represents the value of the IP Precedence Field

d represents the packet dimension (new packet length)

From the above formula it can be concluded that, Packets arriving in queues that already have a large number of packets will get a higher SN, whereas the calculation of the SN takes account of the previous packet SN. The higher the priority of a flow, the lower the cost value "w" and hence the SN. In sleep/active scheduling scheme, unnecessary idle nodes enters into sleep mode by turning off the radio. Only active nodes will participate in data transmission and processing. This saves the energy of idle nodes. In WMN, the energy consumption is directly proportional to the range i.e. there is more energy consumption if the range is large [2]. This is calculated from the relation $E = kdn$. Where *E* is energy consumption, *k* is a constant, *d* is the range of communication and $2 < n < 4$. The transmission range level *r* is $r \leq R/\sqrt{n}$ where *R* is the radio range and *n* represents the numbers of nodes in the level.

3.2 Algorithm

In the proposed Enhanced Adaptive Fidelity Weighted Fair Queue with Priority scheduling nodes with node i sense, process and transmit data during their allocated

timeslots. Below Pseudo-code of proposed EAFWFQP is represented. Consider weighted fair Packet in the queue *Pwfq* as relay node in all levels for transmission. Only Real time data is considered as a weighted fair Queue. Collect only *Pwfq* data from all levels then give higher priority to that data and transmission time active *Ta* for that data in all levels remaining nodes goes to sleep *Ts* during transmission.

The Pseudocode for algorithm is

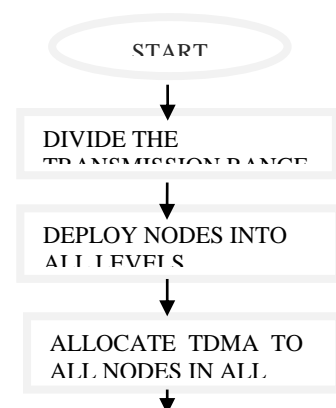
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while node enter into
level k do if Q is
empty then
enqueuePwfq
RETURN;
else
for P ← Q.begin() to
Q.end() do for node i=1 to n then
if node i = Pwfq then
putPwfq pr1;
Ta ← Pwfq ;i++;
else node i not Pwfq
thenTs←Pnwfq then delete nodei;
end if;
repeat
upto node(i,n);
endl;
level k
++i ; collect
Pwfq;
until level k=0;

```

3. Performance analysis

The proposed algorithm is executed in the ns2 simulator. The proposed algorithm consumes 90% of average energy consumption when compared with PPP given in figure 1 which is already proposed in many papers. Throughput in this proposed algorithm is 80% represented in figure 2, which is very high compared with other algorithms.



Step 7. Apply Duty Cycle to all selected nodes.

Step 8. Weighted node is set as active state, remaining nodes are set as sleep state.

Step 9. Set Priority to the active node.

Step 10. The duty cycle automatically takes next higher weight node for next iteration until all nodes in the coverage area remaining nodes are deleted.

Figure 3 shows the packet size and average energy consumption in DAPP as well as in EAFWFQP. DAPP means Packet Delay Aware Protocol discussed already in the existing protocol by Olariu [19] and EAFWFQP means Enhanced Adaptive Fidelity Weighted Fair Queue Priority Protocol. DAPP has utilized more energy for the packet size is 400,500,600,700 the average energy consumption is 14% but EAFWFQP utilized less energy 2% for packet size 400,500,600,700 .So average energy consumption is best in EAFWFQP when compared with the DAPP protocol.

Figure 3 shows Packet size Vs Average Energy Consumption

Fig 2 Flow chart for the proposed Algorithm

Figure 3 represents Queue delay is less than 2% only in this new novel Enhanced Adaptive Fidelity Weighted Fair Queue with priority algorithm. The Enhanced Adaptive Fidelity Weighted Fair Queue Priority Scheme flow is shown in the below flowchart, below. The flow diagram shows how EAFWFQP works. In the below flowchart Figure 2 the steps involved in the proposed scheme is explained below.

Step 1. In the first step select the maximum transmission range in the network.

Step 2. Divide the maximum range into different levels.

Step 3. Deploy the nodes in the maximum transmission range.

Step 4. Apply TDMA to all nodes simultaneously.

Step 5. Calculate the Range

Step 6. Depending on the weight of the node. Select the weighted node in all levels.

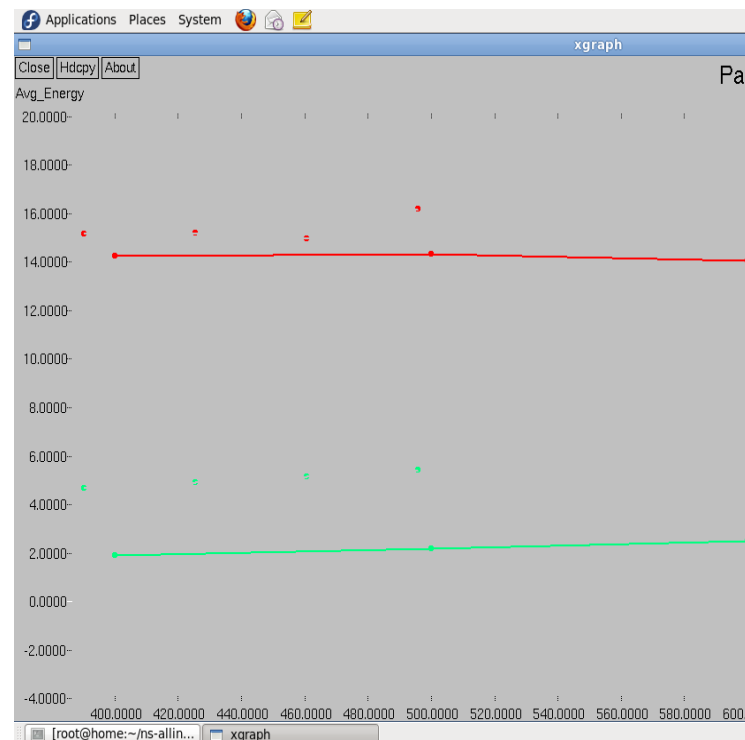


Figure 4
Represent PacketSize Vs Delay

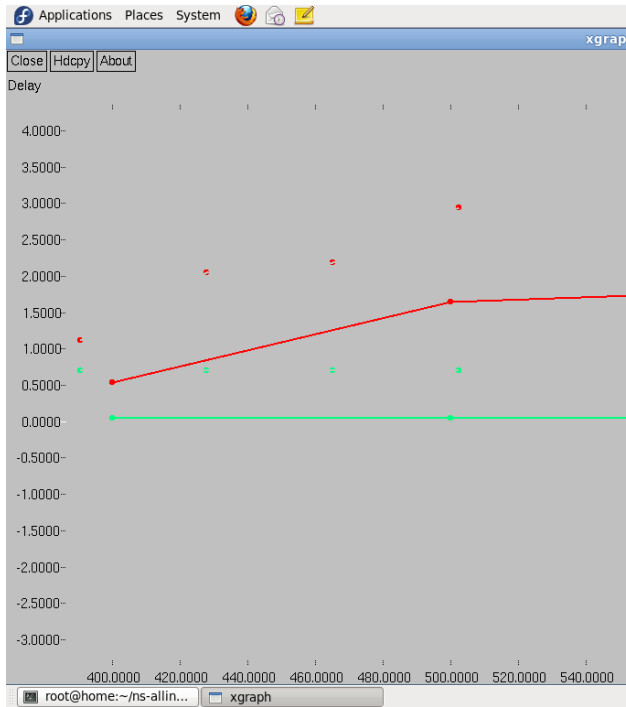


Figure 4 represents the Packet size 400 delay is 0.5 seconds, 500 packets the delay is 1.5seconds ,600 packets the delay is 1.8seconds and finally for 700 packets the delay is 2.5seconds in DAPP scheme if packet size increases the delay is increased. But in the EAFWFQ the packet size 400 delay is 0 seconds delay,500 packets size - 0.1 microseconds,600 packet size- 0.15microseconds,for packet size 600 the delay is -0.18microseconds,for packet size 700 the delay is -0.5 microseconds. By Comparing DAPP scheme and EAFWFQ scheme , delay is much less in our proposed scheme.

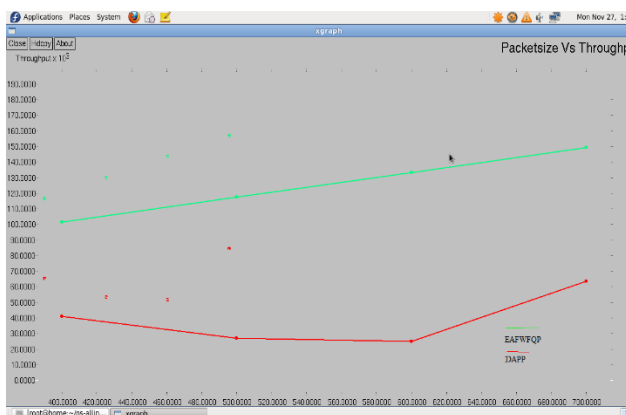


Figure 4 Represents the Packet size and Throughput

Figure 5 represents the packet size and throughput in DAPP and EAFWFQ. In the DAPP scheme the packet size for 400 is 40,the packet size 500 the throughput rate is 30,the packet size 600 the throughput rate is 20,the packetsize 700 the throughput is 60. But in our proposed scheme for the packet size 400 the throughput is 100,packet size 500 the throughput is 110,packetsize 600 throughput is 130,the packet size 700 the throughput is 150. Compared with DAPP and EAFWFQ protocol DAPP protocol has less throughput but EAFWFQ protocol has high.In the proposed scheme EAWFQ throughput rate is increased if the packet size increases .Thus successful message delivery ratio is achieved in the communication channel by our proposed algorithm.



Figure 5 Packet Size and Average Queue Delay

Figure 5 Represents the Packet Size and Average Queue Delay. The Average queue delay in DAPP for 400 packets is 5,500 packet size 15,600 packet size 20 ,700 packet size 100. In our proposed EAFWFQP scheme as the packet size from 400 to 700 increases the average queue delay is from the range of 0.Compared with DAPP and EAFWFQP protocol there is less queue delay in EAFWFQP but in DAPP queue is more .So average queue delay is less in EAFWFQP.Thus EAFWFQP scheme the average queue delay is low.It takes low bit of data to travel across the network from source to the destination node.The below table represents parameters range in the ns2 simulator for EAFWFQP algorithm.,

Table 1 Simulation Setup

No of pkts sent	:	3902
No of pkts received	:	3865
Pkt_delivery_ratio	:	99.0518
Control_overhead	:	6377
Normalized_routing_overheads	:	0.0675309
Delay	:	59664.9
Throughput	:	10.2175
Pkts_Dropped	:	37
Dropping_Ratio	:	0.948232
Total_Energy_Consumption	:	10.2175
Avg_Energy_Consumption	:	889.782
Overall_Residual_Energy	:	98.8647
Avg_Residual_Energy	:	98.8647
Avg_qdelay	:	0.0164158

The simulation for our work is carried out in the ns2 simulator and the simulation results are tabulated above. Number of packets sent is 3902,Number of packets received is 3865,The Packet ration is 99.0518,Routing Overhead is 6377,Delay is 0.0675309,Throughput is 59664.9,Packets dropped is 37,Dropping Ratio is 0.948232,Total Energy Consumption is 10.2175,Overall Residual Energy is 889.782,Average Residual Energy is 98.8647,Average Queue Delay is 0.0164158

4. Conclusion

Proposed Enhanced Adaptive Fidelity Weighted Fair Queue with Priority scheduling algorithm is a highly efficient protocol for routing in heavy traffic in wireless mesh networks. This proposed algorithm greatly minimizes end-to- end data transmission delay. Compared with old algorithms like AODV,DSR,DAPP etc algorithm but in the proposed EAFWFQP maintain average energy consumption, high throughput,. average queue delay is maintained during routing in the networks. This proposed new protocol avoids delay, collision of data, buffer over loading as well as redundancy of data during routing. So, this proposed routing protocol is highly efficient for routing in all networks. To maintain QoS in mesh networking EAFWFQP algorithm is best suitable, because it is low cost, high efficiency, less delay, more energy consumption and more secure in mesh

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