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A Flexible Technique Guarantees Priority-Based Wireless Network to Maintain QoS

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A B S T R A C T

A Wireless Mesh Network (WMN) is a network of communication that includes mesh-based clients and mesh routers arranged into an orderly topology. Mesh networks are reliable and provide redundancy. WMN is self-healing and self-configuring, i.e., in the event that one node cannot function anymore, the remaining nodes will communicate with one another either directly or via an intermediate node or two. This paper focused on the designs and development of new methods to maintain the quality of service and the utilization of the efficiency of energy use in the WMN. In order to efficiently disperse power and provide consistently high-quality service in wireless mesh networks, a novel enhanced adaptive reliability, weighted fair queue method was developed. This paper presents a novel algorithm that was proposed to reduce energy consumption, decrease time-to-transmission delays, and avoid buffer overloading, thereby increasing performance by using QoS and ensuring a shorter network downtime in real-time wireless mesh topology implementations. The goal is to ensure that energy consumption is lower, which will improve efficiency and packet delivery.

1. INTRODUCTION

Wireless networks are now investigating related services and applications. Wireless mesh networks (WMNs) are used in a wide variety of novel contexts, including residential broadband Internet access, smart buildings, healthcare and emergency systems, and disaster and emergency networking [1]. Not only that, but WMNs may make use of a wide variety of multicast broadcasting applications. Examples include the transfer of financial data, conference audio/video, distance learning, and IP television. Wireless routers, wireless network clients (such notebooks, desktops, desktop PCs, PDAs, and mobile phones), and access points (sometimes called gateways) constitute the backbone of a wireless network. They serve as Internet routers as well as wireless network routers. Mesh routers in WMNs permit multi-hop connections between two hosts in addition to connecting connectivity to the Internet through access points. Wireless network routers may serve as access points for those who are connected to the wireless local area network or nodes that serve as the originators of the wireless sensor network, in addition to base stations within the cellular network [2].

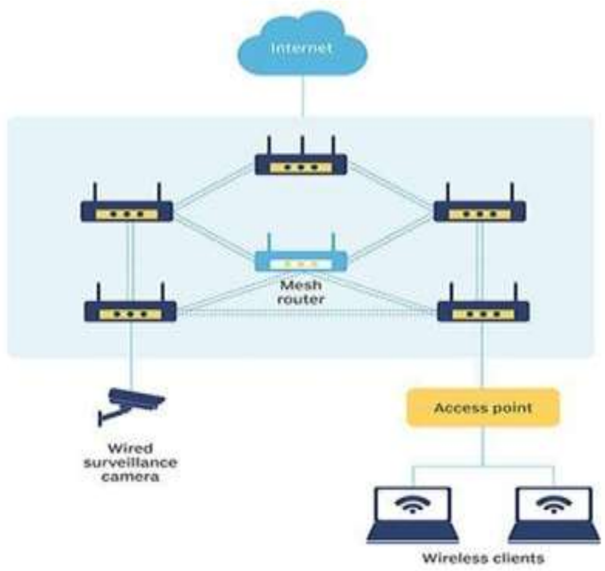

Fig. 1. Wireless Mesh Networks Infrastructure.

Fig. 1 is a sample of WMN's infrastructure. Mesh routers are typically superior to clients in terms of computing and communication capabilities. Additionally, they provide continuous power. They usually remain in static mode and provide connectivity as well as services for mesh clients. They automatically create and manage connectivity between them, which makes WMNs dynamically self-organized and self-configured. These features provide many advantages to WMNs, including lower costs for installation, massive deployment, reliability, and self-management. Although numerous studies on WMNs have been published, there are a few issues that need to be resolved for all protocol layers. For MAC, there are challenges to be overcome, such as effective channel allocating, efficient utilization of spectrum between multiple radios, the scheduling of flows to maximize efficiency, seamless mobility between diverse WMNs, provisioning of various QoS metrics, and so on. Additionally, WMNs require the development of MAC protocols that work in multi-radio multi-channel designs that have met the QoS metrics' requirements, such as end-to-end delay packet loss ratios, quality of the link, interference bandwidth, delay delays, and jitter.

The current situation in computer networks shows that the most efficient communication network for wireless networks is a wireless mesh topology. This is also an example of a wireless ad hoc network. In a wireless mesh network (WMN), ad hoc networks relay information from a source node to a base station via an access point. WMN's decentralized operation reduces the resources needed to support it, makes it more robust, scalable, and dependable, and gives you the widest possible range of services.

Both Ad-hoc as well as mesh routing nodes connect through peer-to-peer connections. Wireless networking nodes have dynamic features. The majority of Mesh networking applications are similar to wireless ad hoc networks. Ad hoc networks function as a collection of interconnected wireless networks in which nodes come and go from a shared communication space, with the nodes in the middle acting as hosts and routers. Mesh networks need to be reliable in order to compete in the future. Several factors affect the quality of service in a mesh network, including energy consumption, data security, transmission latency, and load balancing. The nodes in a mobile advertising network are constantly changing and linked through wireless technology. The military, healthcare, business automation, finance, traffic management, and multimedia applications like voice-over-internet protocol (VOIP) all rely heavily on wireless networks for real-time operations. The suggested method makes use of real-time information, similar to that which is used in VOIP. The utilization of voice-over IP apps in the e-city makes it more practical for the public to use in the future. In a mesh network, data transmission occurs between the source and the target nodes, which is accompanied by several obstacles such as buffer overloading, packet loss, and queue delay [3].

Fairness Scheduling in Wireless Mesh Networks: Numerous methods for scheduling and resource allocation are being considered for WMN. There is a trend to trade-off between fairness and throughput with a constant weighting method or a dynamic system that alters the weights as time goes by to ensure fairness over time. It is crucial to remember that fairness may be different at different times in the wireless network system [4]. Researchers have proposed per-mesh router fairness, or fairness for each link. There is also the notion of "uplink-downlink fairness" due to the mechanisms currently in use, such as the IEEE Distributed Coordination Function (DCF), which permits an inequity between the flow directions in WMNs. Also, the increase in the downlink's throughput could negatively impact the speed of the uplink and the reverse. In recent years, however, it has been focused on fairness for each client. The reason for this is that in commercial apps, every user pays the same amount for the services offered by the network. Therefore, every user should receive the same quality of service (QoS) [5]. It is also essential to determine which metrics fairness is defined about. For instance, the scheduling algorithm may offer fairness in terms of the potential throughput, but the time delay may not be equal. Some nodes within the network could be hungry for communication, while others can connect for a variety of reasons. It is important to take into account the possibility that fairness and scheduling could be dependent on intrusions into the system. The majority of solutions to schedule in WMNs depend on the assumption of cooperation between nodes. This isn't always the case in real-world networks [6].

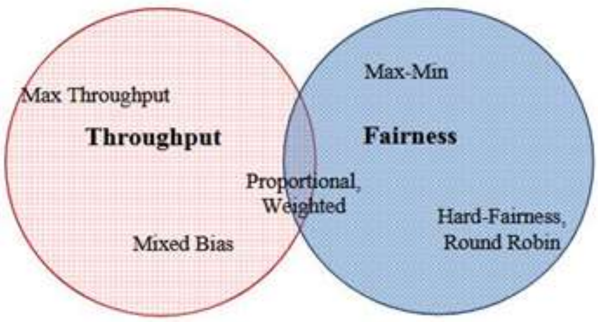

Fig. 2. Scheduling approaches that maximize throughput while still being fair are shown in a Venn diagram.

The Venn diagram displayed in Fig. 2 can be used to demonstrate the trade-off between fairness and throughput in the current solutions. One circle represents throughput, while the other represents fairness. On the left portion of Fig. 2, some algorithms favour throughput and place fairness at a lower priority.

2. LITERATURE REVIEW

It's a time of wireless communications. Because of its widespread popularity, everyone is searching for wireless solutions for homes, offices, and public spaces. It has been observed that there has been a massive expansion of wireless local networks. Recently, this low-cost method has been rapidly developed to create large-scale wireless networks that can provide seamless Internet connectivity and other communication services in urban regions. This revolution in IT has changed the infrastructure of IT and the lives of individuals due to the growing popularity of modern technological devices for computing. This has also altered how end users work. As a result of this, it's now possible to connect our personal, business, and financial assets from anywhere with no restrictions on location or time. Wireless networks are extremely popular due to their convenience, flexibility, and high-quality service.

In [7] examined various elements in WMNs' design and analyzed the various ways that have been proposed either to enhance the performance of a previously established network or to increase the performance of the network through meticulous planning of its deployment. Thanks to the rapid advancement of wireless technology and the rapid expansion of the Internet, wireless networks, particularly wireless mesh networks (WMNs), are experiencing an important change. Making efficient WMNs has become a crucial job for network operators.

The researchers in [8] proposed a brand new geographical routing sensing opportunistic method known as Easy Go, to cope with the problem of routing, i.e., the efficiency of transmission decreases in complex strip networks, due to the superior effectiveness and transmission efficiency of Easy Go. Easy-go strategy for stripping WSNs with the rapidly growing popularity of technology for smart devices, and wireless networks for mobile sensors has attracted lots of attention. Wireless sensor networks with a strip-like structure are widely used in the real world for monitoring pipelines, water quality, and even the Great Wall. However, the standard routing techniques will choose the next-hop node that differs from the transmission direction to the sink nodes in strip networks that have large curvature. This results in a high failure rate in communication and high energy consumption. In particular, by studying the direction of transmission, we can develop an innovative candidate selection algorithm. SLS is introduced, which incorporates the concepts of layer-like and virtual sinks to boost the rate of transmission success in strip WSNs.

The proposed security scheme in [9] is a new one comprised of a more secure encryption and authentication solution that specializes in the overlap between VAN and BAN. The development of Body Area Networks (BANs) has drawn considerable academic and industrial interest since the idea behind BANs offers a viable solution to provide real-time health monitoring. In addition, vehicle area networks (VANs) allow for communication in smart vehicles as well as automated traffic control systems. In real-world scenarios, these two areas can overlap in a variety of situations, and the combination of them could provide many services that are beneficial by their mutually beneficial nature. The rapid growth of BANs and VANs demands the most advanced security strategies to secure communication since each BAN and VAN is transferring more and more sensitive data that is mission-critical.

In [10] the proposed Bayesian network-based data reconstruction method that reconstructs data, instead of relying on the redundant data collected from many sensors, we may use conditional probabilities of body sensor readings to determine where we are missing data or where there are sensor problems. The efficiency of a Bayesian network's structure and parameter estimation is greatly improved by the fact that the number of sensors required to collect data is very minimal in BSNs. A medical body sensor network provides a reliable and adaptable infrastructure for tracking patients' vitals in their everyday environments. Sensor failures and lost data are typical in BSNs because of limited resources, noise, and shaky connections. The majority of the works that are available adopt methods derived from conventional wireless sensor networks to detect the presence of faults and recover data. These works concentrated on fault detection or were unable to attain satisfactory reconstruction accuracy because of the lack of information redundancy within BSNs.

The authors in [11] examined the relationship between variables that can be controlled and observed in the network with the help of a mutual information-based technique called structure learning. The authors demonstrated that every setting, including transmit power and connection time, as well as source rate, and connection interval, affects the overall performance of the network, revealing important numbers, including end-to-end delays, packet delivery ratio, and build time. Bluetooth Low Energy (BLE) is on its way to becoming the standard of the future for low-power, low-data-rate applications. Although it is not specifically designed for mesh operations, Recent research has shown that both broadcast and connected meshes are possible, with the latter eventually becoming part of the standard. To ensure the highest level of performance in a network that is connected by a BLE mesh system, specifically for low-latency and high-reliability applications like healthcare, control parameters have to be carefully selected to avoid congestion and loss.

The study in [12] found that wireless mesh topologies can be a viable technology to connect actuators and sensors with the highest flexibility and with a low cost of investment. For industrial applications, the reliability of the network is crucial. So, two medium access methods that are time-slotted, DSME and TSCH were added to the IEEE 802.15.4 standard. They permit collision-free communication in multi-hop networks and also provide channel hopping to reduce external interferences. The slot schedule that is used within these networks plays a great role in the network's performance. This paper assists in the creation of efficient schedules by offering an analytical model to evaluate the schedules that are based on TSCH. A Markov chain model of the finite queues on each node is proposed that considers the slot distribution. Models of every node are connected to compute metrics of the network like the ratio of packet delivery and the time from end-to-end delay as well as throughput. The model is compared with an example of an orchestra schedule. This model can be applied to Orchestra and also to two distributed algorithms to demonstrate the importance of traffic awareness in the achievement of high throughput.

Problem Statement: The major challenges in wireless mesh networks face many problems because of the increased time between many hops of wireless link connectivity. Because of the energy consumed by reducing the time delay during transmission and by decreasing buffer overload and improving the speed of transmission and QoS, it is necessary to keep the wireless network longevity faster and more efficient in real-time wireless networks.

3. PROPOSED METHODOLOGY

The following section determines the best transmission range that will be used to route. The transmission range that is the maximum is split into levels equal to each other, and every level of time intervals used for transmission allows TDMA for every slot. The distance between two nodes is determined by an equation based on the rate. Nodes that receive data operate as active nodes. Data released from a node works as a sleep node and nodes with a fair queue that is weighted and contains real-time data are prioritized at every level.

Take a look at the node that is the most important using an enumerated fair-queue to serve as the relay at all levels. Data-relief nodes inside a level function as sleep nodes, turning down radio transmissions when they are no longer needed. Turning off the radio in the information-relief node saves power and, thus, less of your battery is used while you sleep. In order to prevent buffer overflow, only the highest-priority relay nodes, those with the most up-to-date information, are chosen to transmit between the source and the destination. This will ensure that energy consumption is decreased. The reason for this technique is that it relies on real-time emergency signals which have the highest priority and have the ability to provide a longer lifespan of wireless networks. The other nodes that are not included in the time of transmission are taken out of the slot to keep them from joining. It is less due to its low energy consumption.

The distance between nodes is calculated using a rate-based formula. Nodes with higher priority are those that have an enumerated fair queue and are considered relay nodes at all levels. Data-relieving nodes within the levels act as sleep nodes, which means that the radios are turned off. Since the relieving node's radio is turned off while it's not in operation, the sleep node has a disproportionately high energy bill. The sleep nodes are eliminated from the slots in order to ensure that buffers are not overloaded, thus the energy consumption average is quite high. Nodes that aren't within the transmission range are deleted from the slot to avoid the possibility of a collision.

The density of the node is calculated by: d= n / R (All Area or Transmission range), which d represents the density of a single node, R represents the radio range and n represents the total number of nodes deployed. In the above formula, the density of the particular node that includes radio frequency is determined. Energy consumption is derived from how many nodes participate within the range of radio. Further, the use of node density in deployment to adapt the fidelity of routing will increase the life of the network. A higher degree of fidelity through adaptive processing suggests that a greater density of nodes can be utilized to prolong the lifespan of networks. In one instance, a four-fold increase in density increases the lifetime of the network.

The basic principles of the mechanism and its extensions to the shared channel to make this study more streamlined, here is an extremely brief overview of the process. The principal objective of the buffer size system is to determine the most efficient buffer size while achieving an exact target loss probability. An analysis of this loss probability in the communication system (buffer and channel for transmission) is possible by determining the probabilities of the state of a queue G/G/1/K at the time of packet arrival. When we refer to these probabilities as ai in the form i=0, 1,..., K and the loss probability is, the problem of calculating those values is very difficult due to the necessity of knowing how the probability density functions for the packet inter-arrival as well as packet service times. The complexity is increased when it's required to perform dynamic calculations over a period of time, which means that the probability functions constantly change. To prevent this problem, a maximum entropy technique is employed, but it is compatible with two actual metrics: the channel as well as the mean number of data packets within the network. Both rates of utilization are determined by the timing of packet arrivals.

In the case analyzed, the value of a_0 is known: $a_0 = 1 - \rho_a$. Therefore, the objective is to maximize the entropy of a_i : $\sum_{i=1}^{K} a_i \ln\frac{1}{a_i}$. Being compatible with the constraints provided by the real measures: $\sum_{i=1}^{K} a_i = \rho_a$.

$$\sum_{i=1}^{K} i \cdot a_i = N_a \quad (1)$$

In this article, not only the G/G/1/K queue has been studied but also other queues with various distribution functions that show the correct operation that is expected of the Dynamic Maximum Entropy (DME) mechanism. In this particular instance, Loss probability (PL) has been calculated by:

$$P_L = a_K = \alpha\beta^K \quad (2)$$

$$P_L = a_K = \alpha\beta^K$$
$$\frac{1}{1-\beta}\frac{1-[(K+1)-K\beta]\beta^K}{1-\beta^K} = \frac{N_a}{\rho_a} \quad (3)$$

And α is equal to $\alpha = \rho_a \frac{1-\beta}{\beta}\frac{1}{1-\beta^K}$.

In order to find the size of the buffer that meets a particular goal of a target loss probability for packets, it is only necessary to separate K from the equation (3.5) and be aware of the fact that Q=K-1 in a single-server transmission system:

$$Q = \left(\frac{P_L}{\alpha}\right) - 1 \quad (4)$$

End-to-End Delay Estimation

The ability to accurately predict latency at each hop along the path is crucial for any quality-of-service-enabled routing approach. The time it takes for an RREQ or RREP packet to travel over a particular path is used by current protocols to estimate the total delay from beginning to finish. However, it is also obvious that RREQ and RREP packets are fundamentally different from typical data packets and are hence less likely to experience loss and delay. Two methods for estimating the total round-trip time delay (RREP packet hop count and sand) are compared and contrasted to quantify the mistakes that each introduces. The RREP method takes into account the delay in both the incoming and outgoing RREQ and RREP packets to determine the total delay. Using the hop count method, one may get the total delay by multiplying the total number of hops by the typical hop delay. A 14-node architecture is selected, and a 5-hop flow is introduced into the system[13].

There are two major causes for the substantial divergence between the RREP estimation and the actual packet delay, both based on wireless interference. The first is that RREQ packets are flooded over many routes on the network during route discovery. The result is a surge of concurrent traffic over several links. This means that RREQ packets travelling along different routes can interfere with one another, creating inter-flow interference that unicast data doesn't experience since it is on a single route at all times. Another factor is intra-flow interference that occurs with data packets. When multiple packets travel through a particular route that is broadcast, the nature of the wireless network ensures that multiple packets in the same stream can interfere with each other, which can result in media contention as well as per-packet delay[14]. Control packets such as RREQ do not suffer from inter-flow interference, since there's not any stream of packets that are in the same direction. RREP underestimates because it believes that inter-flow interference is as the most prevalent but isn't present. Hopper counts underestimate delay since they don't consider inter-flow interference. This is the reason for the utilization of the in-band delay estimation method to determine the duration of delay from end to end.

The TDMA version of this protocol consists of one frame, with each of those frames featuring one slot. The number N is the number of points within the network. This number is also maintained according to our theories. Each node can retain its frame. Each frame contains the control channel table as well as the information channels. M can be modified and changed in the case that the frame does not contain enough slots to support new connections[15]. This protocol regulates expanding and recovering slots not allocated through changing the duration of frames, based on the amount of traffic as well as the number of mobile nodes competing for the frame.

In ATSA frames, frame lengths are constantly adjusted depending on the nodes within the network as well as how it is built. The frame length for each node is fixed at 2 to avoid collisions between packets that occur in those two zones of contention with frames of different lengths. In the case of Fig. 3, the node that is situated in two areas of contention with one hop and frames of 8 and 4 respectively, can send packets that do not cross the two zones in which the contention is present. This is achieved by setting the size of frames at 8. The protocol requires that each node be equipped with a control channel as well as a data channel. The first slot (0') in the control channel is reserved for new nodes as well as those who wish to establish connections. The frame size of the control channel is twice as big as the power channel, and it also includes the slot that will be reserved for the new node.

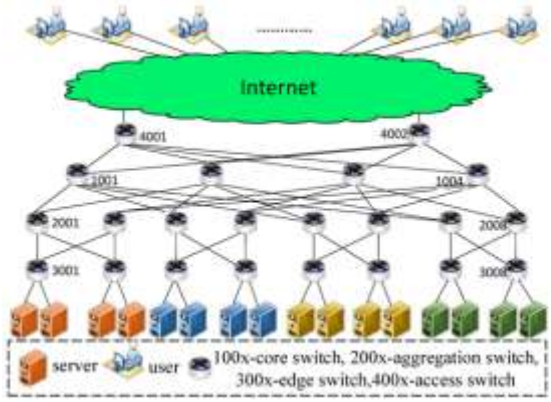

Fig. 3. An example of a network failure recovery method for a data centre network.

ATSA (Adaptive the TDMA Slot Assignment) Scheme is specifically designed to work with wireless mesh networks. It regulates the number of slots that are not assigned by dynamically altering the frame's length in accordance with the amount of traffic being generated and how many mobile devices are in the contention zone. If a brand-new device detects that there is a problem, it will solve it by listening to and recording the slots that are allocated to devices in the area of contention. It is demonstrated that this increases the spatial reuse of channels and improves system throughput. Each node takes part in the reservation process through communication with the other through control slots as well as packets[16].

When the nearby nodes of the slot-requesting node have had their requests for channels added to the TDMA table, the requested channel is allocated. After the neighbors have completed channel allocations, they will send an acknowledgment to the node to let it and the two-hop neighbors know. When the upgrade is finished and the node receives its allotted slot, it will be able to set up a communication link. As an indication that they are unable to utilize the slot, neighbors closer than twice the node's distance from them may "mark" the slot. Any of their neighbors inside the same node with slots allocated to nodes might be in danger of colliding with them if they give out electromagnetic waves[17]. If neighboring nodes try to claim the slot, they'll be rejected because the neighboring nodes have all assigned slots to the nodes in accordance with the table of channel assignments. A warning will be displayed to inform nearby neighbors that the slot is two hops from the newly created node; it is not possible to utilize that slot. But this slot might not be listed in those tables that are used to assign channels for the neighboring two hops on the node. Therefore, even if two-hop neighbors do not In the event that they receive any requests they may be capable of assigning their space to the neighbor who assigned the slot.

Effective recovery method

The DSCA method has the potential to quickly grow in size when there are numerous nodes in the network since frame sizes are dictated by a power of two. If multiple connections suddenly cut off their data transfers without replacing them, one node might end up with a huge frame and many slots unfilled. The ATSA protocol's frame recovery technique, known as frame recovery, is one way in which it may be made more efficient. If a slot inside frames is let go on any input within a specific duration of time, then the device will check the table it uses to identify channel allocation and then determine the percentage of slots within frames that are allocated, but not allocated. If this happens, it will release the slot to ensure that it's not used. Then, it sends the control request packet to enable frame recovery to neighbors who are using the slots on the list of channel allocation. The packet asks them to give slots themselves by the same process and informs them that they've received a request to allocate slots from the recovery-asking network. The neighbors attempt to transfer slots onto the network upon the reception of the packet. They accepted the request of the node that requested recovery[18]. They then transmit a signal of response to their neighbors, notifying them that they have been informed of the change. This increases the efficiency of the frame. Functions for programming are carried out in a node each time the slot is released.

The pseudo-code for the recovery process for ATSA is as is:

```
RecoveryTimeSlot(NODE n):
Noden releases an hour slot
```

Noden checks if 50% of the slots are not used.
If the number of empty slots are greater than or equal to the size of half the frame length
Noden has sent UCTP for its neighbors
The neighbors to node N receive UCTP in their allocated slots
the neighbors of node N change their channel tables and
Reschedule your time slots
Nodes' neighbors N send CCTP to node N noden of node
Receives CCTP
Noden shrinks his channel table, as well as a control table
End If

4. PERFORMANCE ANALYSIS AND RESULTS

The algorithm is run using the NS2 simulation. The proposed algorithm uses 90% less energy, which is a low average consumption when compared to PPP. The throughput for this algorithm has been estimated at 80%, as illustrated in Fig. 4. This is extremely high when compared to other algorithms. Using a priority algorithm, this innovative improved adaptive fidelity weighted queue achieves a latency in the queue of less than 1%.

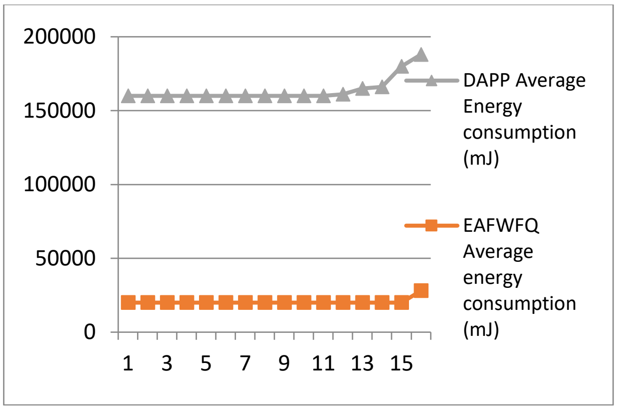

Fig. 4. Packet Size Vs Average Energy Consumption.

Table 1 indicates that in the proposed methodological approach for EAFWFQ, there is a lower average energy consumption when compared to the current methodology of DAPP. Fig. 4 illustrates the dimensions of the packet and the energy consumption average of DAPP and EAFWFQP. DAPP is the Packet Delay Aware Protocol discussed in the latest version. Improved Adaptive Weighted Fair Quota Priority Algorithm is the abbreviation for EAFWFQP. Each packet in DAPP uses more power than conventional methods. EAFWFQP used less energy than the average (14 %), making it an attractive alternative to the former by 2% in packet sizes of 400, 500, 600, and 700. The energy consumption average is the highest in EAFWFQP when compared to the DAPP protocol.

Table 1. Packet Size Vs Average Energy Consumption.

Packet size (bytes)	EAFWFQ Average energy consumption (mJ)	DAPP Average Energy consumption (mJ)
400	20000	140000
420	20000	140000
440	20000	140000
460	20000	140000
480	20000	140000
500	20000	140000
520	20000	140000
540	20000	140000
560	20000	140000
580	20000	140000
600	20000	139999
620	20000	141000
640	20000	145000
660	20000	145999
680	20000	159999
700	28000	160000

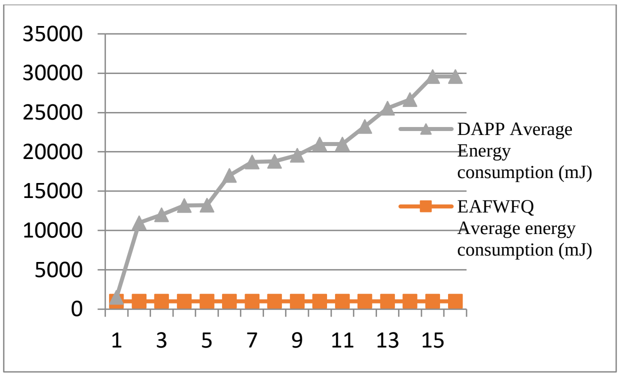

Fig. 5. Represent Packet Size Vs Delay.

The simulation used in the study is conducted using the NS2 simulator. The simulation results are listed below. There were 3902 packets sent and 3865 received. There are 99.0518 packets for every 1 byte of data.

Table 2. Packet Size Vs Delay.

Packet size (bytes)	EAFWFQ Average energy consumption (MJ)	DAPP Average Energy consumption (MJ)
400	1000	500
420	1000	10000
440	1000	11000
460	1000	12200
480	1000	12230
500	1000	16000
520	1000	17725
540	1000	17800
560	1000	18560
580	1000	19980
600	1000	20000
620	1000	22250
640	1000	24568
660	1000	25669
680	1000	28590
700	1000	28590

Table 3. Simulation Setup.

No of pkts sent	3902
No of pkts received	3865
Pkt_delivery_ratio	99.0518 %
Control_overhead	6377 (packets)
Normalized_routing_overheads	1.64994
Delay	0.0675309 (ms)
Throughput	59664.9 (bytes/seconds)
Pkts_Dropped	37
Dropping_Ratio	0.948232(%)
Avg_Energy_Consumption	1.13528 (mJ)
Avg_Residual_Energy	98.8647 (mJ)
Avg_qdelay	0.0164158 (ms)

5. CONCLUSION

An effective strategy for handling enormous amounts of data in a wireless mesh network is the enhanced adaptive fidelity-weighted fair queue using the priority timing algorithm. This algorithm was created to significantly reduce the delay from end-to-end for transmitting data. If compared with older algorithms such as AODV, DSR, DAPP, etc. The proposed algorithm maintains average energy consumption along with high throughput, as well as an average time to queue through networks. The algorithm is extremely efficient in routing across every network. To ensure QoS for mesh networking, the EAFWFQP algorithm is the best choice, due to its low cost and high efficiency, which means less delay, less energy consumption, and more security in mesh networks.

REFERENCES

[1] A. R. Hossain and N. Ansari, "Priority-based downlink wireless resource provisioning for radio access network slicing," IEEE Transactions on Vehicular Technology, vol. 70, no. 9, pp. 9273-9281, 2021, doi: 10.1109/TVT.2021.3095901

[2] B. Hu et al., "A packet scheduling method based on dynamic adjustment of service priority for electric power wireless communication network," Wireless Communications and Mobile Computing, vol. 2020, no. 1, p. 8869898, 2020, doi: 10.1155/2020/8869898.

[3] O. Olorunnisola, T. E. Mathonsi, and D. Du Plessis, "An algorithm to optimize concurrent VoIP calls across wireless mesh networks," Journal of Advances in Information Technology, vol. 14, no. 5, pp. 960-969, 2023, doi: 10.12720/jait.14.5.960-969.

[4] J. B. Ernst and M. K. Denko, "The design and evaluation of fair scheduling in wireless mesh networks," Journal of Computer and System Sciences, vol. 77, no. 4, pp. 652-664, 2011.

[5] M. Koyuncu and A.-F. Hayder, "Comparison of scheduling algorithms for multimedia applications in IPv4 and IPv6," in 2015 9th International Conference on Application of Information and Communication Technologies (AICT), 2015: IEEE, pp. 418-422.

[6] M. Ge and D. M. Blough, "High throughput and fair scheduling for multi-AP multiuser MIMO in dense wireless networks," IEEE/ACM Transactions on Networking, vol. 26, no. 5, pp. 2414-2427, 2018, doi: 10.1109/TNET.2018.2867582.

[7] D. Benyamina, A. Hafid, N. Hallam, M. Gendreau, and J. Maureira, "A hybrid nature-inspired optimizer for wireless mesh networks design," Computer Communications, vol. 35, no. 10, pp. 1231-1246, 2012, doi: 10.1016/j.comcom.2012.03.013

[8] B. Peng and A. H. Kemp, "Energy-efficient geographic routing in the presence of localization errors," Computer Networks, vol. 55, no. 3, pp. 856-872, 2011, doi: 10.1016/j.comnet.2010.10.020.

[9] M. E. S. Saeed, Q.-Y. Liu, G. Tian, B. Gao, and F. Li, "Remote authentication schemes for wireless body area networks based on the Internet of Things," IEEE Internet of Things Journal, vol. 5, no. 6, pp. 4926-4944, 2018, doi: 10.1109/JIOT.2018.2876133.

[10] H. Zhang, J. Liu, and A.-C. Pang, "A Bayesian network model for data losses and faults in medical body sensor networks," Computer Networks, vol. 143, pp. 166-175, 2018, doi: 10.1016/j.comnet.2018.07.009

[11] A. Chiumento, B. Reynders, Y. Murillo, and S. Pollin, "Building a connected BLE mesh: A network inference study," in 2018 IEEE Wireless Communications and Networking Conference Workshops (WCNCW), 2018: IEEE, pp. 296-301.

[12] D. Benyamina, A. Hafid, and M. Gendreau, "Wireless mesh networks design-A survey," IEEE Communications Surveys & Tutorials, vol. 14, no. 2, pp. 299-310, 2011, doi: 10.1109/SURV.2011.042711.00007

[13] W. Jiao, M. Sheng, Y. Shi, and Y. Li, "End-to-end delay estimation for multi-hop wireless networks with random access policy," Science China Information Sciences, vol. 57, pp. 1-13, 2014, doi: 10.1007/s11432-014-5103-y.

[14] S. Chakraborty, S. Nandi, and S. Chattopadhyay, "Alleviating hidden and exposed nodes in high-throughput wireless mesh networks," IEEE Transactions on Wireless communications, vol. 15, no. 2, pp. 928-937, 2015, doi: 10.1109/TWC.2015.2480398.

[15] F. R. Raja, D. Chen, and R. Hexel, "A flexible communication protocol with guaranteed determinism for distributed, safety-critical real-time systems," IEEE Access, vol. 10, pp. 48049-48070, 2022, doi: 10.1109/ACCESS.2022.3170102.

[16] G. Jia, Y. W. Wang, F. J. Meng, G. H. Ye, and G. L. Wang, "An adaptive TDMA slot assignment algorithm for scalable wireless mesh networks," Applied Mechanics and Materials, vol. 392, pp. 872-875, 2013, doi: 10.4028/www.scientific.net/AMM.392.872.

[17] C. A. César and S. V. Carvalho, "A queuing model for distributed scheduling in IEEE 802.16 wireless mesh networks," International Journal of Communication Systems, vol. 28, no. 5, pp. 910-927, 2015, doi: 10.1002/dac.2715.

[18] M. Oche, R. M. Noor, and J. I. Aghinya, "Network centric QoS performance evaluation of IPTV transmission quality over VANETs," Computer Communications, vol. 61, pp. 34-47, 2015, doi: 10.1016/j.comcom.2014.12.001.