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ALTINBAS UNIVERSITY

Institute of Graduate Studies

Electrical and Computer Engineering

CONTROLLING NETWORK TRAFFIC OVERFLOW AND ENSURING QoS ROUTING IN MANETs

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Istanbul, 2020

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by

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Electrical and Computer Engineering

Submitted to the Institute of Graduate Studies

in partial fulfillment of the requirements for the degree of

Master of Science

ALTINBAŞ UNIVERSITY

2020

The thesis titled "CONTROLLING NETWORK TRAFFIC OVERFLOW AND ENSURING QoS ROUTING IN MANETs" prepared and presented by Ihab Jawad Abdulkadhim AL-SAEED was accepted as a Master of Science Thesis in Electrical and Computer Engineering.

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Approval Date of Institute of Graduate Studies:
23/10/2020

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Ihab Jawad Abdulkadhim AL-SAEED

DEDICATION

I devote and pledge this research work to my supervisor who is salient for guiding me through whole research work as well as my family for always assisting me in my hard time.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisor Prof. Dr. Sefer KURNAZ for guiding and helping me along the way in writing this dissertation. Discussing my progress, problems, and ideas with my supervisor Prof. Dr. Sefer KURNAZ a couple of times every week helped me tremendously in understanding the logic behind the research. It made me better realize the technical need for this research work. He helped me by looking outside of all the machine learning and network-based information, and considering the cryptocurrency-based knowledge from a more holistic perspective than just from the productivity point of view. He patiently explained to me a great number of technical details with regards to block-chain and cryptocurrency, for example how to deal with solving problems and to provide insight into the reliability of those results. Without his time and help none of this research would have been possible, and I'm grateful to him for giving me the opportunity to work on this interesting subject. I am also very thankful to my parents as well as my friends who always supported me through whole of this journey.

ABSTRACT

CONTROLLING NETWORK TRAFFIC OVERFLOW AND ENSURING QoS ROUTING IN MANETs

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Date: July/2020

Pages: 56

The aim of this thesis is to design to control the network traffic overflow as well as ensuring the adaptive QoS routing in mobile ad-hoc networks. To achieve high-quality services implementation of network monitoring and QoS routing algorithm is inevitable. Dynamic routing in physical network hardware is not suitable for cost- effective business models. Therefore, to lower operational and capital expenditure, we propose a technique called adaptive routing managed with the support of QoS (Quality of Service and MANET (Mobile ad-hoc Network). We introduce an economical QoS routing model which will assist in meeting the demands of the consumers and at the same time provide significant savings in product cost and usability. To perform adaptive QOS routing, we designed a topology in a virtualized environment. We programmed CSMA (Carrier-Sense Multiple Access) for network traffic overflow management which acts as a steady northbound API in QoS routing. Network traffic is injected variably from 1MB up to 10MB (link b/w) in a successive manner for the same network traffic with 10 network instances. Lastly, we performed adaptive QoS routing applying control theoretic technique with the help of CSMA and GTS algorithms. By comparing two routing scenarios, we observed a notable difference in throughput for controlling network traffic application in MANETs. Network traffic overflow information is updated after every 60 seconds.

Keywords: Network traffic, QoS, MANET, routing, CSMA, topology, layers, GTS.

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LIST OF ABBREVIATIONS

CA	:	Channel Assignment
CSMA	:	Carrier Sense Multiple Access
CSS	:	Cooperative Spectrum Sensing
DLT	:	Distributed Ledger Technology
FRS	:	Fixed Resolution Sensing
GTS	:	Grouped Task Scheduling
MAC	:	Medium Access Control
NAV	:	Network Allocation Vector
LTE	:	Long Term Evolution
QoS	:	Quality of Service
SNR	:	Signal to Noise Ratio
WLAN	:	Wireless Local Area Network

1. INTRODUCTION

Nowadays, service providers must keep up to provide the best network capacity to end users due to rising bandwidth dependent applications and services. Capacity management in traditional networks takes time and planning as mentioned in [1]. CSMA algorithm can solve this problem by its ability to shrink and expand resources. Network functions (NF's) which can provide additional CPU, storage, and bandwidth which can be requested by VIM (virtual infrastructure manager) and allocated to NF's as explained in [2]. To alter parameters like CPU, storage, and bandwidth in traditional networks it will require a full physical device replacement as mentioned in [3]. Adaptive QoS routing provides the cost reduction based service provider tries to lower capital investment in maintenance of network devices. To decrease the budget for system maintenance in IT departments virtualization and software-defined techniques are introduced.

Research in networking has created solutions to many complex issues which occur in traditional networking as mentioned in [4]. We can find various routing matters related to multimedia communications and one of the critical challenge is QoS routing. We cannot achieve specific goals of QoS (Quality of service) routing using traditional networks such as determination of paths that satisfy QoS constraints and at the same time determining an alternate path for unwanted traffic. To achieve certain tasks, we need the network to be more flexible and programmable as mentioned in [5]. Networking with the integration of CSMA (Carrier-Sense Multiple Access) can help networks achieve these tasks. To achieve optimal path required for QoS routing, a network should be able to implement adaptive routing. Adaptive QoS routing can help network achieve optimal throughput and desirable QoS parameters. Adaptive routing can also assist in improving link bandwidth utilization which in turn enhances performance for multimedia applications as mentioned in [6]. This research provides the underlying network traffic overflow with overflow controlling and sensing with the help of GTS and CSMA algorithms based on overflow detection due to its lower complexity and compatibility along the MANETs operations. The proposed QoS routing protocol mechanism, the network bandwidth and thresholds are chosen based on their target network traffic control with sensing steps for making the final network overflow controlling decision as mentioned in [7].

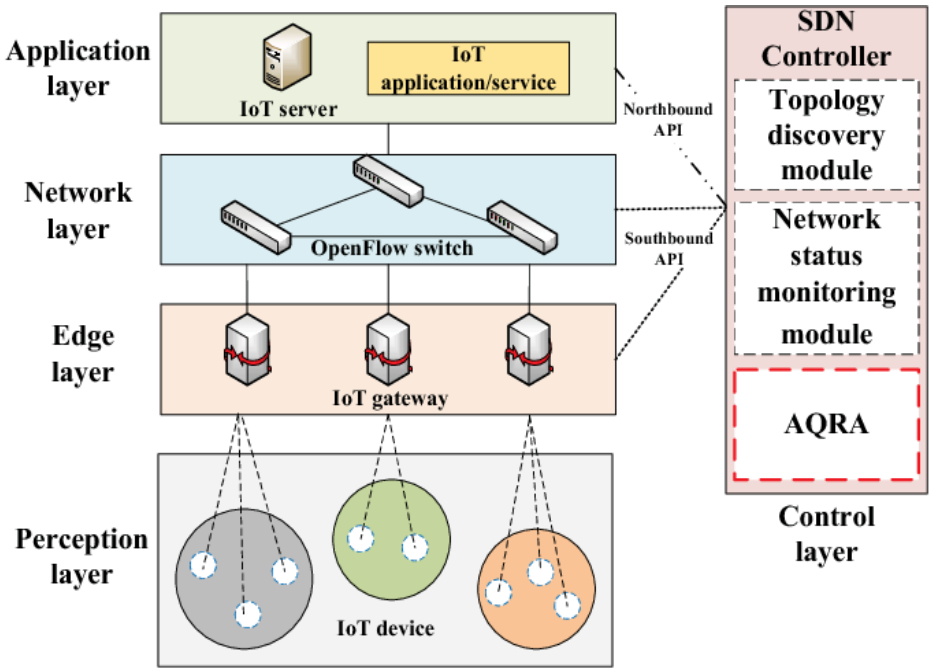

Figure 1.1: The architecture of SDN based openflow network traffic in IoT-based network [5].

Control layer: This layer in networking is decoupled from networking infrastructure layer. Control layer consists of a controller which provides a centralized view of the network infrastructure. With the help of centralized view provided by the controller, a network can manage, configure underlying devices and program automated network policies. Network traffic controller is the core entity of a network which is used to install flows into network devices. Controller uses protocols such as OpenFlow to install optimal routes in forwarding devices as mentioned in [8].

Forwarding layer: The forwarding layer consists of all network devices; hence it is also known as infrastructure layer. Forwarding layer enables data transfer to and from clients through multiple protocols installed by the network traffic controller. Forwarding plane consists of network devices such as router or switch. These network devices can perform various tasks on data packets such as dropping, prioritizing, explicit blocking of packets, etc.

Application layer: Several types of applications and services together form the application plane. In this layer network applications such as firewall, IDS and load balancers can be managed. Open programming nature of QoS architecture can help these applications to provide some information to the network traffic controller which will help the network to be more flexible, resilient and well-organized. Applications which directly support operations for the forwarding plane such as routing process within the control plane are not considered as a part of the application layer.

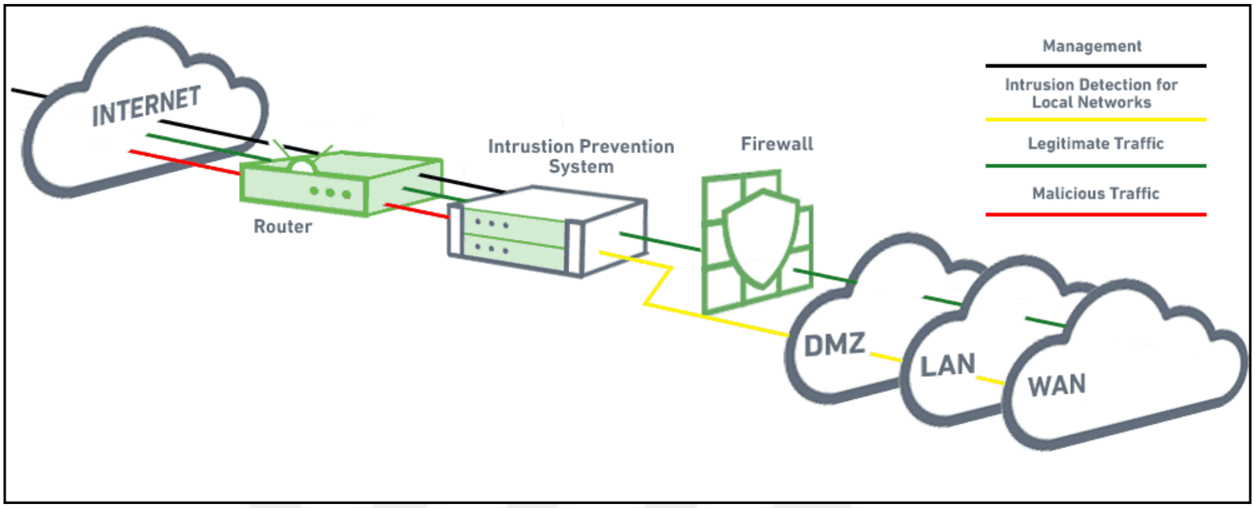

Figure 2: Different types of uncontrolled network traffic on the internet [9].

The primary user network occupancy identification process is to be developed because of the accurate prediction of the presence of malicious users. The accuracy will be analyzed present in the large number of the malicious users. To design for the automatic reconfiguration of the cognitive MANETs are to be analyzed. [10] The cognitive techniques are to be employed which is to utilize the unused network present in the military architectures. The designing of the MANETs has the various cognitive features are to be presented at all layers. The designing has the various objectives such as topology based, routing based and application based. This design has the following steps such as place platforms, design hierarchy, design topology, design routes or design paths, design MAC schedules, and manager checks as mentioned in [11].

1.1 PROBLEM STATEMENT

There are some major problems that have to be the analyzed and solved in this research given as following:

- How the topology of network traffic control has not been found and analyzed which has to be control network traffic overflow problem which can be formulated with multi objective QoS routing optimization?
- How the QoS routing performance degradation presented video streaming in network with the differentiation of the cell blocking and dropping between the various phases of the MANET network topology?
- What are the various protocols related to mobile ad hoc networks for controlling network traffic and enhancing the QoS?
- How the quality of services (QoS) improved with secondary users as channel reservation scheme? And location of the cooperative network sensing will also be analyzed present in MANET for controlling network traffic and ensuing QoS?
- How the quality of services routing enhances with the help of the incorporating GTS and CSMA algorithm in MANET?

1.2 CONTRIBUTION

The aim of contribution is to test the integration of network traffic and ensuring the QoS routing and implement adaptive QoS routing after acquiring the network traffic stubs, we created a virtualized testbed using CSMA and GTS algorithm which helps to set up network. In this testbed, we created a Client-Server scenario separated with four MANETs (Mobile Ad-hoc Network). Integration of CSMA and GTS will need network orchestration and management. Moreover, the interaction between Virtual network functions (VNF) and the controller for efficient operation of MANET requires network management via CSMA and GTS algorithms. Therefore, we programmed a proposed system using the python programming using these two framework. The ensuring of Quality of Service (QoS) are processed in the heterogeneous MANET network. These two algorithms are processed on time sensing which has zero effect on the system performance of MANET. This model helps to obtain the quality of services (QoS) in MANETs such as termination probability of secondary users, MANET blocking probability, controlling network traffic. The quality of services (QoS) will be improved with secondary users as channel reservation scheme are proposed. The location of the cooperative network sensing is analyzed in MANET for controlling network traffic and ensuing QoS.

1.3 CHARACTERISTICS OF NETWORK TRAFFIC

With the implementation of NFV network administrator would not be dependent on hardware devices to build a service chain for communication systems.

Following are the characteristics of controlling the network traffic overflow:

- **Flexibility:** Physical network devices have limited functions related to computing, memory, storage and networking facilities. The modification of these tasks needs more time and money. With the help of NFV, administrators can select physical devices which have hardware capacities required to provide optimal network architecture.

- **Agility:** The capability to configure, deploy, terminate network functions is very agile in NFV's. With NFV, a provider will be able to allocate on-demand resources to improve services for the end-users. On the other hand, in traditional networks allocation and deallocation of network resources will consume more time and money because of the installation of physical hardware resources.

- **Scalability and Elasticity:** Nowadays, service providers must keep up to provide the best network capacity to end users due to rising bandwidth dependent applications and services. Capacity management in traditional networks takes time and planning. NFV can solve this problem by its ability to shrink and expand resources. Network functions(NF's) can provide additional CPU, storage, and bandwidth which can be requested by VIM (virtual infrastructure manager) and allocated to NF's. To alter parameters like CPU, storage, and bandwidth in traditional networks it will require a full physical device replacement.

- **Cost reduction:** Every service provider tries to lower capital investment in maintenance of network devices. To decrease the budget for system maintenance in IT departments virtualization and software-defined techniques are introduced.

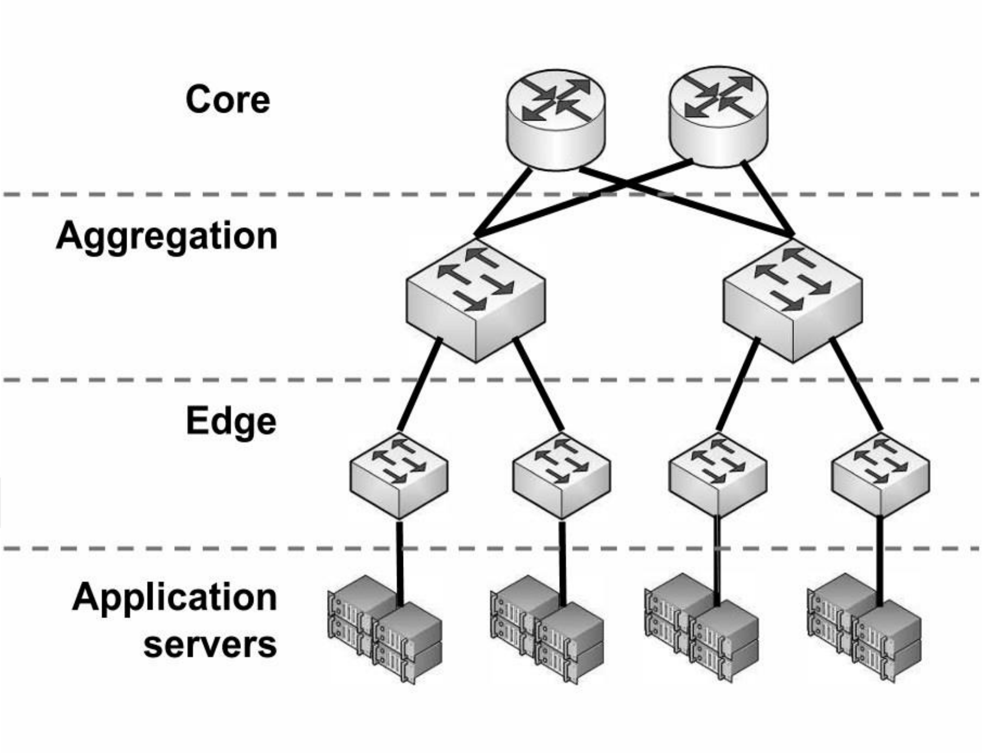

Figure 1.2: Hierarchical representation of different level of core network distributed traffic flow [12].

1.4 NETWORK TRAFFIC OVERFLOW HETEROGENEITY

Network heterogeneity allows the blocking of additional network traffic overflow to find a best available free channel for the channel of interest and to operate in multiple radio frequency bands as mentioned in [13]. Network sensing is important to identifying the network opportunity that is associated with QoS routing commands regarding how often and in which order traffic senses the channel as mentioned in [14]. According to QoS request, routing protocol allocates the available resources to the SUs opportunistically. Multiple access operation enables network access among multiple SUs more dynamic which must be required for real-world implementation of the QoS routing.

Network traffic operation poses a lot of challenges in designing an efficient MAC protocol. More importantly, the access strategy must consider the nature of heterogeneity among the network traffic for contention access in order to protect traffic transmission from non-routed traffic data transmission as mentioned in [15]. Interference protection to network traffic from the secondary transmission is guaranteed by the network sensing task. On the other hand, QoS routing ideally does not aware of the insight of the network sensing when it has to improve spectral efficiency. Investigations [16] show that the maximization of spectral efficiency relies on the following aspects:

- How efficiently an extensive amount of network opportunity can be discovered by using a smaller amount of underlying resources.

- By using which techniques, the network opportunities can be utilized to its fullest extent.

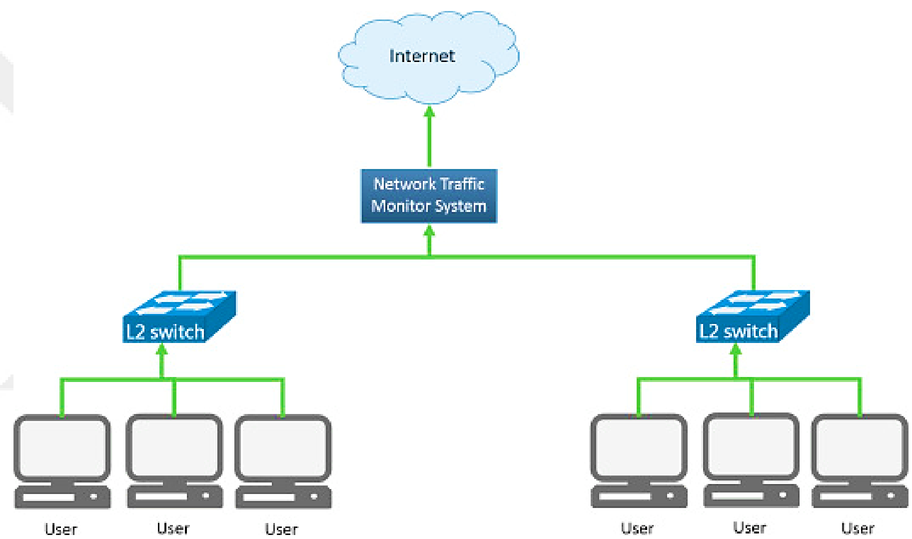

Figure 1.3: Distribution of network traffic per switches for the purpose of monitoring [17].

Data transmission in the QoS itself depends on the availability of a vacant channel, so maintaining a fixed control channel for opportunistic data transmission is not cost-effective for the network traffic simulation. Thus, network access has to aware of the dynamic channel state in the ad hoc environment and needs to provide the fastest access transmission excluding the control channel operation. Network traffic overflow aim to maximize throughput while avoiding interference to the primary network as mentioned in [18]. The whole time frame consists of sensing and transmission operations, and the data rate achieved through the transmission depending on the sensing decision in that whole frame is referred to as throughput of the secondary network. Network traffic overflow can also be optimized by improving access techniques at the medium access control (MAC) layer in MANET. Even though throughput optimization techniques at QoS routing evolved independently, some QoS-based protocols for throughput optimization also rely on sensing. Network traffic technology has emerged as a promising paradigm for efficient network traffic network traffic overflow spectrum utilization, and network access is a key component to improve the utilization of the MANET operation as mentioned in [19]. The research gaps that exist in the designing of sensing assisted access protocol for controlling the network traffic are potentially threatening the advancement of MANET capability and from them also unsolved questions.

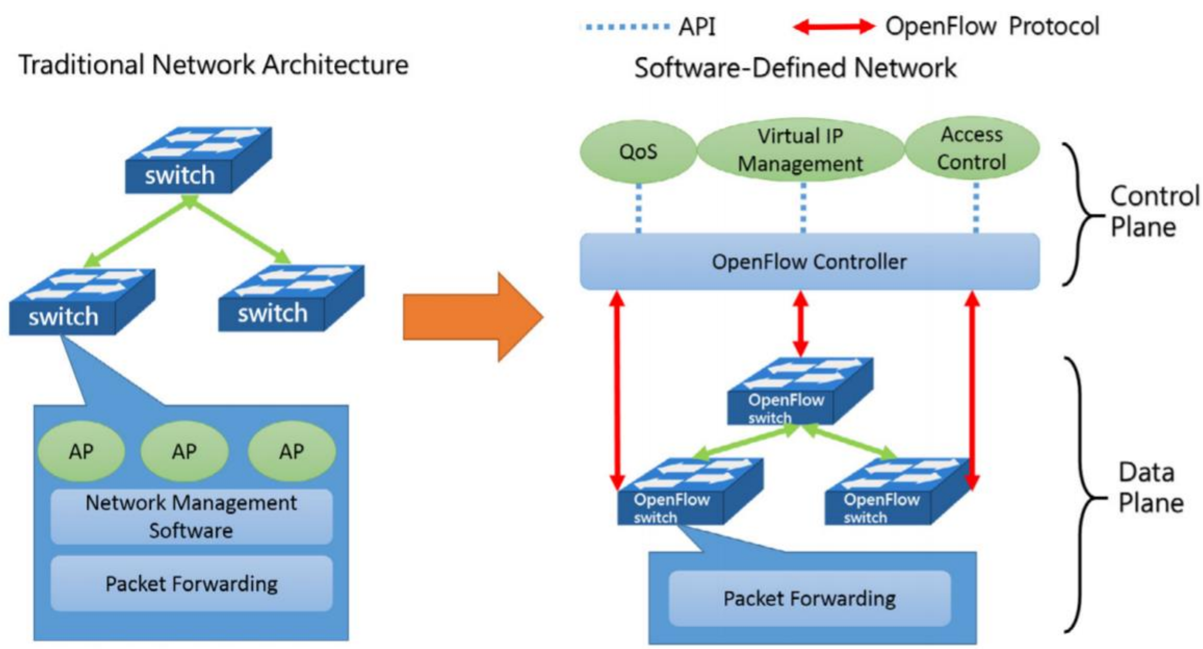

Figure 1.4: Mapping of traditional network architecture to the traffic overflow oriented software defined network [20].

1.5 STRUCTURE OF THESIS

The research structure presented in this thesis is organized as follows:

Chapter 1: This chapter explains introduce the research community to this domain and provides problem statement for the research and draws the significance of research that contributes to the controlling network traffic overflow and ensuring QoS routing in MANET. The aims of study and the technical approaches used as well as problem statement with contribution are also presented in this chapter.

Chapter 2: This chapter provides an overview of controlling operation and a comprehensive literature review on relevant aspects of network traffic access in current network traffic overflow controlling and monitoring technology and its deployment scenarios. This chapter focuses on the challenges and solution branches of the network access mechanisms. The required branches of an algorithms and advance network, such as the network architecture, network modeling, sensing, and access methods, are thoroughly reviewed along with the current challenges and future trends.

Chapter 3: This is most important chapter that shows the methodological approach for network traffic overflow control impacts of load prediction on the design of the network operation through a capacity measurement of the price prediction opportunity. The underlying obstacles of the prediction-throughput trade-off, issue is synthesized with the analysis of the receiver operating characteristic and access probability. To achieve the highest possible price prediction of network traffic, a novel GTS and CSMA based mechanism is proposed by differentiating the target network traffic overflow in MANETs. And also provides the design aspects of these algorithms mechanism in order to achieve the highest possible controlling the network traffic overflow throughput. The achievable throughput by these algorithms are formulated based on the proposed mechanism. To obtain maximum throughput under the constraint of controlling the network traffic overflow, an optimization is conducted between the traffic prediction period and the detection probability of the CSMA and GTS algorithms for controlling the network traffic using the same mechanism in this chapter. This optimization shows the significance of the controlling network traffic using algorithms for designing an efficient access with QoS routing.

Chapter 4: This chapter provides the simulation-based results for controlling the network traffic overflow using devised algorithms and mechanism for controlling the network traffic. The network traffic overflow prediction using the devised CSMA and GTS frameworks of the predicting the controlling of network traffic is described, with consideration of practical monitoring the network traffic scenario. The derivation of the network traffic detection sensitivity configuration according to the contention parameters is provided in this chapter. The achievable throughput is formulated with the network traffic in MANET based on proposed mechanism.

Chapter 5: This chapter presents a complete discussion of performed experiments for a controlling the network traffic overflow with proposed algorithms and mechanism. The network traffic with QoS routing ensures the quality of controlling exhibited in chapter 4 is exploited with the contribution of embedding the network traffic and doing comparison of accuracy with existing literature.

Chapter 6: This chapters presents the conclusions of this thesis along with the essentials of the tasks accomplished and the technical contributions made. In addition, recommendations are made for the further improvement of the access strategies in controlling the network traffic overflow with proposed mechanism.

2. RELATED WORK

This chapter provides the background information needed to understand the chapters that follow. It delivers a basic overview of a literature on controlling the network traffic overflow and network detailing the infrastructures, nodes, the literature of proposed algorithms and mechanism in communication as well as briefly discuss the standards, sensing methods and security implemented. Secondly, this chapter investigates controlling the traffic overflow as a method of blocking additional traffic with previous papers. Finally, it briefly discusses the components of QoS routing for ensuring the quality of traffic control and standardization of network traffic overflow.

2.1 LITERATURE REVIEW

We begin literature survey by discussing implementing QoS and CSMA together for accomplishing automated network. We aimed to apply adaptive routing in multimedia communications for eliminating QoS constraints. Software-defined networking supports the idea of openness which leads to programming network devices. Hence, the configuration of southbound and northbound API in QoS allows the functioning of QoS enabled NFV network as mentioned in [21, 22]. While designing SDN and NFV network, services like network management and orchestration are very imperative. Therefore, network management is very crucial for execution of adaptive routing.

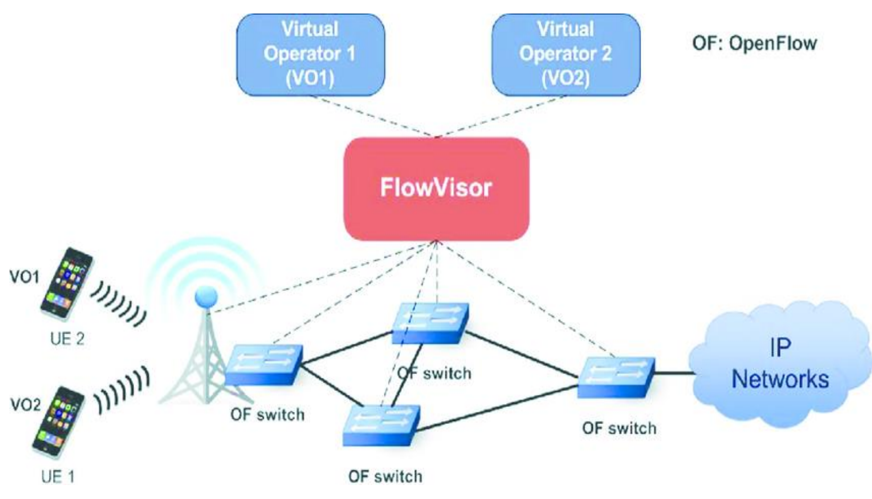

Figure 2.1: Different types of uncontrolled network traffic on the internet [22].

The QoS routing which can be used as network management tool for controlling the network traffic and allows us to execute control theory in networking. Execution of control theoretic approach to operate SDN and NFV network together is previously done in [23], where RINA is used for managing VNF nodes. In [24], monitoring CPU load of two VNF instances is carried out and load balancing traffic for respective VNF's is executed. Our focus is to implement the similar technique to improve throughput for multimedia communications by accomplishing the idea of adaptive routing. Quite a few papers have been published regarding the development of northbound SDN API. The authors in [25] have developed an NBI architecture which follows principles and guidelines provided by the Open Networking Foundation (ONF). The work in [26], demonstrates NBI design using REST services which is the most common choice for northbound API in SDN. The paper correspondingly talks about issues faced using REST API.

The research in [27] and [28] focuses on QoS provisioning using SDN. The work in both the papers shows the importance of application layer in SDN used for QoS routing. With the implementation of a particular framework for their research, an idea of flexibility provided by SDN application layer is highlighted. QoS routing is achieved by using network monitoring services in [29] and [30]. In this thesis, our foremost objective was to provide maximum link bandwidth to video streaming applications. To achieve similar goals different ideas are implemented in [31] using NFV as a traffic monitoring system. In [32] optimal route for data transfer is calculated considering QoS parameters and later priority flows are installed in the network. Deployment of NFV as a routing function is carried out in [33] where different routes are established, and packets are classified based on ipv4 and ipv6. Our work is related to [34] where optimal routing function is generated to improve overall throughput using network monitoring. But there is one notable difference; our emphasis is to provide best effort service to a single application with the implementation of adaptive QoS routing.

Network traffic controlling operation promotes the concept of dynamic access in the underutilized network for improving the spectral efficiency. There are no restrictions on the network architecture of the cognitive radio networks unlike other wireless networks such as QoS routing and cellular MANET networks. Therefore, many network models are adopted the CR concept for providing the best effort services in different applications. This chapter provides a literature for network traffic overflow monitoring and controlling operation and shows the application site of the MANET concept in current trends.

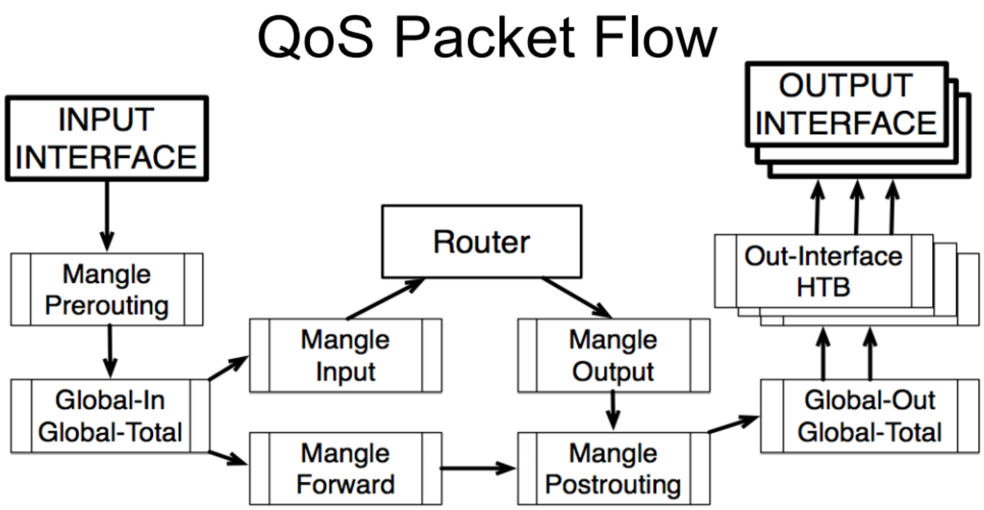

Figure 2.2: Prioritizing the network traffic using the QoS packet flow with router on-board [34].

The introduction of new network access policy also brings numerous technical challenges for real-world implementation. Since MANET network technology aims to operate in the best available network, existing QoS hardware has to be upgraded with the capability of multi-band operation as given in [35]. Smart software models have to be connected with the physical QoS model with learning capabilities as shown in [36]. The network model will be more complex due to the dynamic and high load balancing issue. The transmission protocol needs to be reconfigured because the primary and secondary network within a MANET cannot be coordinated with a dedicated control channel as explained in [37]. Overall, the QoS technology has raised many research challenges as well as promoted huge opportunities for innovation, to bring about a new era of wireless industry for controlling the network traffic overflow.

2.2 NETWORK TRAFFIC MONITORING SERVICE

Considering the importance of sensor parameters for further contributing to network traffic network traffic overflow spectrum access, the parametric hypothesis-testing procedure is used in this research. Simply, the transmission of the network traffic is constrained with the target network which is not specifically provided with the selection factors of any detector as mentioned in [38].

However, the sensing efficiency of the detectors may vary in different channel conditions. These variations only signify the attribute of different detectors. There is a large body of literature on the choice of detection method for QoS signal as mentioned in [39]. The study of detector selection as a tool for network traffic network traffic overflow spectrum sensing is not an objective of this research, but most importantly, the further utilization of the sensing parameters with a post-processing algorithm is an objective to improve the spectral efficiency as mentioned in [40]. Detector-independence and post-processing of the sensing parameters provide greater flexibility in designing the universal access protocol, and they have become extremely significant in the recent literature on QoS routing technology.

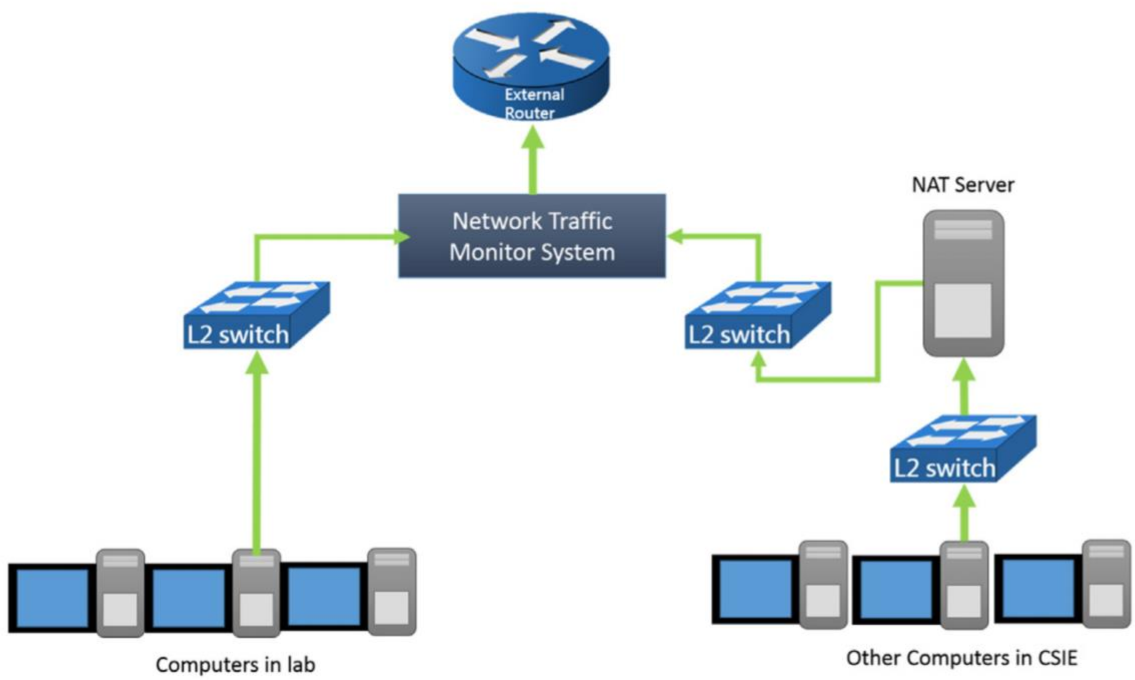

Figure 2.3: The network traffic monitoring system with multiple switches on the NAT server for controlling the network traffic [40].

The QoS routing and exceptional MANETS network propagation in the network are used. To meet the requirements of QoS routing protection and efficient network traffic network traffic overflow spectrum utilization, the QoS capabilities comprise network traffic network traffic overflow spectrum sensing, database access services, channel set management, and geolocation services. All supporting devices, such as network with QoS routing, need to be empowered with the given

MANET capabilities. The QoS capabilities enable the MANET network to produce robust decisions regarding the characteristic of the using QoS routing. The traffic activity of the incumbents of the network traffic bands is dynamically updated in the database which information can be used as a supplement of the sensing to protect the incumbents. The type of detectors is not regulated by this standard. However, this standard promotes the scheduled network traffic network traffic overflow spectrum sensing and sensing information sharing to make a central decision.

As the research activities documented in this thesis is focused on the issue of sensing- assisted access strategy, the IEEE 802.22 standard is thus reviewed on the context of research issues. According to the standard, the QoS routing accommodates all necessary tools for protecting the incumbent users of network bands and for the coexisted services as mentioned in [41].

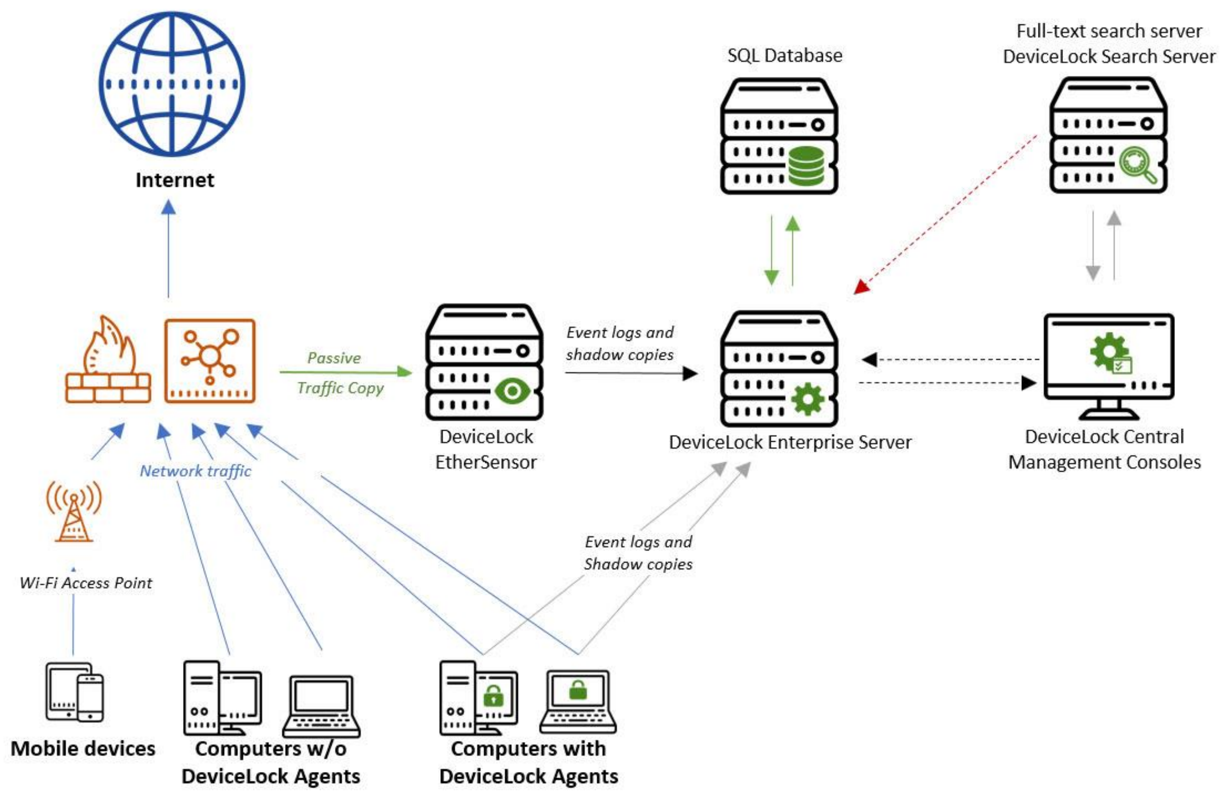

Figure 2.4: The management and monitoring of network traffic through the database servers with access points [41].

The network traffic management and monitoring manages multiple QoS routing and the medium access is controlled by the QoS routing protocols. In the downstream transmission, when network transmits and network receives, QoS routing protocol supports time-divisional multiplexing (TDM). During the upstream transmission, QoS provides a combination of access strategy depending on the user application including its QoS. When multiple QoS attempt to transmit simultaneously by sharing the same channel within a cell or overlapping cells, then the QoS provides the upstream scheduling based on the following mechanisms: unsolicited bandwidth grants, polling, QoS header-based contention, and CSMA-based contention. No specific access protocol is proposed in the standard; it is assumed that the existing access protocols are sufficient to support the network traffic capabilities. In the implementation, however, the existing access mechanisms are not directly applicable as the current working group of the IEEE 802.22 have suggested.

2.3 QOS ROUTING PROTOCOL

The Quality of Service (QoS) protocol provides channel access mechanisms for several users while sharing the communication medium [42]. In most of the wireless networks (e.g., WLAN, WSN, and WPAN) all users must be organized by MAC protocol for efficient utilization of the shared medium. Traditional QoS protocol, however, can interfere with the primary network and degrades the overall throughput. Robust operation of a cognitive cycle can be ensured by the proper control of the sensing and access mechanism. A QoS protocol can facilitate the control operation on the distribution of network traffic network traffic overflow spectrum sensing and access in a cognitive network traffic cycle.

Due to the network heterogeneity, QoS users require additional features in the QoS protocol for providing interference protection to the primary network without any internetwork collaboration. This requirement forces a drastic redefinition of the functionality of the QoS protocol for MANET. The cognitive QoS protocol must assist the secondary network to cope with the network traffic heterogeneity through a compatible channel access strategy for exploiting the full potential of the opportunity.

The operational efficiency of the QoS protocol is generally influenced by several QoS-independent factors, such as network traffic activity, tolerable interference to traffic, and hardware constraints for multi-band operation. An efficient network access strategy can aid the QoS protocol in improving the operational efficiency. Thus, QoS routing protocol should also take into account the sensing scheduling task as well as the network access task because sensing is an obligatory task to protect the primary network as mentioned in [43]. Not only the sensing scheduling but also the sensing decision can be crucial for improving the capabilities of the QoS routing protocol. Network traffic access through QoS routing is a complex task due to the dependency on sensing decisions, and there are many issues requiring research in the area of sensing integrated QoS protocol for traffic control.

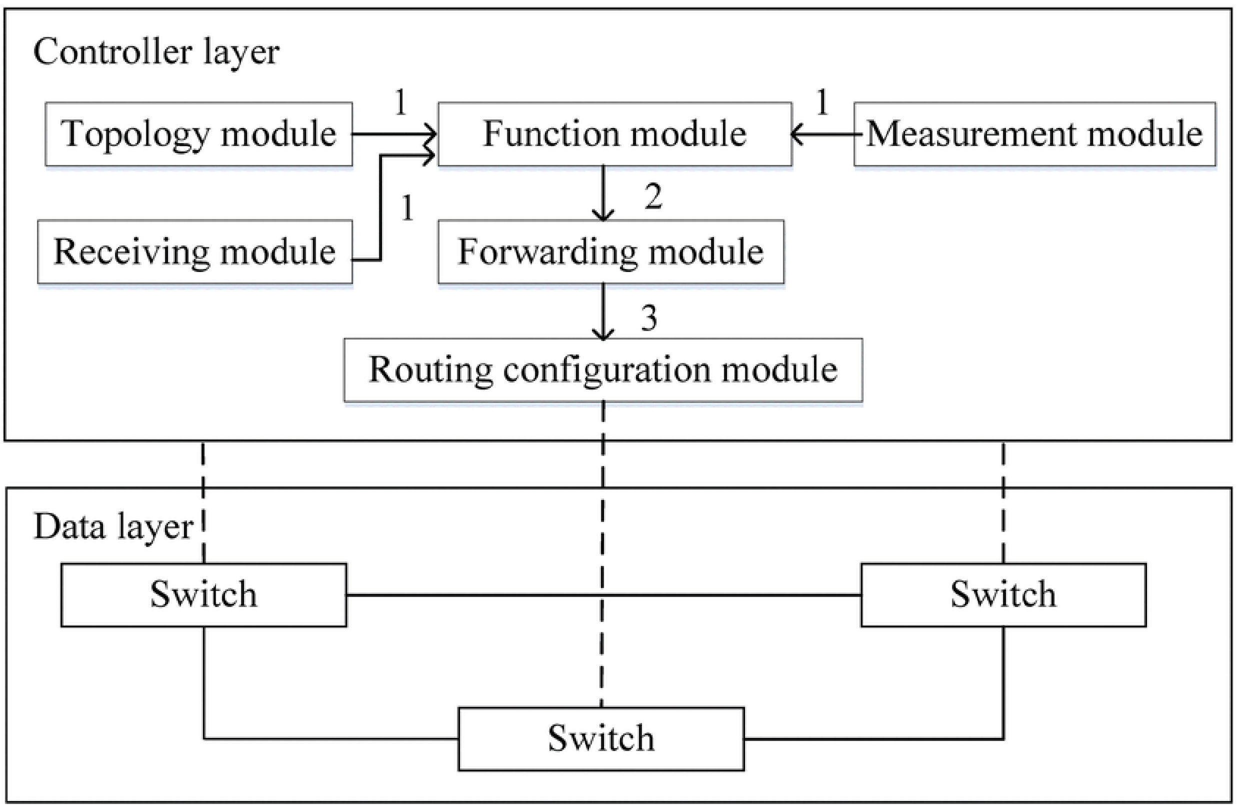

Figure 2.5: The architecture of centralized QoS routing for controlling the network traffic [43].

Network traffic access with QoS routing protocol allows the post-processing of the signal detection data from the network for further evaluation. In the network, QoS protocol detection is carried out by using the following techniques: energy detection, matched filter etc. In particular, the received signal is synthesized according to the detection techniques, and by comparing the processed output and pre-defined threshold value, the final decision is obtained. In this research, it is assumed that the CSMA and GTS algorithm conducts the entire operation of the network discovery for QoS operation from network signal detection to post-processing.

2.4 CONDITIONS FOR CONTROLLING NETWORK TRAFFIC

There are many conditions for controlling the network traffic, network decision varies depending on local observation which needs to be further processed for making a global and robust decision about the MANET channel activity. To overcome the deficiency of a network decision, cooperative network traffic control sensing is proposed in [44], by sharing the local observation over the network to make a combined decision about the network activity. In the network QoS protocol, all local decisions, either soft or hard decisions, are taken into the fusion machine. Based on decision rules, either AND or OR rules, a final decision comes out regarding the channel status. The diversity gain is imposed to overcome the deficiency of the sensing experienced by low network traffic. Challenges in the implementation of CSMA algorithm include increased complexity and the requirement of an additional control channel [45]. Even though the CSMA algorithm can enhance the sensing output under channel impairments, the large overhead in the CSMA algorithm makes it inefficient for access protocol design in [46].

A dynamic QoS sensing technique with WLAN is proposed by [47] with the scheduling of multiple sensing cycles before data transmission. Higher network traffic network traffic overflow spectrum utilization is achieved by the dynamic sensing method when compared with single and static method of the sensing. The sensing period is differentiated by lower sensitivity into multiple stages in multi-stage sensing algorithms. The dynamic sensing or multi-stage sensing has a great advantage in wideband sensing, as shown by [48], where an optimal sensing round with different sensitivity is allocated to maximize the throughput. The idea of multi-stage sensing is narrowed down by exposing the multi-threshold values in different sensing stages under the constraint of primary user protection. A significant difficulty in multi-stage sensing includes modeling of the multi-threshold value in a discrete time scale where the channel state may change dynamically over the given sensing period. Sensing cycle design is an important task for configuring the transmission period in the QoS protocol. The capability of sensing cycle design in the QoS protocol is referred to as network discovery and/or network search.

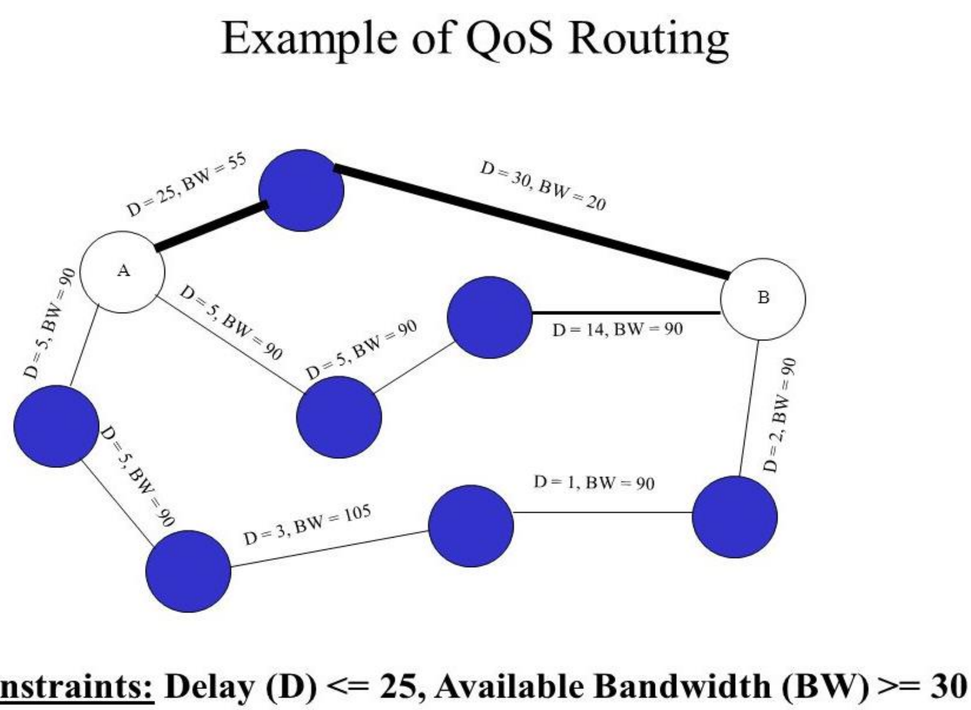

Figure 2.6: Example of QoS routing with network traffic conditions [49].

The researcher in [47] found that the overall discovery of QoS is maximized and the delay in finding idle channels is minimized by choosing an optimal sensing cycle. The authors in [48] proposed a two-stage sensing, where the multiple frequency-divided channels are simultaneously observed by using multiple antennas. In the frequency dimension, sensing starts with coarse resolution sensing and partitions all the channels for network traffic monitoring within a defined bandwidth regardless of obtaining any idle channels. Then, fine resolution sensing of network traffic analysis takes into account that newly defined bandwidth and continues until obtaining an idle channel. This type of network traffic sensing algorithm is particularly proposed for spread network traffic network traffic overflow spectrum where frequency hopping is used [50].

2.5 SUMMARY

The method followed for research has been outlined in the above sections. The philosophy being highlighted through this study is that of positivity in the light of network traffic monitoring and controlling fluctuating by huge margins and network administrator confidence eroding with every passing day. The experiments use a QoS routing protocol approach to create results on which analysis can be performed and a near to accurate controlling of network traffic can be obtained. The approach used to capture the data and datasets used in the process has been highlighted. Also, the review illustrates the necessity of network traffic monitoring design for developing a framework for controlling system for network traffic. According to the network usage cycle, network traffic is one of the key enablers of the network traffic operation that should be considered explicitly in the design of a complete monitoring and controlling of network traffic. Therefore, the impact of network traffic in the MANET on the design of the QoS routing system is thoroughly performed in the next chapter, with their applications and technical challenges and methodology.

3. METHODOLOGY

Controlling network traffic overflow has been performed on the platform on Anaconda Navigator on the IDE of Sypder. The data collected was cross-checked with that from network aspects in order to avoid any unwanted discrepancies. Data collection in the beginning stage was manual since network traffic deprecated their API Library which was earlier used on Python Programming on Anaconda Navigator IDE to seamlessly fetch data and save it directly by making an API call to the ensuring the QoS routing. However, in due course it was realized that the existing data had values which even though were compensated for, still affected the network traffic prediction and thereby produced good results. Hence, a shift was made to using many different libraries which proved to be significant since the results now obtained were more accurate and meaningful. The flow diagram has been shown in Figure 3.1.

We have implemented adaptive QoS routing in a virtualized topology for network traffic overflow using GTS and CSMA algorithms. Adaptive QoS routing which is also known as dynamic routing is a method which will establish optimal routing path for data packets based on particular situations. With the help of CSMA and GTS implementation of adaptive routing is much easier. Due to the openness of MANET, determination of optimal routing path and directing packets through this optimal path is possible. Adaptive routing can be calculated using many parameters such as hop counts, bandwidth, CPU usage and other networking constraints to provide optimal path. In our testbed, the high priority packets will be directed towards the optimal path (shortest path) and the low priority packets will have an alternate path. The adaptive routing mechanism will be triggered only for the required applications; in our case it is MANET application. By using virtual network function as a service with the integration of QoS we developed a control theoretic approach which enables Adaptive QoS routing for MANET application for our topology. To execute this idea management of CSMA and GTS is essential. Therefore, multi-stage network traffic overflow controlling and sensing gained a reputation for largely protecting the primary users; however, this controlling and sensing may require a longer sensing and controlling period which impacts on the increases in the throughput performance.

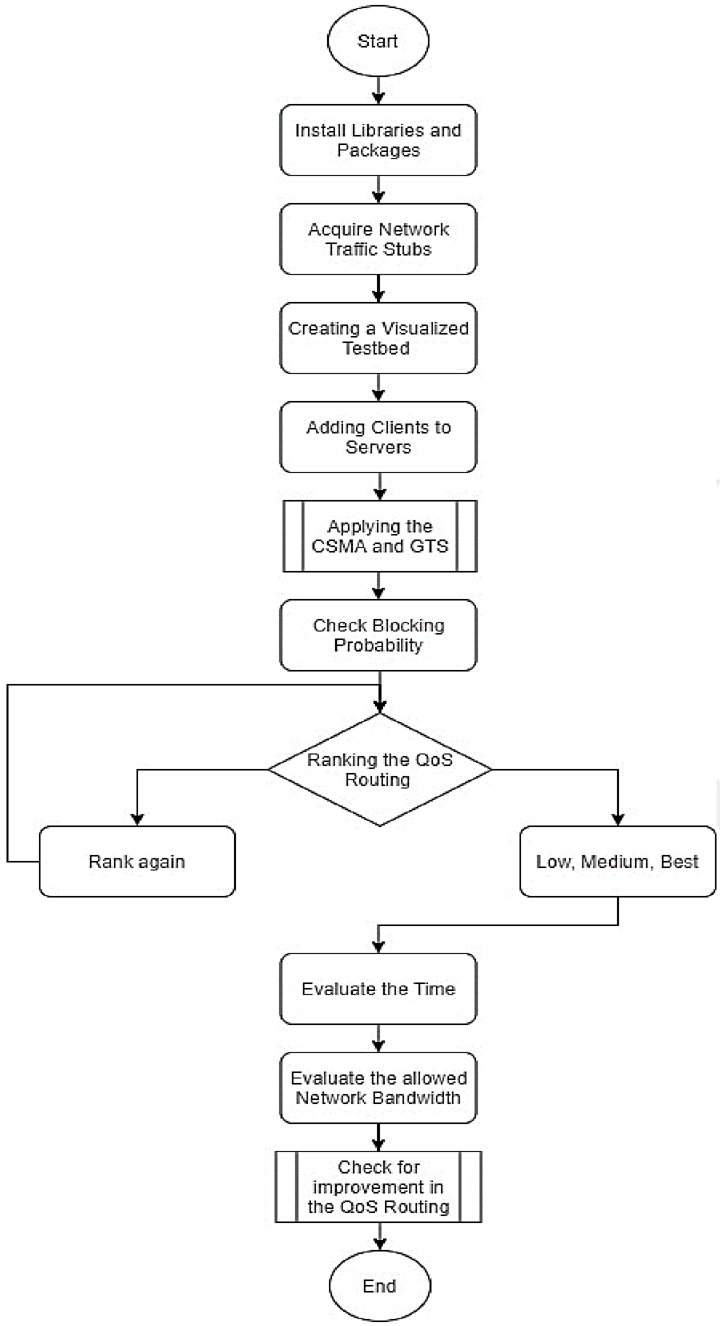

Figure 3.1: Flow diagram of approach being followed.

During the upstream transmission, network traffic provides a combination of access strategy depending on the user application including its QoS. When multiple CPEs attempt to transmit simultaneously by sharing the same channel within a cell or overlapping cells, then the network traffic provides the upstream scheduling based on the following mechanisms: unsolicited bandwidth grants, polling, network traffic header-based contention, and CSMA-based contention. No specific access protocol is proposed in the standard; it is assumed that the existing access protocols are sufficient to support the QoS routing capabilities. In the implementation, however, the existing access mechanisms are not directly applicable as the current working group of the IEEE 802.22 have suggested.

3.1 QOS ROUTING OVER DIFFERENT LAYERS

Every QoS routing can be viewed as a layer of communication. CSMA operates on the principle of layered recursive networking; therefore, all the routing is performed and assembled into one layer. This one layer has many clustered QoS routing where required processes repeat over different scope to form a communication channel. For example, consider Figure below wherein level of QoS (shared state) will deliver services for N – level QoS. Providing services to the lower QoS levels which primarily performs recursive communication is one of the principles of controlling network traffic. There is no separate protocol for every single layer, just the configuration and policies can be different depending upon the QoS (Quality of Service). A collection of QoS is called Distribution Application facility (DAF) which perform similar tasks and use shared states.

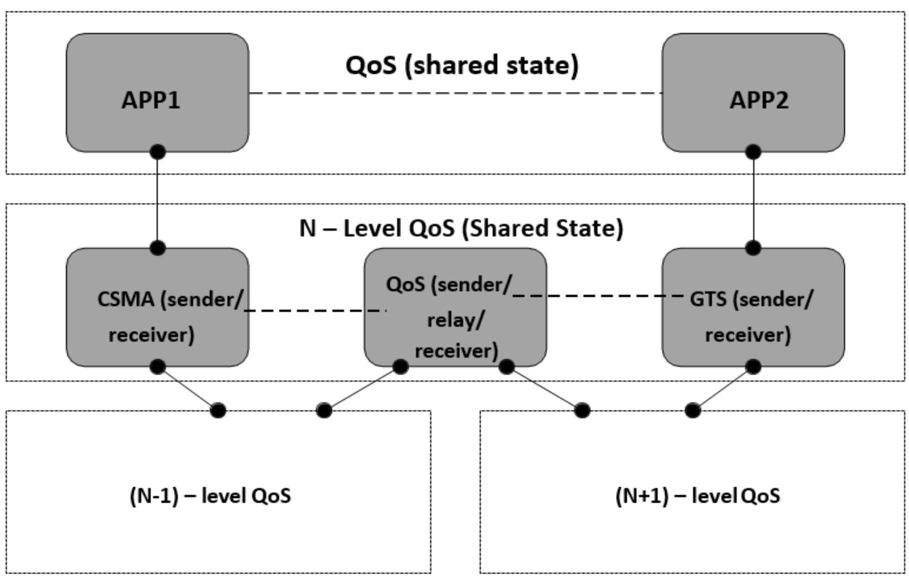

Figure 3.2: Division of QoS routing on different levels with shared states for controlling network application traffic.

QoS shared states consists of different network traffic controlling application entities (App1 and App2), which can execute a particular function on distinct levels such as single host, multi-host or a network level. One can create numerous services such as network packet streaming, implementing routing algorithms and other network related applications by using QoS. Interaction of different application entities needs low-level data transfer which is provided by internal python based Application Programming Interfaces (APIs). The concept of CSMA and GTS technique has received considerable attention for its capacity to enable opportunistic access in wireless sensor networks (WSN). The network traffic overflow could be controlled with these techniques as well with the capabilities in the networks empower the sensor node with the ability to access reachable channels opportunistically. This feature drastically the transmission reliability and energy-efficiency drastically of the QoS routing in MANET networks.

3.2 CSMA AND GTS ALGORITHMS FOR QUALITY ASSURANCE

We have integrated CSMA with GTS which provides a better setup for traditional QoS routing. In figure below, we see an CSMA and GTS algorithms for network with a controller and many networking devices such as MANET and other heterogeneous devices where both are distinguished by control layer and forwarding layer. Here CSMA controller which gets a centralized network view uses LLDP (link layer discovery protocol) to calculate the shortest path between nodes. After calculating the shortest path, a controller will generate flows which are installed in GTS algorithm using different networking protocols. We could see that network traffic will take two hops of QoS routing to reach a server. Similarly, network traffic will take two hops of adaptive QoS routing using the CSMA and GTS to reach a server. Therefore, network traffic overflowing will be blocked using the same path to reach server. Simultaneously, by injecting traffic using network from CSMA to GTS will take very low time in QoS routing for MANET to a network traffic to share path. These techniques are very promising paradigm for network traffic oriented services by upgrading the conventional network traffic with overflow controlling capabilities.

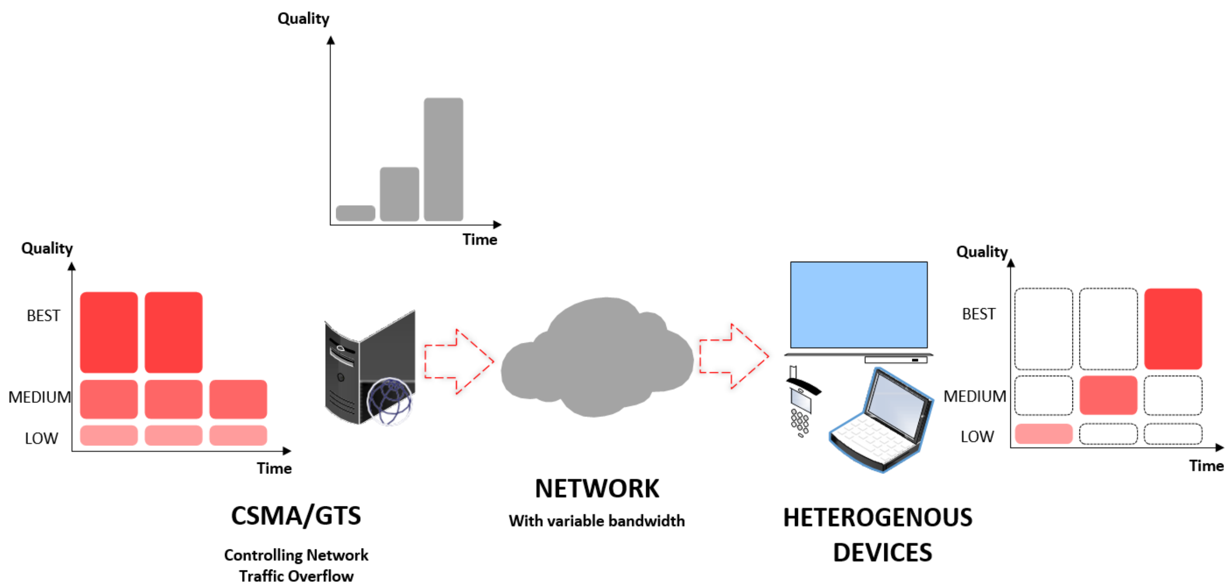

Figure 3.3: The metrics of Quality check with low, medium and best for CSMA and GTS algorithms for controlling the network traffic overflow with variable network bandwidth.

3.2.1 Carrier Sense Multiple Access (CSMA) Algorithm

The Carrier Sense Multiple Access (CSMA) algorithm allows the post-processing of the signal detection data from the different layers of network for further evaluation. In the network traffic detection is carried out by using the following techniques: energy detection, matched filter, overflow detection. In particular, the received signal is synthesized according to the detection techniques, and by comparing the processed output and pre-defined threshold value, the final decision is obtained. The final decision can be either a soft decision (parametric value) or a hard decision (e.g., binary hard decision is ON or OFF). This network traffic detection decision can be further proceeding to increase the controllability of the QoS routing and sensing for network traffic overflow controlling, and this is referred to as post-processing of the detection of network traffic. In this research, it is assumed that the CSMA algorithm conducts the entire operation of the network traffic overflow discovery for QoS routing operation from network traffic detection to post-processing.

In many conditions, an individual decision varies depending on local observation which needs to be further processed for making a global and robust decision about the channel activity. To overcome the deficiency of an individual decision, Carrier Sense Multiple Access (CSMA) algorithm is proposed, by sharing the local observation over the network to make a combined decision about the user activity. In Carrier Sense Multiple Access (CSMA) algorithm, all local decisions, either soft or hard decisions, are taken into the fusion machine. Based on decision rules, either allow traffic or disallow traffic rules, a final decision comes out regarding the channel status. The diversity gain is imposed to overcome the deficiency of the sensing experienced by low QoS routing in the MANET network. Challenges in the implementation of CSMA algorithm include increased complexity and the requirement of an additional control channel. Even though the CSMA algorithm can enhance the sensing output under channel impairments, the large overhead in the CSMA algorithm makes it inefficient for access protocol design.

CSMA.py*

```
"""
CMSA Algorithm
"""
import sys
from view import MainView
from controllers import InputTextController
from controllers import CheckBoxController
from model import CMSACDModel
from PyQt5 import QtWidgets
from PyQt5.QtCore import QThread, QMutex

if __name__ == '__main__':
    app = QtWidgets.QApplication(sys.argv)
    app.setApplicationName('Network_Traffic_Overflow')
    MainWindow = QtWidgets.QMainWindow()
    lock = QMutex()

    model = CMSACDModel(lock)

    input_text_controller = InputTextController()
    check_box_controller = CheckBoxController()

    main_view = MainView(input_text_controller, check_box_controller, lock)

    model.update_signal.connect(main_view.update)
    input_text_controller.sync_signal.connect(model.sync)
    check_box_controller.burst_mode_signal.connect(model.set_burst_mode)

    worker = QThread()
    model.moveToThread(worker)
    worker.start()

    MainWindow.setCentralWidget(main_view)
    MainWindow.show()
    sys.exit(app.exec_())
```

Figure 3.4: The CSMA algorithm that is being used in this work.

3.2.2 Grouped Task Scheduling (GTS) Algorithm

A dynamic sensing technique is used in the work with the scheduling of multiple sensing cycles before data transmission for controlling the network traffic overflow. Higher scheduling utilization is achieved by the grouped task scheduling (GTS) when compared with single and static method of the sensing of network channel. The network traffic overflow period is differentiated by lower sensitivity into multiple stages in multi-stage sensing algorithms. The GTS algorithm in sensing or multi-stage sensing has a great advantage in wideband sensing, where an optimal sensing round with different sensitivity is allocated to maximize the throughput. The idea of multi-stage sensing is narrowed down by exposing the multi-threshold values in different sensing stages under the constraint of primary user protection. A significant difficulty in multi-stage sensing includes modeling of the multi-threshold value in a discrete time scale where the channel state may change dynamically over the given sensing period. Sensing cycle design is an important task for configuring the transmission period in the QoS routing protocol. The GTS capability of sensing cycle design in the QoS routing layer is referred to as network traffic network traffic overflow spectrum discovery and/or network traffic network traffic overflow spectrum search. GTS algorithm sequence scheduling through the QoS routing protocol is used for overflow segmentation. We found that the overall discovery is maximized and the delay in finding idle channels is minimized by choosing an optimal sensing cycle for network traffic. A two-stage network traffic sensing, where the multiple frequency-divided channels are simultaneously observed by using multiple traffic segments. In the frequency dimension, sensing starts with grouped task scheduling (GTS) and partitions all the channels within a defined bandwidth regardless of obtaining any idle channels. Then, fine resolution sensing (FRS) takes into account that newly defined bandwidth and continues until obtaining an idle channel. This type of network traffic sensing algorithm is particularly proposed for spread network traffic network traffic overflow spectrum where frequency hopping for network traffic overflow control.

To overcome the network traffic overflow sensing-throughput trade-off, issue, multi-stage sensing algorithm gains great attention in the literature of QoS routing. Nonetheless, the resourceful ordering of the stages, weighting factors in stages, the optimal parameters designing, and integrating with the access protocol can impact on the performance improvement.

GTS.py*

```python
from dataclasses import dataclass
from random import randint
from PyQt5.QtCore import QThread, pyqtSignal, pyqtSlot, QObject, QMutex
import time

class GTS(Traffic):
    # Network properties
    _writes_now: QMutex
    _previous_text: str = ""
    _output: str = ""
    _burst_mode: bool = False

    # just for emulation
    _channel: str = ""

    # constants
    SLOT_TIME = 0.005  # of second
    COLLISION_WINDOW = 0.004  # of second

    update_signal = pyqtSignal(tuple)

    def __init__(self, writes_mutex: QMutex, *args, **kwargs):
        super().__init__(*args, **kwargs)
        self._writes_now = writes_mutex

    # for observer pattern
    def _notify(self, about: tuple):
        self.update_signal.emit(about)

    def _write_to_debug(self, value: str):
        self._notify(("debug", value))

    def set_output(self, new_output: str):
        self._output = new_output
        self._notify(("output", new_output))
```

Figure 3.5: The GTS algorithm that is being used in this work.

3.3 EVALUATING NETWORK TRAFFIC BLOCKING PROBABILITY

Evaluating network traffic blocking probability a comprehensive analysis of how the CSMA and GTS algorithms control and sensing mechanism impacts on improving the network traffic network traffic overflow spectrum opportunity for overflow controlling operation. Before the traffic transmission, the capacity measurement of the network traffic opportunity is essential for setting an efficient access protocol. Therefore, network traffic opportunity is expressed using the underlying parameters of the network traffic network traffic overflow spectrum controlling to gain insights into sensing in order to increase the network traffic network traffic overflow spectrum opportunity. On the other hand, interference protection to the network traffic is provided by sensing a high target traffic value in the detection mechanism which increases the overflow. The detection mechanism cannot produce greater network traffic network traffic overflow spectrum opportunity when the detection has a large network traffic. This dilemma cannot be handled efficiently when a network traffic overflow mechanism is applied. To overcome this issue, a network traffic overflow with CSMA and GTS mechanism is proposed based on two conditional sensing steps during the sensing period to jointly decide the channel occupancy status.

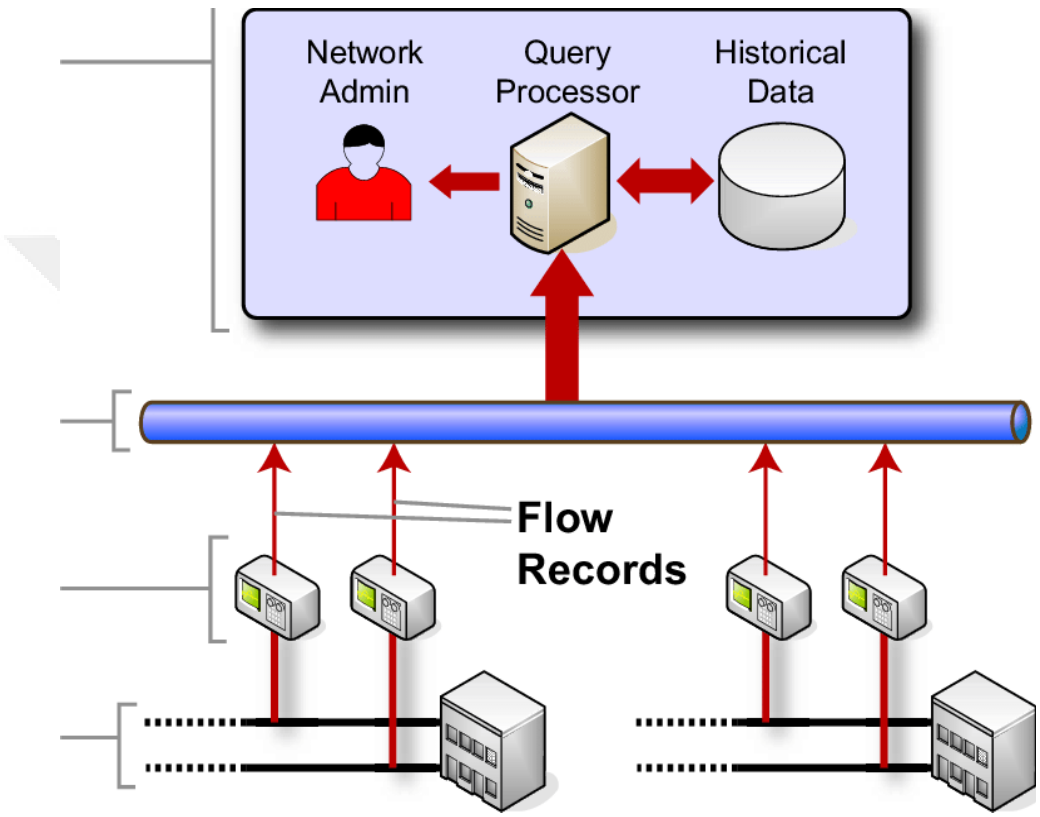

Figure 3.6: The block diagram representing the network traffic overflow monitoring system [51].

In the proposed CSMA and GTS mechanism, two different target traffic are set over the controlling and sensing period where those two steps also achieve the overall network traffic is controlled. When the target traffic is relatively low, then the detection mechanism produces a lower network traffic. As a result, the network traffic network traffic overflow spectrum opportunity is increased for network traffic transmission with the lower network traffic. The detection capability of the CSMA and GTS mechanisms is assessed with the QoS routing protocol for different network traffic values. Also, the achieved opportunity is examined by measuring the access probability in relation to the sensing period and the channel idleness. The QoS routing protocol in MANET network traffic analysis implies that the proposed CSMA and GTS mechanism has better signal detection capability than the QoS routing at any network traffic value. Access probability analysis shows that the CSMA mechanism also achieves higher network traffic network traffic overflow spectrum opportunity than the GTS mechanism, even when the CSMA is greatly protected with a high value of the target network traffic. Overall, this work concludes with the statement that the proposed CSMA and GTS mechanism discovers a large network traffic network traffic overflow spectrum for controlling the network traffic opportunity which can be capitalized on through an advanced access protocol to significantly improve the throughput and interference protection.

3.4 EVALUATE ALLOWED TRAFFIC BANDWIDTH

In this optimization problem, the main goal is to maximize the throughput of the network traffic bandwidth controlling based access protocol under the constraint of overall target network traffic bandwidth in QoS routing. As the internal operation of CSMA mechanism is conditioned with each other by the sensing decision, therefore, any one of the sensing steps' network traffic bandwidth and sensing period can be relevant to use as optimizer to meet the target network traffic bandwidth. To emphasize the reduction of CSMA of GTS-based access protocol over single-level sensing and traffic overflow controlling, we set the constraint of the total sensing period equal to the optimal sensing period of CSMA and GTS mechanism for a given target traffic control. In this condition, we check the feasibility of minimum network traffic bandwidth by convex analysis with respect to the first detector's network traffic bandwidth for the constraints of target network traffic bandwidth and total sensing period. Through the comprehensive feasibility analysis, we proved that GTS-based access method reduced the overall network traffic bandwidth compared to CSMA-based method at the same target network traffic bandwidth regardless of extending the overall sensing period. We transferred network traffic segments on the basis of the estimated link bandwidth. Therefore, network traffic has not impact the bitrate of every packet that is being transferred because of the shared link of QoS routing. Network traffic is injected variably from 1MB up to 10MB (link b/w) in a successive manner for the same network traffic. This is how a MANET network provides a downloading bitrate for every segment which is monitored and recorded. So, we examined from that QoS shared link results in high bandwidth utilization and lower network traffic eventually decrease the bitrate of under consideration network.

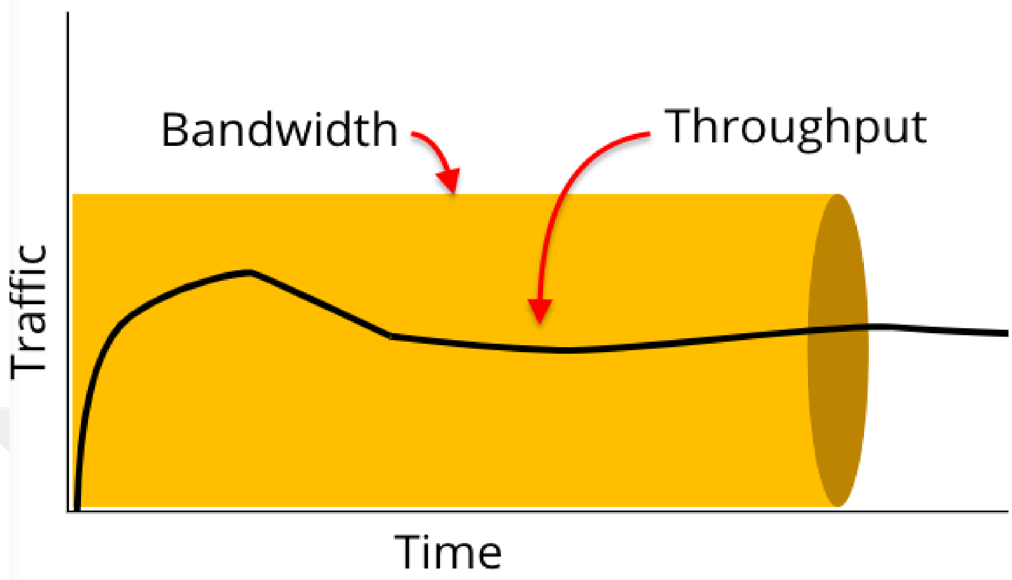

Figure 3.7: The representation of network traffic against the bandwidth and throughput of network over specific time.

3.5 CHAPTER SUMMERY

The proposed CSMA and GTS network traffic overflow mechanism overcomes this issue. However, the detection sensitivity such as a target network traffic in each level with required sensing time is a crucial design aspect for the deployment of the CSMA and GTS mechanism. The conducted optimization provides the solution for this design aspect of the CSMA and GTS mechanism. The solution approach to the optimization problem is formulated over three steps. In the first step, the MANETs network is minimized regarding the QoS routing at the first sensing stage while other system parameters remain unchanged. Before this minimization, the feasibility of minimum network traffic is analyzed by convex analysis. From the feasibility analysis, the optimal boundary of the MANET network at first sensing is obtained. This MANET network with QoS routing minimization ensures the significance of the CSMA and GTS algorithm mechanism as the throughput improvement is hugely dependent on the minimized amount of QoS routing from the sensing and controlling the network traffic. In addition, the required sensing time to obtain a decreased QoS routing also impacts on the throughput performance. Therefore, in the second step, the optimal boundary of the sensing period for a unique value of the maximum throughput is identified with the analytical model. Due to the mathematical complexity in computing the MANET network of the objective function regarding the optimizer, the solution is accomplished with a proposed semi-analytical algorithm. At the last step, the feasible boundary of the optimizer is employed in the proposed algorithms to obtain the maximum throughput. For fair comparison and model validation, the proposed algorithm is compared with a purely numerical approach. The performance analysis indicates that the solution algorithms can enhance the throughput performance optimally under the constraint of QoS routing protection within a limited computational complexity.

4. RESULTS

After starting all the methodology explained above, QoS routing executes shortest path routing algorithm using QoS protocol with LLDP as base protocol in QoS routing. With the help of QoS routing, specific flows are added in python programming which will duplicate all the traffic coming from interface and direct it to another interface. The representation duplicates flows of CSMA and GTS algorithms. Python programming is configured in such a way that it will generate alert file whenever network traffic is increased receives incoming packets from a source port of HTTP server. Therefore, all the incoming packets to our proposed system approaching from HTTP server who have a specific port number and source IP are detected by our proposed system. Detection of network traffic segments is done based on the port number of QoS routing. The QoS controller will launch a service where the published event is retrieved by creating a subscribe event. Thus, using CSMA and GTS stub algorithms for the communication layer which is generated. Every 1 sec, network traffic overflow information is updated and transferred to the QoS routing controller.

The shorter boundary reduces the computation complexity significantly than the direct usage of the numerical method in solving the optimization problem jointly CSMA and GTS algorithms. Finally, the numerical analysis of network traffic overflow validates the results of developed algorithms and indicates that proposed algorithm can achieve efficient throughout which outperforms the state of the arts of the MANET networks. Therefore, we proposed a semi-analytical method to control the network traffic overflow with the boundaries for QoS routing minimization and applied the boundaries into the steepest descent method to calculate the optimal solution. Then we maximize the throughput by optimizing the controlling period and the CSMA of first controlling level to meet the overall target network traffic.

As a result, this work achieves higher throughput in controlling the network traffic overflow. Moreover, the throughput can be reduced due to the waste of network traffic overflow spectrum opportunity and the packet collision in network. When the false alarm occurs during the network traffic overflow network traffic overflow spectrum sensing, the secondary users lose the access opportunities even though the network traffic overflow network traffic overflow spectrum is vacant. On the other hand, missed detection leads to collision effect during the channel access. If missed detection occurs, not only the throughput is reduced but also the activity of the MANET network is interrupted.

In networks, the access QoS routing protocol defines its operational mechanism associating with the network traffic overflow network traffic overflow spectrum sensing and controlling the traffic. Without the additional sensing policy, only the QoS routing protocol cannot reduce the collision effect occurring due to the missed detection. The periodical sensing before any data transmission during the access period can reduce the likelihood of collisions. The purposes of the network traffic overflow network traffic overflow sensing are not only to find the access opportunity but also to scaling the interference protection to the network traffic overflow. Motivated by the above facts, a novel QoS routing protocol is aimed to develop in this work to increase the throughput concurrently with guaranteeing a strongest interference protection with lower network traffic overflow.

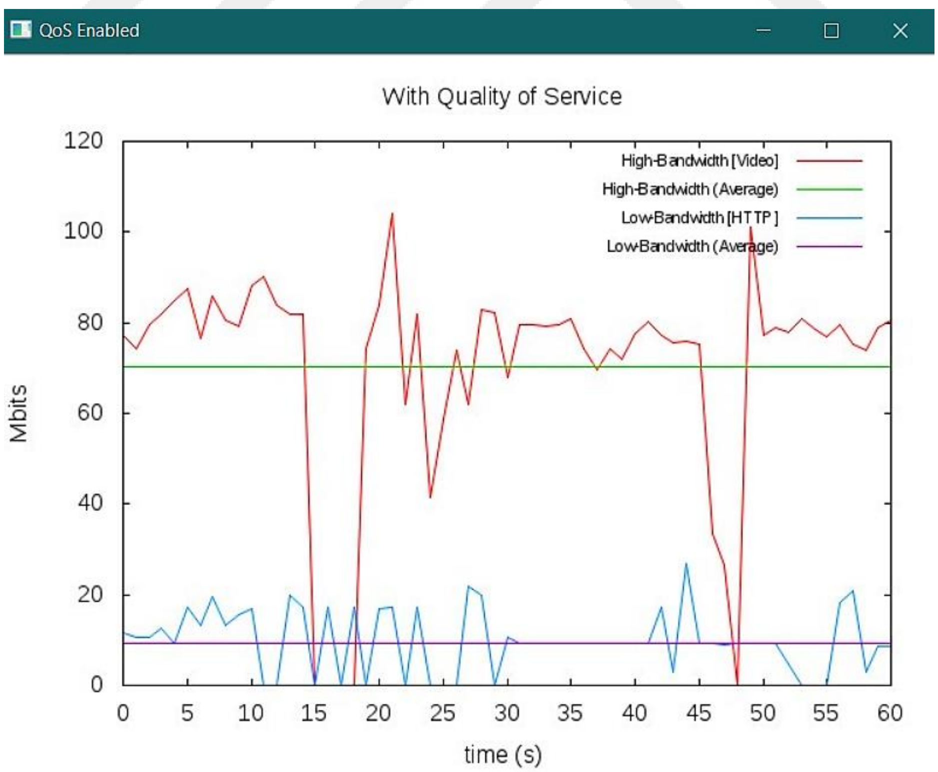

Figure 4.1: A graphical representation of network traffic bandwidth allowing different types of metrics in M-bits with QoS enabled.

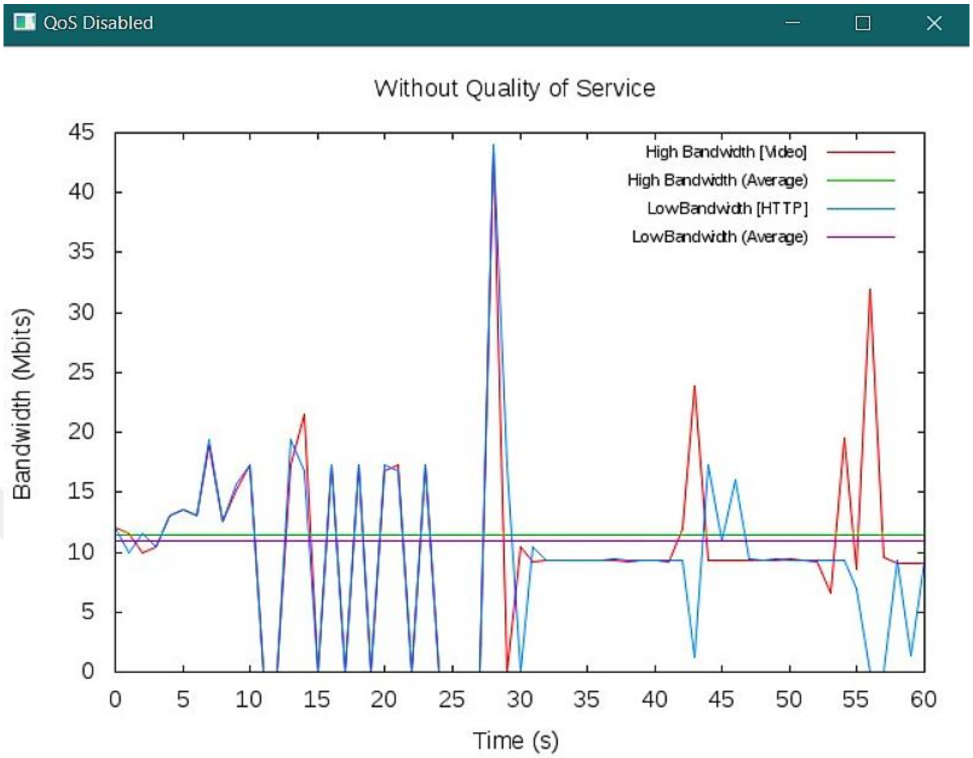

Figure 4.2: A graphical representation of network traffic bandwidth allowing different types of metrics in M-bits with QoS disabled.

In particular, the advantages of network traffic overflow controlling and sensing with CSMA and GTs with QoS routing protocol mechanism towards collision reduction during multiple access has contributed in scaling the detector. As a result, the detection process achieves larger opportunity with larger collision probability. By using the contention process and the CSMA/GTS based packet transmission mechanism, the overall collision effect is reduced during the channel access. A comprehensive analysis is presented to demonstrate the enhanced detection and the throughput performance at various channel conditions. The purposes of the network traffic control and sensing are not only to find the access opportunity but also to scaling the interference protection to the QoS routing protocol in MANET. Motivated by the above facts, a novel QoS routing protocol is aimed to develop in this chapter to increase the throughput concurrently with guaranteeing a strongest interference protection in network traffic overflow controlling.

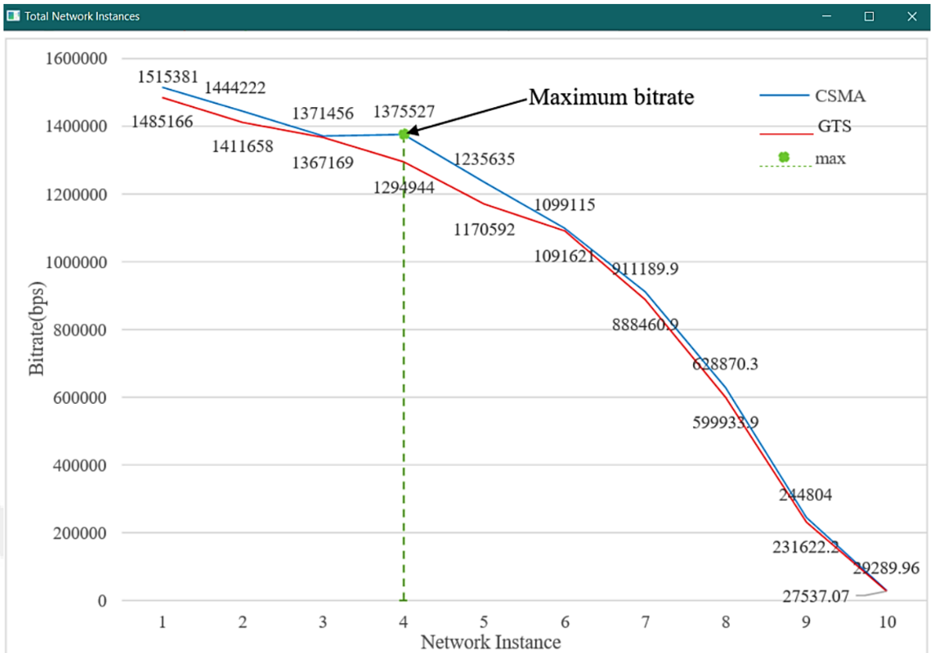

Figure 4.3: This graphical representation explains the total networking traffic instances on the x-axis while the allowed traffic bitrate on the y-axis using both CSMA and GTS with max-bitrate.

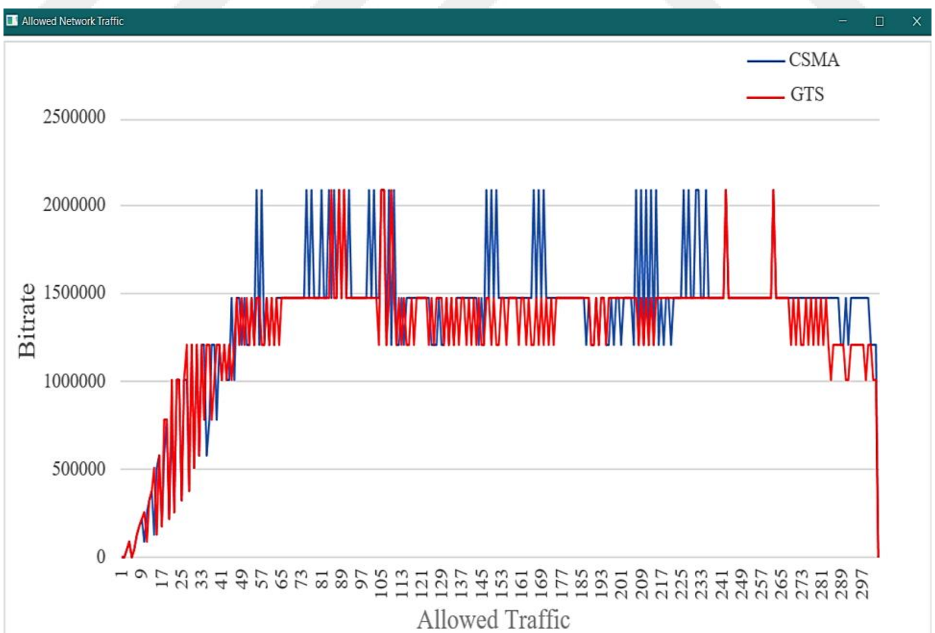

Figure 4.4: This graphical representation displays the allowed traffic instances with CSMA and GTS with QoS routing enables on all segments of network traffic.

The QoS routing protocol initiates a CSMA/GTS based network traffic overflow controlling and sensing process when the channel is sensed as busy either by spectrum discovery or by QoS routing. The network traffic overflow process is designed to produce a random delay for scheduling the packet transmission among multiple contenders asynchronously. This process is accumulated with the QoS routing, counter and the routing stage. In the proposed model, QOS routing is ensured with CSMA/GTS counter is a detrimental mechanism when network traffic neither senses the channel nor transmits any packet. At the start of QoS routing in MANET, a random number is chosen for counter from the contention window (CW) and the QoS routing is performed when the counter reaches to zero. Since this process is executed before the QoS rotuing, it can be integrated into the model to reformulate the detection objectives in the CSMA/GTS. This integration has been done by a QoS routing in MANET network design in the proposed model. The details formulation of the using QoS routing mechanism including its depending parameters has been done in this research work.

5. DISCUSSION

5.1 DISCUSSION

We have implemented dedicated QoS routing for a specific topology, in the real network we must implement it based on CSMA and GTS algorithm. Alternate path QoS routing can be calculated which will direct low priority traffic to an alternate path instead of the shortest optimal path. We believe implementation of Alternate routing with the help of an algorithm will gradually increase throughput in multimedia communication. Lastly, we are using layer three and layer four information to detect segments of controlling network traffic in proposed application. In our approach, we explicitly configure CSMA and GTS on different dives including MANET to identify packets from coming from QoS routing network. To avoid this, we need to install a mechanism called deep packet inspection in our proposed system. It will allow us to detect the network traffic overflow in the video segments based on its payload. We conclude by affirming the contributions of our work and state the work to resolve these challenges:

- Calculating all the QoS constraints like delay, bandwidth, priority, CPU load for optimal path for controlling the network traffic overflow.

- Implementing alternate path algorithm for unwanted traffic

- Initializing CSMA and GTS mode in any under consideration network including MANET.

For the sake of simplicity, the complex QoS routing, process with infinite re-transmission and controlling the network traffic overflow is considered herein as it can only consolidate the effectiveness of network traffic controlling, process by means of packet service protocol. Since this research deals with the cross-layer design of the sensing-access method, thus, the only situation where the sensing has taken place in the network, process is sufficient to consider for formulation.

As described above, network traffic overflow controlling and sensing is performed at every network traffic overflow stage after finishing the counter. In this proposed method, the target network traffic in channel sensing at every QoS routing stage is then reformed according to the network traffic overflow parameters. The objective of this target network traffic controlling reformulation is to adaptively change the sensitivity of the detection process to characterize the channel state. As a result, the detection output become an integrated function of the network traffic controlling, parameters and detection sensitivity. By examining the merged function, the overall objectives, throughput improvement and collision reduction, can be accomplished significantly by this work. The performance evaluations are demonstrated with model validation and performance comparison, which implies that the proposed scheme achieves significant improvements both in protecting the network traffic overflow activity and in increasing throughput. Compared with other existing schemes of Erlang's Ideal Grading (EIG) in [51], the EIG scheme provides an unstable throughput regime when the network traffic overflow controlling bandwidth value is also comparatively low.

Table 5.1: A comparison between several techniques for controlling the network traffic overflow with different network instances upon different techniques.

TECHNNIQUES	BANDWIDTH/ THROUGHPUT	CITATION
Erlang's Ideal Grading (EIG)	Analytic Calculation only	[52]
Hierarchical Multiservice System (HMS)	Network Instances/300s	[53]
Markov Chain Models (MMC)	Minimizing Block Rate only	[54]
QoS Routing with CSMA/GTS	1-10 Mbps/60s	Proposed Work

5.2 ANALYSIS AND LIMITATIONS

Among QoS routing protocols, a carrier-sense multiple access (CSMA) and grouped task scheduling (GTS) has the compatibility with network traffic overflow controlling and sensing operation as it also does channel monitoring before any data transmission. To deploy the CSMA and GTS, a back-off mechanism is the collision avoidance feature to reduce the collision among packets being transmitted by the other users, with a predefined enumeration process. In particular, the QoS routing mechanism not only depends on the different layer parameters, i.e., contention window (CW), but also depends on the decision of physical channel monitoring in REST services like HTTP. For the equal access priority among homogeneous type users, we assumed perfect sensing during the QoS routing mechanism and captured the sensing error regarding collision probability while the simultaneous transmission occurred in a given slot. Following this strategy applied a similar QoS routing mechanism without considering the sensing error which can result in intolerable collision among secondary and primary users. Although those strategies may improve the throughput performance, they cannot guarantee enough interference protection to primary users. To facilitate sufficient interference protection to the MANET networks under similar QoS routing mechanisms requires a higher sensing period which brings more challenges to sensing-throughput overflow problem.

6. CONCLUSION

6.1 CONCLUSION

In this research, we discussed the challenges faced in traditional networking and MANETS for network traffic overflow and how we can resolve it by implementing CSMA and GTS algorithms. We proposed the idea of Adaptive QoS routing which can be used for many multimedia applications where the primary objective is to provide Quality of Service (QoS) and revoking addition network traffic. By observing the results, we deduce that implementation of adaptive QoS routing can create an optimal dedicated path for a specific application or service. It also achieves network traffic segments of higher bitrate approximately 10% more than that in a shared path using CSMA and GTS. Therefore, overall network traffic throughput will be enhanced by these two algorithms. Additionally, we saw that using QoS routing as a network management tool allowed us to implement control theoretic approach with CSMA and GTS. Currently, almost all QoS controllers use REST service to build communication between a controller and network applications. Execution of QoS enabled network with the deployment of CSMA in the real network will lower network traffic overflow. Moreover, implementing adaptive QoS routing in the real network will also be beneficial to all multimedia service providers. Our approach has no limitations while implementing it into the real network. In this research, we did calculate optimal path considering all the QoS parameters. QoS constraints such as delay, CPU load, error rate, etc., can be considered to achieve optimal QoS routing in future.

6.2 FUTURE RECOMMANDATION

The research concentrated on developing solutions controlling the additional network traffic overflow for the access strategy to overcome the controlling and sensing-throughput trade-off with CSMA and GTS algorithm in MANET network, issue and was less focused on the issue of the energy efficiency. As such, proposed access strategies have mostly relied on the dual steps of the sensing operation which may consume relatively higher power than the conventional case. The proposed QoS routing protocol applied continuous sensing operation during the contention access period for a transmission attempt.

- We will use the QoS routing protocol in Wireless Sensor Networks (WSN) required a much smaller access delay for any transmission attempt when compared to the existing methods.
- We will control the shorter access delays in future with the access protocol may consume energy for a shorter period.
- We will evaluate the performance of the proposed access strategies can be further evaluated in the context of energy efficiency and controlling the network traffic.
- We will also analyze the underlying detection method in the network traffic controlling and sensing algorithm on energy detection due to its lower complexity and compatibility along the WSN networks operations.
- We also aimed to control the network traffic overflow in the LoRaWAN networks with double threshold values are applied to a binary hypothesis testing problem of controlling the network traffic overflow, then traditionally there is a region of confusion between two threshold values in the probability distribution of the performance function.

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