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Highlights

TCP Congestion Control

Smart Home Automation System

Security Framework for IOT

Quality of Service in Software

Discovering Thoughts, Inventing Future

VOLUME 18 ISSUE 3 VERSION 1.0

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TCP Congestion Control: A Contributing Factor to Congestion in Long-Term Evolution Networks

By Damilola Fowora, Oludele Awodele, Olakunle Olayinka & Oyebode Aduragbemi
Babcock University

Abstract- Long-Term Evolution (LTE) has evolved the field of data transmission, bringing about the era of 4th Generation Networks capable of providing broadband speeds to mobile users based on the development experienced in the field of data transmission. There has been a sporadic increase in the utilization of Long-Term Evolution (LTE) networks, due to the ever-growing utilization of network links and network services, certain issues begin to rise, one of such issues is the problem of congestion. The more utilized a network becomes, the more vulnerable it is to congestion. Data networks become congested when network cannot keep up with the growing demand for the networks resources. Transmission Control Protocol (TCP) is the most used protocol today, and its application in Long-Term Evolution networks is analysed. This work show that TCP contributed to congestion in Long-Term Evolution networks.

GJCST-E Classification: C.2.5

TCPCONGESTIONCONTROLACONTRIBUTINGFACTORTOCONGESTIONINLONGTERMEVOLUTIONNETWORKS

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TCP Congestion Control: A Contributing Factor to Congestion in Long-Term Evolution Networks

Damilola Fowora [α], Oludele Awodele [σ], Olakunle Olayinka [ρ] & Oyebode Aduragbemi [ω]

Abstract- Long-Term Evolution (LTE) has evolved the field of data transmission, bringing about the era of 4th Generation Networks capable of providing broadband speeds to mobile users based on the development experienced in the field of data transmission. There has been a sporadic increase in the utilization of Long-Term Evolution (LTE) networks, due to the ever-growing utilization of network links and network services, certain issues begin to rise, one of such issues is the problem of congestion. The more utilized a network becomes, the more vulnerable it is to congestion. Data networks become congested when network cannot keep up with the growing demand for the networks resources. Transmission Control Protocol (TCP) is the most used protocol today, and its application in Long-Term Evolution networks is analysed. This work show that TCP contributed to congestion in Long-Term Evolution networks.

I. Introduction

The Internet, created as far back as January 1983, has revolutionized communication, business and also wealth creation (Sagar & Shankar, 2013). The Internet and basically all kinds of networks can be viewed logically as a queue of packets. Packets are unit of data fragments that are constantly being transmitted between nodes, and this is the foundation of all forms of networking. Networks perform the tasks of packet transmission between nodes thereby reducing the number of packets remaining in the queue waiting to be transmitted. The exponential increase of network usage and also network capacity brings up more comprehensive issues which are paramount to the network's overall performance (Alkharashi, 2016).

Broadband services have been made available to mobile users at homes, offices, schools with static equipment such as hubs, switches and also routers providing high-speed data. As at 2007, it was estimated that over 1.8 to 2 billion people will have broadband services by 2012 and over two-thirds of them will be mobile broadband users subscribing to various networks built on the High-Speed Packet Access (HSPA) and Long-Term Evolution (LTE) technology (ERICSSON, 2007). It is estimated that global mobile users will surpass 5 billion by the end of year 2017 (GSMA, 2017), that is more than two-thirds of the world's population, one can only imagine the amount of traffic that will be generated with such great number of users (Internet World Stats, 2017). The Long-Term Evolution technology brings about so many beneficial advantages over previous technologies to both users and the network administrators, these advantages can be categorized into three major points; which are performance and capacity; simplicity and a wide range of terminals (Khalil, 2015).

The problem of congestion has existed far back as the creation of computer networks, it has persisted to modern networks and solutions are far from being absolute. Long-Term Evolution technologies offers high speed broadband services at cheap and efficient rates to users (Sauter, 2011). This technology is built on packet switching which means that data is broken down into packets and these packets are transported via routes to their destinations, due to the dynamic nature of packet switching the packets can follow different routes and on getting to the destination all the packets are gathered and the data is rebuilt from the packets (Willassen, 2003).

Congestion can easily disrupt network process, as a result of heavy traffic on the network packet can be delayed, timed out, contain error and sometimes even be lost. This is a serious problem leaving networks clogged with so much traffic and so little work is done. Although it should be stated that the Transmission Control Protocol (TCP) which is the integral protocol for the transfer of packets between network elements provides some sort of congestion control ensuring that the network is not filled to its capacity with traffic load (Jayakumari & Senthilkumar, 2015), but this method of congestion control is highly on ineffective when it is being applied to Long Term Evolution technology which provides high-speed broadband services due to the design of the protocol (Alkharashi, 2016). TCP favours reliability over performance and is not built to handle huge volumes of data. Thus, TCP congestion control policies tend to be ineffective when being implemented on Long Term Evolution networks.

II. Literature Review

Congestion occurs when the request for packet service is greater than the available resource the network has at that present moment. This leads to the loss of data packets due to the long queues of packets waiting to be transmitted. As computer networks continues in the state of congestion the throughput of the network drops while utilization sky rockets meaning that although the network is heavily utilized, little or no work is done (Khalil, 2015). This is a complex problem

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for network administrators to deal with due to the fact that congestion occurs at the interlink between nodes, the network's gateway and also at routing point. Also, various networks operate with numerous protocols, traffic control schemes and varying equipment. Therefore, looking for a solution to fit all network works is tasking.

Networks in a state of congestion are also in a state of deadlock, new packets entering the networks will create a clogging effect. This is the primary reason for the drop-in network throughput (Mohamed, Sahib, Suryana & Hussin, 2016).

Congestion occurs when the request for packet service is greater than the available resource the network has at that present moment (Ullah, Shahzad, Khurram, & Anwer, 2014). Although congestion can be described as a resource allocation problem, making resources more accessible is not a viable solution. Some of the solutions that has been widely provided include:

1. Congestion is caused by lack of sufficient buffer memory so the solution to this is that memory has to become cheap enough thereby allowing for infinite storage.
2. Slow links between connecting nodes is the cause of congestion. Having high speed connecting links will solve the problem.
3. Having slow processing power will lead to congestion, having high speed processors will solve the problem.

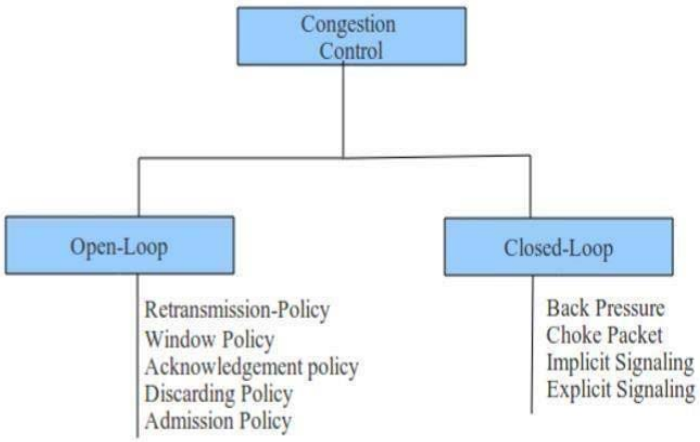
All these solutions listed only provide just a temporary fix to the problem, if they are seen as fact by network administrators it could lead to improper network planning and implementation. On the contrary to all these assumptions, proper network protocol designing and implementation is needed to establish a network to combat congestion. Hence, by implementing any of these assumptions above, would reduce the overall throughput and also reduce performance thereby adding more congestion to the network system (Amoroso, 2009).

Infinite buffer storage although not a bad idea cannot offer a total solution to the problem, it gives just a temporal solution which will not last for long. Although small memory buffers when faced with too much traffic suffer from buffer overflow and loss of packets but if we are to have infinite butter storage during heavy traffic would result in long queues of packets, delays and so on. Finally, when packets leave the queue, so much time would have passed and these packets would time out (Floyd & Fall, 1999).

Also, having high speed links between nodes will not make much difference to solve the problem of congestion, at the time when the Internet began, the speed for nodes and workstation available as at the time was not more than 300 bits per seconds (300b/s). Gradually with increase in technology speeds of up to 1.5 megabits per seconds (1.5Mb/s) was attainable with the introduction of Local Area Networks (LANs) and also Ethernet speeds of about 10 megabits per seconds (10Mb/s) was possible (Jain, 1990) (Mohamed, Sahib, Suryana, & Hussin., 2016). It was at this point in history the issue of congestion started to gain recognition due to a mismatch such that fast-high speed LANs were connected via slow links and slow nodes that cannot keep up to the speed of these links. Today, when it come to the speed of data or Internet connections we can have speeds up to Gigabits or even Terabits but the issue of congestion still persists. Therefore, having high speed links is not the solution. Also, the same can be taught of for slow processors, having high speed processors can lead to a mismatch.

a) TCP Congestion Control

Congestion Control is a network layer problem that is concerned with how the network responds to situations where we have huge amounts of data packets in the network than can be sent, this causes a clogging effect in the network. Congestion control is different from other issues such as Flow Control, Flow Control is a data link layer issue and also it is concerned with just one sender overloading the network with packets (Moses, 2010). Congestion Control refer to the specific means and methods that have been adopted over time to control the effect congestion possess to various networks (Ramb, 2011). Congestion Control mechanisms can broadly be divided into 2 main Categories: Open-Loop Congestion Control which provides ways and procedures for the prevention of congestion and Closed-Loop Congestion Control which provides ways of the removal of congestion completely from a network.



Source: Ramb, 2011

Figure 1: The 2 main categories of congestion control

Over the years several techniques, algorithms and methods has been developed and also proposed for Congestion Control, these section gives an overview of some of the them (Jiao, Gao, Yang, Xia, & Zhu, 2014).

The Transmission Control Protocol employs a congestion avoidance algorithm which includes various schemes such as:

1. *Additive Increase/Multiplicative Decrease*: This is a feedback congestion control algorithm with is known for its deployment in TCP congestion control. It brings together the linear increase of the congestion widow coupled with the reduction as soon as congestion takes place. The algorithm increases the transmission rate also know has the congestion window size while examining for usable bandwidth. When congestion is detected in the network, the transmitting node decreases the rate of transmission by a multiplicative factor thereby reducing the congestion window.

Understanding this mathematically, let's assume $w(t)$ is the congestion window size i.e. the sending rate during a time slot t, a *(where* $a > 0$*)* is the additive increase parameter and b *(where* $0<b<1$*)* be the multiplicative decrease factor, Therefore,

$$w(t+1) = \begin{cases} w(t) + a & \text{if congestion is not detected} \\ w(t) \times b & \text{if congestion is detected} \end{cases}$$

2. *Slow Start:* This is also part of the congestion control strategy adopted by TCP, as we know Transmission Control Protocol is the mostly used protocol by most devices and application on the Internet. Slow start is employed together with other algorithms to avoid the transmission of huge data packets that surpasses the network threshold. These can help avoid having to deal with a congested network.

In other to avoid having a congestive collapse, TCP employs a multi-faceted congestion control policy, for every connection, TCP maintains a fixed window size thereby limiting the total number of packets which will be unacknowledged (Shahzad, et al., 2015). TCP also uses the slow start algorithm to increase the congestion window size after the initialization of a connection. TCP favours reliability over performance and is not built to handle huge volumes of data. Thus, TCP congestion control policies tend to be ineffective when being implemented on Long Term Evolution Networks. Long Term Evolution Networks provide high-speed broadband services and this huge demand for data services makes the use of TCP Congestion Control to fall short of performance and increase the overall network load (Pawar & Pawar, 2012).

III. TCP Simulation Results in Long-Term Evolution Network Environment

A Long-Term Evolution Network environment was created using the NS-2 installed on a Linux Operating System. The network comprised of 3 eNodeBs and each of these eNodeBs was be connected to 10 User Equipment, also a Relay Node was added in other to make the simulation appear as realistic as possible. A packet size of about 1500 Bytes was used with a simulation time of 100 seconds. The TCP protocols employed were TCP Reno and SCTP.

The link parameters employed for the Long-Term Evolution network environment includes allocating 100 megabits per second of bandwidth to the server with a delay of 100 micro-second and also have 2 routers with bandwidth of 1 gigabits per second with a

delay of 3 micro-second each. The 3 eNodeBs would have a bandwidth of 1 gigabits per second and a delay of 3 micro second and the same parameter was used for the relay node.

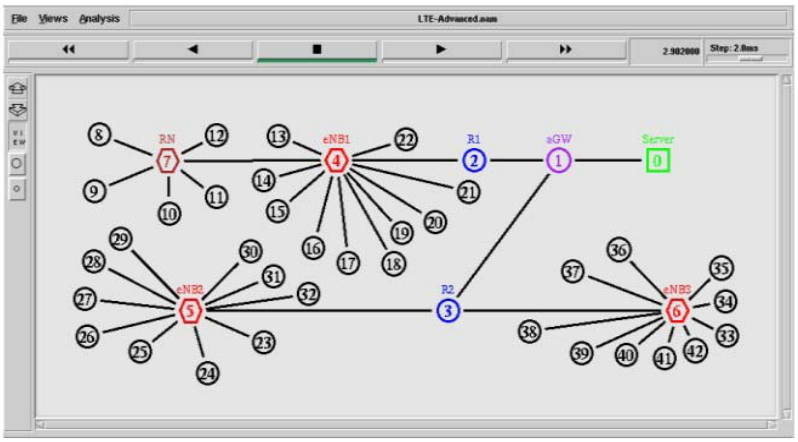


Figure 2: View of the Simulated Long-Term Evolution Network Environment

Figure 2 shows the real-time simulation of the Long-Term Evolution network environment. The green node in the Figure 2 represents the server, which symbolizes the Packet Data Network (PDN) aspect of the network and it is directly connected to the gateway. The two routers are connected to the gateway with a bandwidth of 1 gigabits per second and all the eNodeBs are connected to it in order to gain access to the server and this represents the Evolved UMTS Terrestrial Radio Access Network (E-UTRAN) segment of the network. Also, there are various User Equipment connected via the air interface to the eNodeBs.

The results obtained from the Long-Term Evolution network environment simulation gives a general overview of network operations.

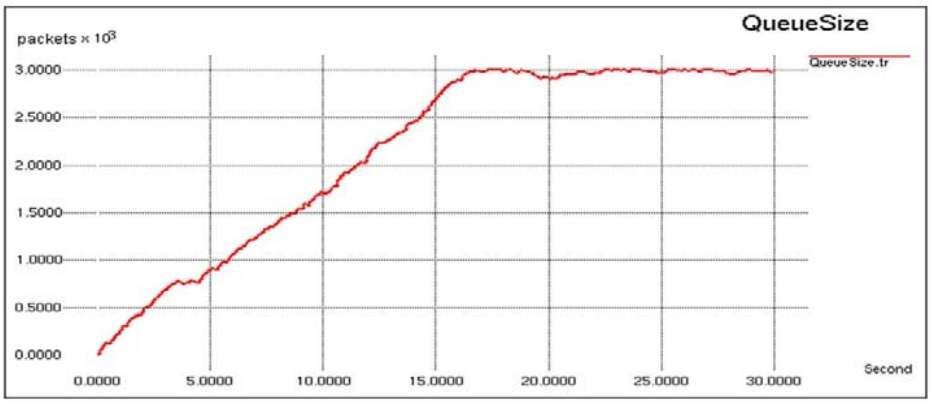


Figure 3: Queue Size against time of TCP Reno over Long-Term Evolution network

Figure 3 shows how the queues size increases over time in the Long-Term Evolution network environment. It can be seen that over time more packets are added to the queue and if these packets are not attended to, they tend to build up and become so much that it will leads to packet loss.

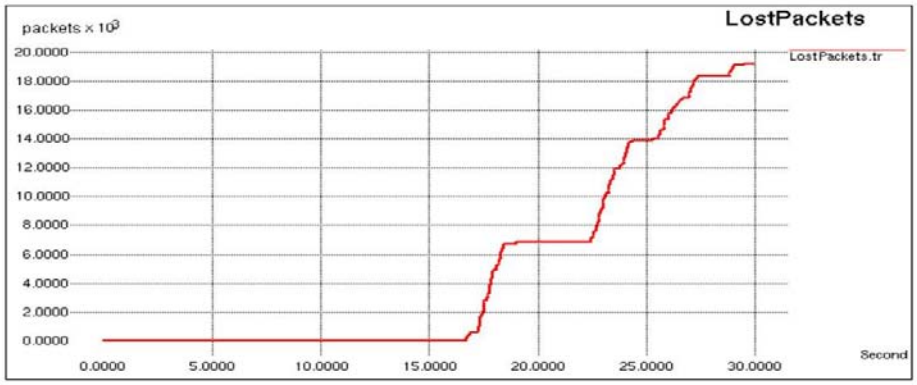


Figure 4: Lost Packets versus time of TCP Reno over Long-Term Evolution network

Figure 4 shows the effect of packets queuing up, as these packets queue up it leads to some of these packets being lost. As shown from the simulations as packets and data traffic increases over time the queue size would increase leading to packets being lost and congestion is created within the network.

IV. Performance Evaluation of TCP in Long-Term Evolution Simulated Network Environment

The simulated Long-Term Evolution network which uses the traditional Long-Term Evolution network architecture was evaluated using the following metrics: Throughput, Average End-to-End Delay, Network Utilization and Packet Delivery Ratio. These metrics show how effective the model is and how it is affected by congestion.

1. *Throughput:* This refers to the total amount of packets that is successfully transmitted to the destination network element from the source network element. The network throughput is measured in bits per second.

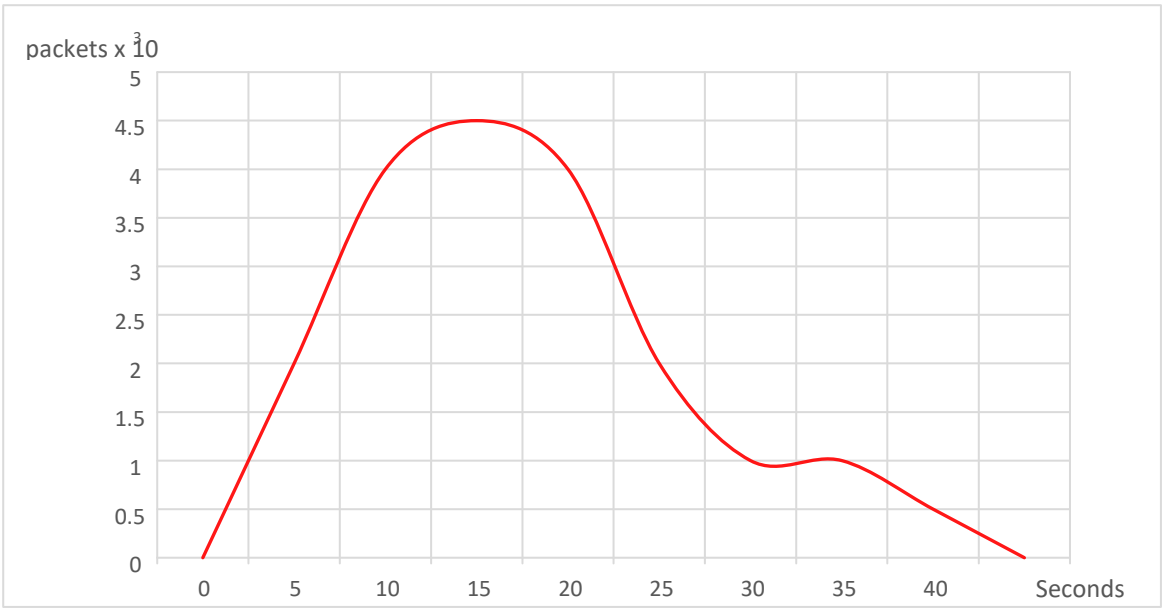


Figure 5: Throughput Analysis of Simulated Long-Term Evolution Network Environment

Figure 5 shows how throughput is affected in the Long-Term Evolution network. From the result obtained, it can be seen that as traffic increases over time, a pick level of throughput is reached after which throughput starts to decline. If this goes unchecked it can lead to a situation where no reasonable work can be done on the network. At the stage the network is said to be in a stage of congestive collapse. Figure 5 shows how congestive collapse is reached when traffic and the requests of data packets gets so high that the network itself cannot handle the incoming traffic.

2. *Average End-to-End Delay:* This refers to the amount of time spent from the creation of data packets to the time it is delivered to the destination network element. This performance metric is automatically increased when the rate of re-routing in a network is increased.

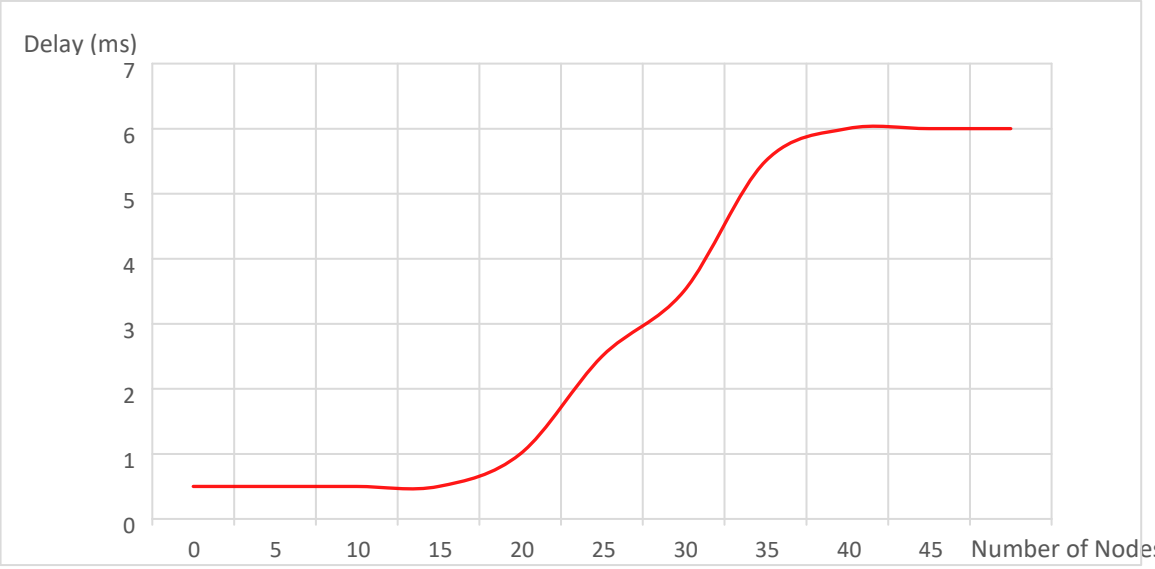


Figure 6: Average End-to-End Delay Analysis of Simulated Long-Term Evolution Network Environment

Figure 6 shows how the average end-to-end delay is affected by congestion. As shown in Figure 3, the Long-Term Evolution simulated network environment has loads of packets in the queue waiting to processed. The queue increases as shown in Figure 3, the average time spent for a packet to move from source to destination increases as shown in Figure 6.

3. *Network Utilization:* This refers to the ratio of the current traffic being experienced in the network to the maximum traffic that can be handled by the traffic. It shows the state of the network whether it is in a busy, normal or idle state.

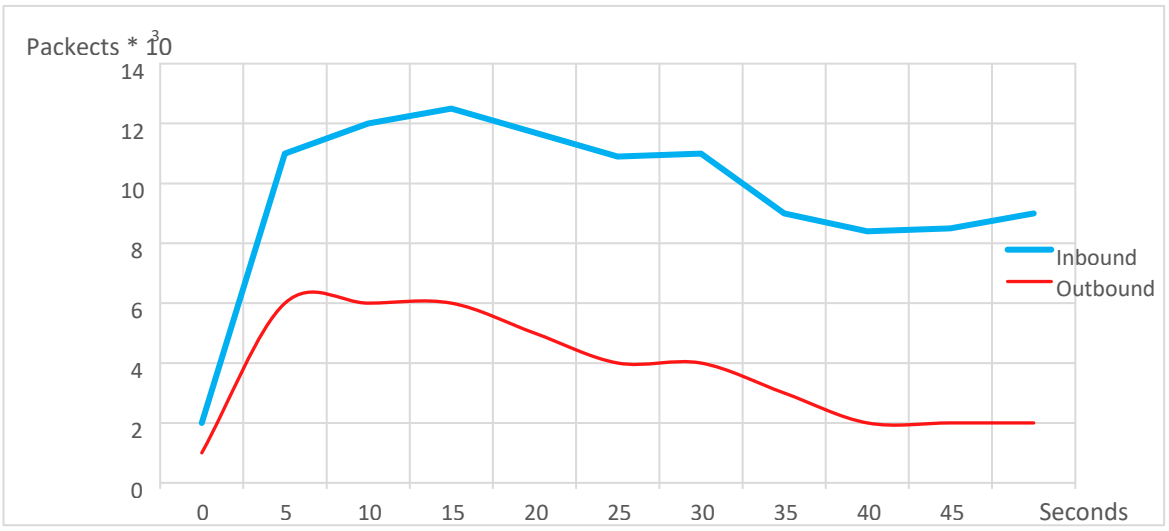


Figure 7: Network Utilization Analysis of Simulated Long-Term Evolution Network Environment

Figure 7 shows both inbound and outbound network utilization gotten from the network simulations Long-Term Evolution Network. The Figure 7 shows a massive difference between inbound and outbound traffic. The inbound traffic will keep piling up and will not be processed because the network is taking so much traffic and it cannot process it all.

4. *Packet Delivery Ratio:* This refers to the ration of data packets which are received successfully at the destination node to the total amount of packet sent.

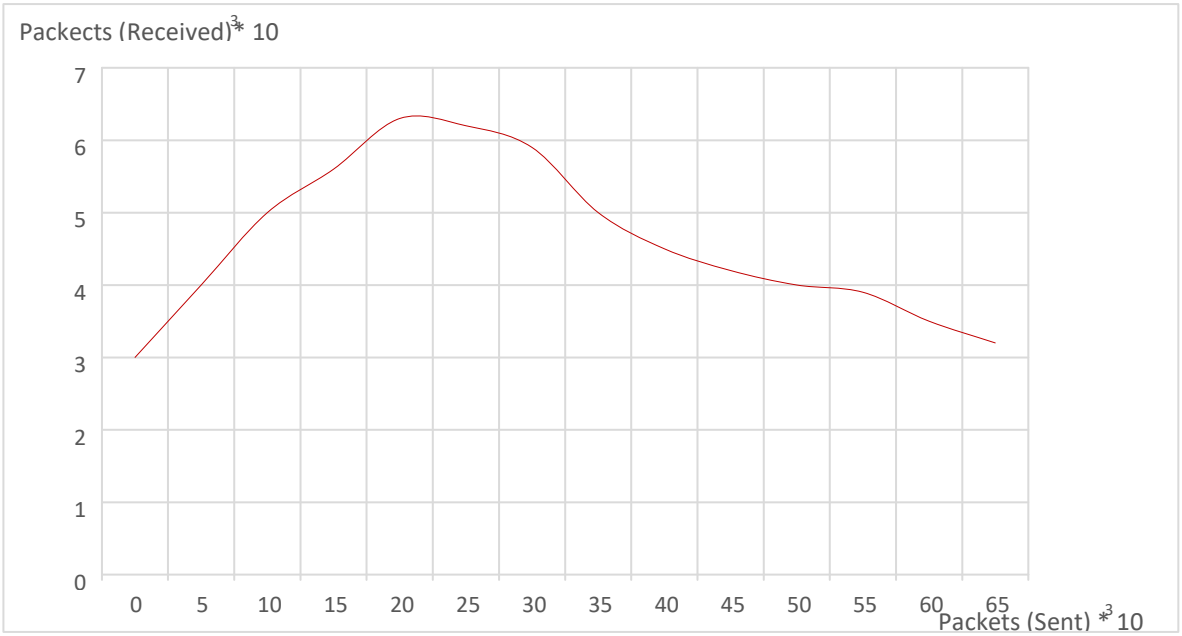


Figure 8: Packet Delivery Ratio Analysis of Simulated Long-Term Evolution Network Environment

Figure 8 shows how the Packet Delivery Ratio in Long-Term Evolution Networks is affected by congestion. As traffic increases the packet delivery ratio drops, it shows that the network cannot keep up with the inflow of packets coming into the network and therefore the time taken for packets to be delivered to the destination node is significantly high.

V. Conclusion and Recommendations for Further Studies

Today the Internet is very much built on TCP and its application in Long-Term Evolution Networks shows how ineffective it can be. We have been able to show from the simulation results that TCP is a contributing factor to congestion in Long Term Evolution networks and this can pose a huge problem if it is continued to be deployed on Long Term Evolution networks. Further studies should be carried out to look for methods to solve this problem.

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A Security Framework for IOT based Smart Home Automation System

By Nazmul Hossain, Md. Alam Hossain, Rafia Sultana & Farzana Akter Lima
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Abstract- The Internet of Things (IoT) is a new platform for our technology. Though of IOT, we can control our daily life work such as home application, control, and easy communication systems, improve our digital services, etc. The Internet of Things (IoT) is joining our daily contents information wisely to the internet to make communication between objects and people and among themselves. In this paper, we show improved home automation with the help of IoT. For calculating response time of IoT, we need fog computing platform. Fog computing is also known as fogging or edge computing which is built by Cisco and it is extended the version of cloud computing through a network.

In our proposed system, we use the motion sensor, SBC-PT which is a network access component and daily life component in a home. We can monitor and control that equipment by the approach of IOT based system. The home automation system uses the portable devices as a user interface. They can connect with home automation network through an internet approach. The user will move straightly with the system via control interface whereas home apparatus is remotely controlled through sensor and server.

Keywords: *IOT, home automation, smart home, response time, control system.*

GJCST-E Classification: *I.2.1*

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Nazmul Hossain [α], Md. Alam Hossain [σ], Rafia Sultana [ρ] & Farzana Akter Lima [ω]

Abstract- The Internet of Things (IoT) is a new platform for our technology. Though of IOT, we can control our daily life work such as home application, control, and easy communication systems, improve our digital services, etc. The Internet of Things (IoT) is joining our daily contents information wisely to the internet to make communication between objects and people and among themselves. In this paper, we show improved home automation with the help of IoT. For calculating response time of IoT, we need fog computing platform. Fog computing is also known as fogging or edge computing which is built by Cisco and it is extended the version of cloud computing through a network.

In our proposed system, we use the motion sensor, SBC-PT which is a network access component and daily life component in a home. We can monitor and control that equipment by the approach of IOT based system. The home automation system uses the portable devices as a user interface. They can connect with home automation network through an internet approach. The user will move straightly with the system via control interface whereas home apparatus is remotely controlled through sensor and server. The home automation system has an additional property that enhances the facet of defense from unauthorized accidents. The communication with the server consents the user to pick out the receivable device. This design proposed an efficient control of home automation system.

Keywords: IOT, home automation, smart home, response time, control system.

I. Introduction

Home automation also known as an intellectual home system. Numerous people often and often shift from one place to another for their business purpose, personal work, traveling, etc. [1]. So that kind of people leaves their home without checking their household component. That's why they need to exhort and control their things. In this situation, we needed smart home automation. Intellectual home system makes with a network, monitoring instrument and home ingredients [2].

In modern time we use this system for controlling our home automatically. This system raises the alleviation of our home equipment. Equipment that we use in our system is light, door, fan, window, motion detector, webcam, lawn sprinkler, etc. [3]. If the system built in the home, we will control the home things virtually. For controlling the system, we need not to present physically at home.

To implement a smart home system, we need to control centrally. To save the information centrally, we employ fog computing in exchange for cloud computing. Fog computing minimizes the bandwidth and low latency, because cloud computing is not stable for numerous IOT use [4]. Though this computing system, we can easily connect between sensors and IoT device.

In this paper, we proposed an approach to improve home automation system. At first, we discuss IOT, then our proposed system through Cisco and why we use home automation. Finally, we discuss the goals of our works.

a) *Benefits of Home Automation System*

- Monitoring and ruling all home devices from one space.
- Progressed home security.
- Improved energy efficiency.
- Save time.
- Save money and utilizes suitability.
- Remote control of home objects.
- Ease to use components of a home.
- Prick detection, CO and smoke detectors.
- Governing house peoples activities.
- After all increasing peace of mind.

II. IoT Based Home Automation

IoT means a world-wide network of interconnected things that are incomparable. An advanced network of IoT is being created, when a public wants to associate with different objects. IoTs terminology is applied for the enhancement of intelligent houses to increase the surviving formats of life [5]. It proposed leading connectivity among services, apparatus, and systems. It uniquely identifies not only attached computing system but also internally handle existing internet architecture [6]. It gives us strong-level facility at the communication and knowledge.

There are three main natures in IoT ecosystems: consumers, governments, and businesses purposes [7]. IoT platforms act as the bridge between the devices, sensors and the data networks. IoT safety and privacy have become the major worry among consumers and businesses [8].

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a) Some Advantages of IoT

- Sensor-guided decision analytics.
- Method optimization.
- Momentary control and feedback of difficult autonomous process.
- Real-time calculation of a system.
- Lessened errors in gathering data.
- Reduced cost.
- Raised situational conscious.
- Originate workable systems.
- Saving time.
- Control and automation of any system.
- Cost-reducing and power expense.
- Easy to communicate with our daily life things.

The fact is that the IoT permits for virtually bondless advantages and connections to accept the position. Most of us can't even imagine and understand the impact of today's issues. Security is a major challenge that is again and again brought up. We have the missions of security and data sharing. IoT is a hot-button matter withal today, so one can barely think how the speech and anxiety will step by step increasing when people are discussing billions of devices being appended [9].

Home automation is made of one or spare computers to manage basic home activities and form deliberately and sometimes remotely [10]. An automated home is also called an intellectual home. For connecting home objects through the internet, we need a platform that is known as Internet of Things (IoT) [11]. We use IoT because it provides our surrounding objects to append Internet easily. IoT devices that are peer to the Internet will more than triple in 2020.

b) Future of IoT

- In the next five years almost 6 trillion IoT's objects connected to the Internet.
- Businesses will be the bearer of IoT solutions cause of IoT's behavior and those are cheaper operating costs, raising productivity and prolong to current markets or spread new manufacture oblation.
- The complicated infrastructure of the Internet of Things exuded into individual ecosystem.
- The profuse extensive staving to the benefits and drawbacks of fake cellular and internet networks.
- The major role of analytics processes, along edge analytics, cloud analytics, fog analytics will perform in building the most of IoT sending.
- The skate privacy challenges submitted by the IoT and that defeated.
- Upcoming IoT's infrastructures are connectivity, security, data storage, system integration, device hardware, and application development.
- In-complex analysis the IOT ecosystem will alternative and in several industries.

III. Background and Related Work

The smart house was concepts, not real form. Though home materials were not suspect as smart in the early twentieth century (1901-1920). The first engine-power vacuum cleaner invented in 1901, and the electricity-power vacuum invented in 1907. The ECHO 4 was the fundamental smart machine, but it was not vending in the market in the year of 1966-1967. In the year of 1990s, this home automation department reached some new experiment and processing. Smart house become exoteric in the early century 2000s, and various terms began to arise [12]. Suddenly in this century, smart homes ripen affordable choice for people [13]. Now we can control home by a remote server or any wireless component such as a laptop, Wi-Fi, mobile phone, tabs, sensing from any sensor [14].

To implement the automation system of functionality and comfortably, we designed a standalone, liberal, melodious and cheap cost home monitoring and controlling system using sensor service. This work is implemented to retire the troubles of existing methods. It bears much resilience, consolation potentiality and security.

This paper proposes a smart home automation system that services the segregation of objects that connected through the motion sensor, fog computing, server and switch connection among things. This system uses a laptop to monitor the home components. The main object of this paper is to operate household components by sensing the motion sensor. When the sensor detects motion, then those components are automatically turned ON/OFF. We can also turn ON/OFF that objects through server if we want. This system is useful from other systems, because when the motion sensor is sensing objects in that time, they are instinctively changed their state. After a lag time sensing, components go back to their previous state. This process happens back and forth.

IV. Proposed System Framework

a) System Description

Signal Board Computers (SBC-PT) is one kind of network access component. In that component, we will connect motion sensor and others household objects like as door, fan, light, window, etc. Sensors are necessary to gain real-time data from things. These sensors rapidly create a huge volume of data. The main thing is to make a home automation system based on the Internet of Things idea composed of a main controlling instrument and all objects connected to the sensors. In SBC board we will describe the system configuration for detecting the motion sensor. While a man enters in the automated room, a motion creates in this stage, so the sensor is alarmed for obtaining products activation. When it finds out any motion, then automatically all the objects turned ON/OFF. Whereas

the sensor will rotate ON it shows high input after finishing its delay (1000ms) time it naturally closed OFF. This process happened continuously until motion object present in the existing home.

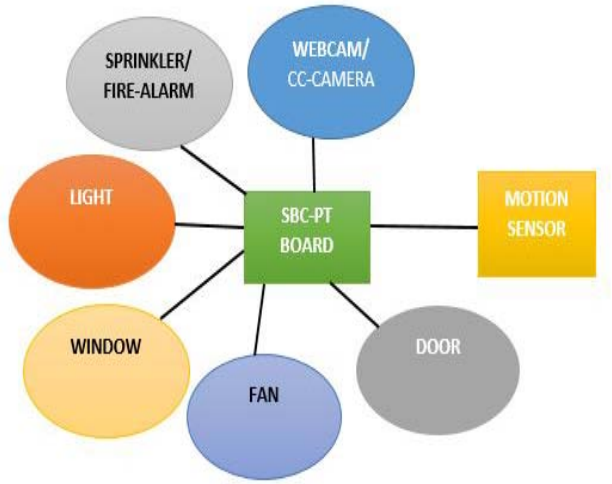

Fig. 1: Proposed System Framework.

When sensor finds out any motion then automatically all the objects turned ON/OFF. Whereas the sensor will rotate ON it shows high input after finishing its delay (1000ms) time it naturally closed OFF. This process happened continuously until motion object present in the existing home.

b) Proposed System Functions

The proposed home automation system has the abilities to observe the following objects in users home and monitor the following activities:

- Light ON/OFF
- Fan ON/OFF
- Door ON/OFF
- Window ON/OFF
- Webcam/CC-Camera ON/OFF
- Fire-Alarm/Sprinkler ON/OFF

The goal of the proposed work is not to formless costly objects such as high-end own computers. This scheme allows approved hose masters to control and monitor associated instruments at home. The smart home must complete essential condition, processed data and consoling equipment to create a better home automation system.

V. Analysis of Proposed Framework

a) Software Design

For implementing the proposed system in virtually here, we will use Cisco Packet Tracer. It is very helpful to design IoT components. Here we use Server-PT, Switch-2960, Laptop-PT, SBC-PT, Motion Sensor and other IoT components. Steps that we will do in the simulation are:

- First, we connect server, laptop, and several IoT objects through Copper Straight cable.
- Setup server IP address for accessing the components.
- For controlling devices through laptop also need to configure laptop's IP address.
- Then we configure all IoT components uniquely.
- For Signing up to the web browser, we set a username and password. This password is used for login into the server access.
- When we go to the web page for login to the remote server, then put server IP address into the URL box, and next ask to input username and password. If we input correct information, then login to the server.
- Next turn on the Registration server.
- Connect all components to the Registration Server.
- For SBC-PT connection we use IoT Custom Cable.
- Finally, we will join our proposed system with the server simulation.
- For connecting to the Registration Server, we go to the IoT accessories configuration then turn on the Remote Server option and put Registration Server's IP address, username, and password. Do that process for all IoT components.
- If we want to control home automation things through remote laptop, then put IP address, username, and password for turn ON/OFF the objects.

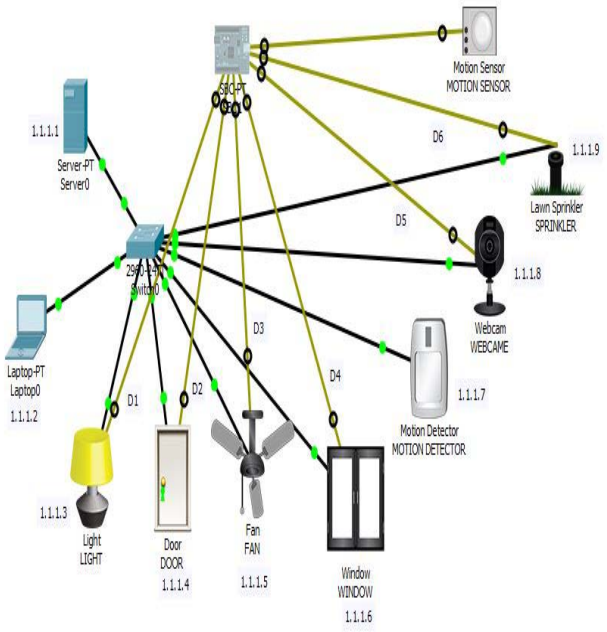

Fig. 2: Software Implementation of Proposed System.

b) Security Issues

When motion detected, it will process its work. But its sometimes create a problem because when any unwanted people such as thief, abductor, robber enter the room then its hamper our actual action. So that we need to, trace out home living people. For that, we

invent a way to discover original living people [15]. In this purpose to identify wanted people, we will use Eye Retina Scan. It is feasible because no two people have the similar retinal pattern. Exceptionally it has low negative effect rates for detecting [16].

It recognizes the objects very quickly. While any staying people enter the room, the home automation system first configure with unique patterns of a person's retina blood vessel. It releases a stealthy beam of low-energy infrared light into a person's eye. So when retina scan matched successfully to the sensor and gave positive output, then the motion sensor start its process to serve to the user requirements. This method provides a high-security system for our home automation actions. Here a flow chart for our proposed design:

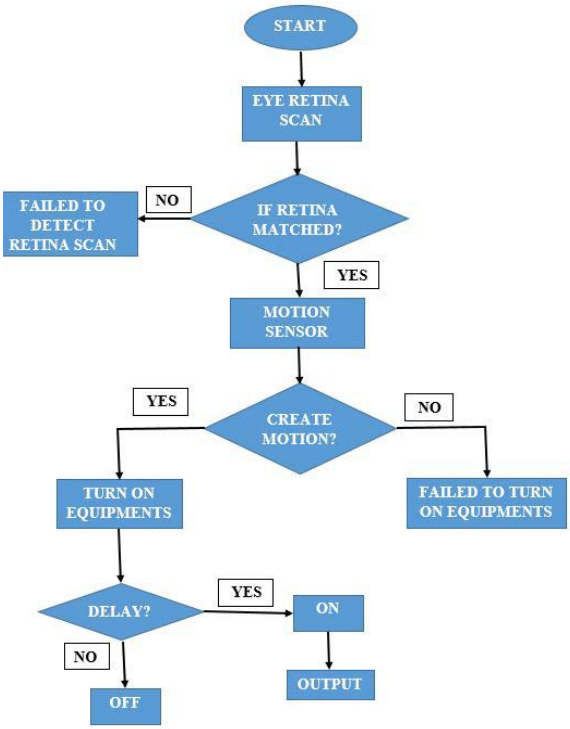

Fig. 3: Flow Chart of System Design.

c) Future Work

In the 21st century, the communication among social and computer is splitting aged obstacle and starting a new kingdom [17]. Nowadays mobile phone or computer is an important part of our modern life. Mobile phone or computer is not only a material for communication but also tries to give us better control for automated home [18]. There are some existing home automation systems which are built with real instruments of our house. This equipment is monitored through switches. The engine is switched ON/OFF manually when it is necessary. The existing method is not highly protected and misuse of electricity. The proposed system is better and more secure than the existing system. And the system is also imagined networking in our mobile phone to all the things through smart technology [19]. In the proposed system, all the house appliances could be monitored by the owner from a remote area with the favor of user's mobile phone or computer through a network.

VI. Result

In this paper, the implemented system's that is connect all the devices with the sensors and the automated home is controlled by the controller. But there is some lacking in the other existing system. The main lacking is in the security portion. The security is a little bit weak in that observed process. In our home automation system, there are huge benefits than the other systems. Our system controls all the instruments of our house through mobile phones or computers. And the control system is simpler than the others. The system we build there is no lacking in security because we improved the security system of our proposed system. Our system is much secure than the others because here we use identical eye retina scan pattern for professed sensor's response which will detect the owner of that home.

VII. Conclusion

The home automation system is one of the most important sectors of the Internet of Things (IoT). In this paper, the home automation using the Internet of Things (IoT) proved that it has been worked favorably by joining simple equipment to it, and the appliances were practically monitored remotely through the internet. As one of the request state in the Internet of Things, the smart house appeals the most effort from the market. The process is preferable for real-time home security controlled and maintaining from fire accidents with quick solution. The system gives us better-secured home and controlled theft issues in our house. The proposed system consult the sensor data like temperature, motion, gas, light sensors, and activates a scheme following the necessity [20]. This process will explore different situation to control the home anytime anywhere. In this process, the sensors can be performed to save data that can examine the process. The modern home system utilizes that the users controlled the central control for all of their materials. In our system, we build a new technology to create an excellent automated home system which is more useful and more secure in our regular advanced life. And the smart house process is monitored with our mobile phones and computers, and it is to handle our busy lifestyle.

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Eye Shaped MIMO Antenna for Ultrawideband Applications

By R. Sambasiva Nayak, Dr, R .P. Singh, Dr. M. Satya Sai Ram, Dr. G.R. Selokar, Dr. Pushpendra Sharma, Dr. Sonal Bharti & Prof. Alka Thakur

Sri Satya Sai University of Technology and Medical Science

Abstract- A totally distinctive MIMO sharp band-notched antenna with high isolation for UWB applications is given. The antenna consists of two antenna elements with an overall space. A shaped stub is extruded among the bottom plane to enhance isolation associated with a shaped stub to introduce band-notched. The designed antenna possesses an occasional mutual coupling over the operative band. The performance of this antenna is studied in terms of isolation between the 2 ports, pattern, efficiency, realized gain, and envelope correlation coefficient.

Keywords: *eye shaped (ES), band-notched, envelope correlation coefficient (ECC), radiation pattern.*

GJCST-E Classification: *C.1.m*

Strictly as per the compliance and regulations of:

Eye Shaped MIMO Antenna for Ultrawideband Applications

R. Sambasiva Nayak [α], Dr, R.P. Singh [σ], Dr. M. Satya Sai Ram [ρ], Dr. G.R. Selokar [ω], Dr. Pushpendra Sharma[¥], Dr. Sonal Bharti[§] & Prof. Alka Thakur[χ]

Abstract- A totally distinctive MIMO sharp band-notched antenna with high isolation for UWB applications is given. The antenna consists of two antenna elements with an overall space. A shaped stub is extruded among the bottom plane to enhance isolation associated with a shaped stub to introduce band-notched. The designed antenna possesses an occasional mutual coupling over the operative band. The performance of this antenna is studied in terms of isolation between the 2 ports, pattern, efficiency, realized gain, and envelope correlation coefficient.

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I. Introduction

MIMO systems transmit an equivalent power using multiple antennas at the transmitter and receiver thereby increasing the data rate while not the requirement} of extra information measure or power. The capability of the MIMO systems suffers because of the stronger mutual coupling between antennas. Therefore, so as to boost the capability of the MIMO systems, a high decoupling between antenna components is needed. Hence, isolation improvement between diverging components is one among the most challenges in MIMO antenna styles. In recent years, varied decoupling structures between similar radiating components appreciate projected grounds, tree-like structures, defected ground structure, rectangular stub are reported. On the opposite hand, varied techniques that are applied to suppress interference at specific frequency have also been developed, appreciate by etching 2 split ring resonator slots on the individual radiators, by inserting 2 thin strips in the ground plane. On top of reported antennas have advanced structures and also the overall dimensions of those antennas are larger than the projected antenna.

In this Letter, a compact style of MIMO band-notched antenna for UWB applications is given. The designed antenna incorporates a very easy structure with a compact size of eighteen × thirty-six mm2. The projected antenna has smaller size and high isolation compared with the on top of reported papers. The performance of this antenna each by simulation and experiment indicates that the projected MIMO antenna has smart electrical phenomenon matching, low mutual coupling, and smart diversity performance, throughout the UWB with a band-notched characteristic.

II. Antenna Configurations

The projected MIMO antenna invented on the FR4 stuff substrate. The general compact size of the projected antenna is simply 0.18λ0 × 0.36λ0 wherever λ0 is that the free-space wavelength at the specified initial resonant frequency of 3.0 GHz. The eye-shape slotted circular radiator almost like is adopted as an associate elementary radiator of the projected MIMO antenna. The divergent component consists of a circular formed monopole radiator with a radius of 4.4 millimeters from that an eye fixed formed slot is eliminated to realize an improved electrical phenomenon information measure. A fifty Ω microstrip-feed line of size is connected at the lower edges of every radiator. To maintain the compactness of the designed antenna 2 divergent components share same rectangular ground plane of size i.e. is found at a lower place the divergent components. During this little size antenna, the ground plane can act as a neighbourhood of radiator itself. At this stage, a powerful mutual coupling between 2 components exists because of ground surface current and close to field region. Moreover, to attain better isolation between the 2 radiators, a ground plane is changed by extruding a formed stub shaped by the horizontal strip of size and a vertical strip of size (Lg2 × Wg2). Because of that, the distribution of surface current in ground plane changes associated results in an increment within the isolation. To validate the projected antenna, simulations were applied mistreatment the computer simulation technology Microwave Studio.

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The current distribution on the antenna surface is illustrated in Figure. 1 at the notched frequency, with and while not the formed strips once port one is worked up and port 2 is terminated. Figure.1a illustrates that the sturdy surface current happens at feeding strip and radiating component at port 1. Using the formed strips, Figure. 1b reveals that strong maxima of current occur to the formed strip, left portion of formed ground and radiating component at port 1. Therefore making a deep band notch.

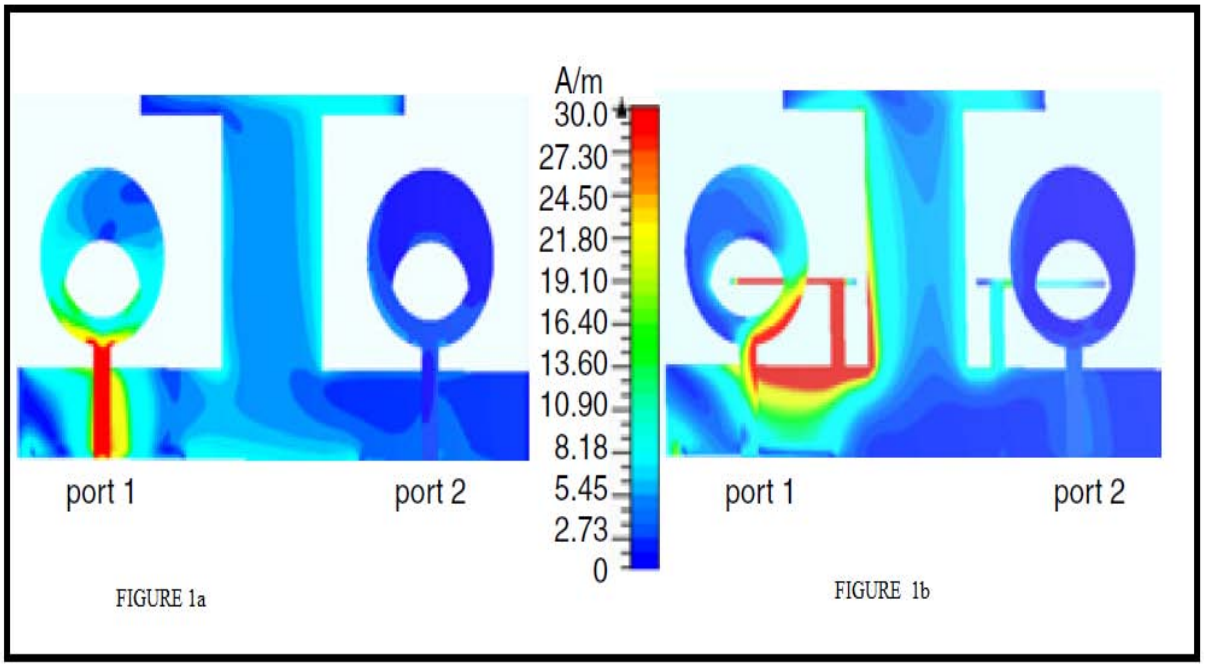

Figure 1: a. Without formed strip b. With formed strip

III. Results

The projected antenna was fabricated with the MITS-Eleven research laboratory PCB machine. Then to validate the simulation results, the antenna parameters were measured by an Agilent N5230A vector network instrument. The S-parameters were measured and also the obtained results along with the simulated results are shown in Figure. 2. The simulated and measured electrical phenomenon information measure of MIMO antenna with associate degree isolation between 2 antenna components is healthier than −20 decibel for the complete UWB vary with band-notched characteristics at C-band. The measured and simulated S11 and S21 are similar to the S22 and S12. The measured results are in smart agreement with simulated results.

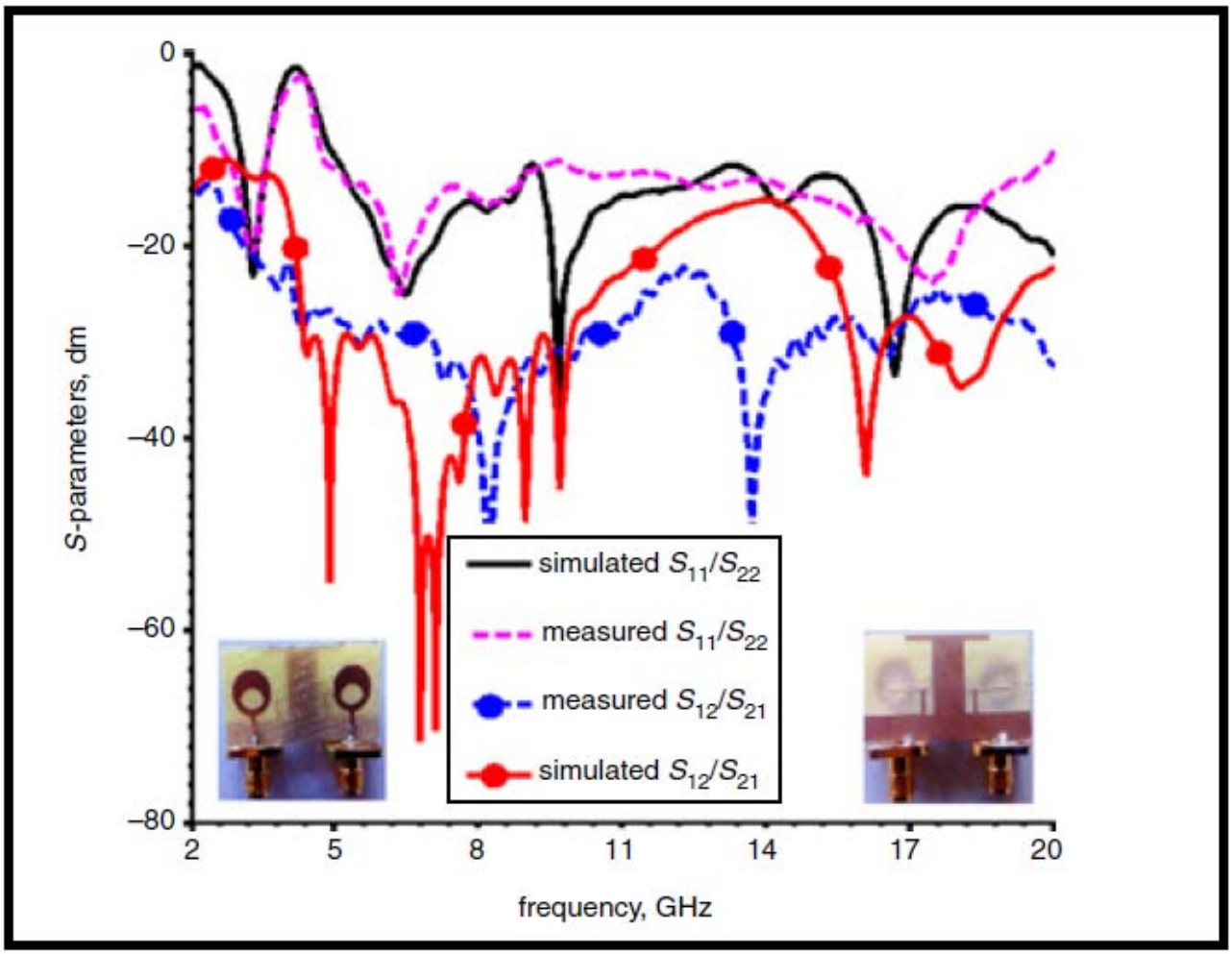

Figure 2: Projected MIMO band-notched antenna

The second radiation patterns for the projected MIMO antenna, in the xz, the yz and also the xy planes are represented in Figure. 3. it's seen from Figure.3 that the antenna shows unstable Pattern whereas at the alternative operative frequency it's sort of a monopole antenna pattern. At higher frequencies, the radiation is due to the higher-order modes which are responsible for a splitting of the radiation lobe.

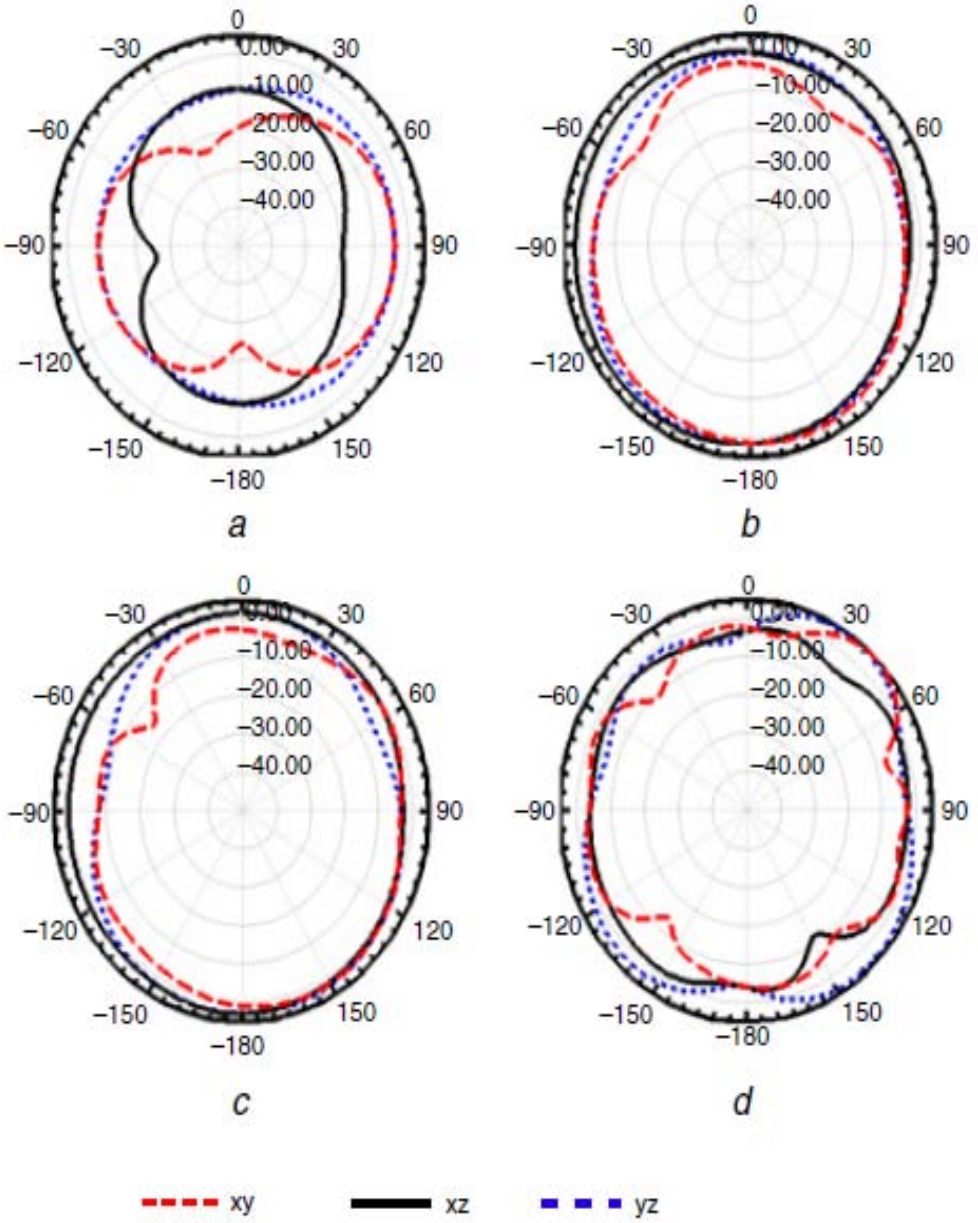

Figure 3: RP for projected MIMO antenna

To verify the potential of the projected antenna for MIMO application, it's necessary to realize an occasional ECC. The ECC may be alive that describes what quantity the communication channels are isolated or related to with one another. The ECC may be evaluated using S-parameters.

However, the ECC thought to be ideally zero but the smart limit for associate unrelated diversity antenna is ECC}. The ECC of the Projected UWB MIMO/diversity antenna calculated using S-parameter. It's seen that ECC and DG using S-parameters. At the notched frequencies, the ECC will increase and DG decreases for sure for the notch Operate. The whole efficiency, multiplexing efficiency and gain of the projected MIMO UWB antenna. It's Determined that the efficiency of the antennas stay nearly identical. The multiplexing efficiency} defines as the ratio of the desired SNR between the imperfect MIMO antenna and also the ideal antenna. it may be observed that the multiplexing efficiency is sort of the typical worth of the one port efficiencies shown by the 2 ports because of the low correlation and equal efficiencies. The gain of the MIMO antenna varies from 1.6 to 6 dB.

IV. Conclusions

We've got projected increased information measure, compact, MIMO antenna with band-notched characteristics for contemporary wireless UWB applications. The projected MIMO antenna offers an electrical phenomenon bandwidth with smart a decent electrical phenomenon matching and good isolation over the band with band-notched at C-band.

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Quality of Service in Software Defined Networking

By Md. Alam Hossain, Mohammad Nowsin Amin Sheikh, Monishanker Halder, Sujan Biswas & Md. Ariful Islam Arman
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Abstract- Software Defined Networking (SDN) promises to provide a powerful way to introduce Quality of Service (QoS) concepts in today's communication networks. In SDN the behavior and the functionality of the network devices is programmatically modified using a single high-level program. Software Defined Networking (SDN) instantiation OpenFlow is designed according to these properties. The realization of the Quality of Service (QoS) concepts becomes understandable with SDN in a convenient way. This paper focuses on the existing architectures parameters such as response time, switch capacity and bandwidth isolation and we evaluate these parameters here. Although concepts of QoS are well researched, it is hard to understand that due to high implementation complexity and realization costs. OpenFlow as the best-known SDN standard so far defines a standard protocol for network control. These observations of switch variety may provide SDN application developer's insights when realizing QoS concepts in an SDN-based network.

Keywords: *SDN, QoS, ROIA, NOX, ForCES, MPLSTE, RSVP, FE, CE, HTB, SFQ, RED, QoS.*

GJCST-E Classification: *C.2.m*

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Quality of Service in Software Defined Networking

Md. Alam Hossain [α], Mohammad Nowsin Amin Sheikh [σ], Monishanker Halder [ρ], Sujan Biswas [ω] & Md. Ariful Islam Arman[¥]

Abstract- Software Defined Networking (SDN) promises to provide a powerful way to introduce Quality of Service (QoS) concepts in today's communication networks. In SDN the behavior and the functionality of the network devices is programmatically modified using a single high-level program. Software Defined Networking (SDN) instantiation OpenFlow is designed according to these properties. The realization of the Quality of Service (QoS) concepts becomes understandable with SDN in a convenient way. This paper focuses on the existing architectures parameters such as response time, switch capacity and bandwidth isolation and we evaluate these parameters here. Although concepts of QoS are well researched, it is hard to understand that due to high implementation complexity and realization costs. OpenFlow as the best-known SDN standard so far defines a standard protocol for network control. These observations of switch variety may provide SDN application developer's insights when realizing QoS concepts in an SDN-based network.

Keywords: SDN, QoS, ROIA, NOX, ForCES, MPLSTE, RSVP, FE, CE, HTB, SFQ, RED, QoS.

I. Introduction

SDN provides network functionality and also the behavior of network devices. The data-plane is forward through the network, such as packets and the hardware that is used to forward it, such as, switches. The control-plane represents all logic and devices that are responsible for deciding how and to where data in the data-plane is to be sent. In SDN, network operator can manage networking elements by running software on an external server. We can easily understand SDN against traditional network by a simple example, suppose if we want to deliver a packet in the network it has to change its route multiple times for finding the optimal path. But in SDN it automatically traces the entire possible and shortest route for delivering the packets. By separating the control plane from data plane in SDN, some controller increased its flexibility in deploying new services (e.g., virtual private network, cloud computing), programmability in open API, reliability in converged IP network. In few controllers installing control software remotely from forwarding element reduces the complexity of the forwarding element but increases the dependability of the network.

Real-time Online Interactive Applications (ROIA) is connecting high numbers of user applications such as multiplayer online games, simulation base e-learning etc. In ROIA the reaction of user happens virtually and immediately. ROIA provides High Quality of Service on underlying network. Resource Reservation Protocol (RSVP) is one kind of traditional technique for controlling QoS for reserving network bandwidth. It is mainly static by nature and not suitable for changing demands of ROIA dynamically. There is a problem for SDN is to design the Northbound API. It defines the communication between the controller and high-level program [1].

Packet scheduling is essential for entire supporting applications on Software-Defined Networking (SDN) model. However, on OpenFlow/SDN, QoS is only performed with bandwidth guarantees and by a well-known FIFO scheduling. QoSFlow module adds extensions to the standard software switch (datapath) of Open Flow 1.0. During the starting time of the QoSFlow project, the specification 1.0 of Open Flow was the latest stable version and was used in the project. Even though OF 1.3 has brought a new mechanism for rate limiting, but as well as the Open Flow 1.0, we are able to use FIFO instead of other packet schedulers to achieve different treatments to the packets. The Open Flow datapath plus QoS modules form the QoSFlow datapath [2]. This datapath is a user space implementation where queues are located in the kernel space. The QoS module opens a channel with the kernel through Netlink and Packet socket families to connect both user and kernel space. Thus, the packet schedulers can be instantiated to enable traffic shaping and enqueueing of flows. The components called Traffic Shaping, Packet Schedulers and enqueueing that constructs the QoS module of the QoSFlow datapath.

Network operating systems (NOX) applications will be written as centralized programs on high level of instability in network resources, unlike algorithms distributed from lower back [3, 4] applications. The network operating system does not manage the network itself; It provides a programming interface with high level objects (such as CPU processing power, memory, disk storage volume, link

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power, etc.) of network resources, which enables network application programs to handle secure and functional complex tasks on a wide variety of networks [3]. The NOX, however, fails in providing the obligatory functions for QoS-ensured software defined networking (SDN) [5] accommodation provisioning on carrier grade provider Internet, such as QoS-vigilant virtual network embedding, end-to-end network QoS assessment, and collaborations among control elements in other domain network.

II. Related Work

Previous work on providing QoS using Open Flow has three categories. First, studies deploying dynamic QoS in an SDN environment [6], [7], [8]. Second, studies on switch diversity [9], [10], [11], [12].Third, research on network performance resulting from QoS with OpenFlow- enabled switches [13], [14].

Some of the work done in the area of SDN based on demand provisioning of network resources, is targeted towards automated, policy-based network provisioning [15, 16], while the other is targeted towards traffic engineering across Wide Area Networks (WANs) [17, 18]. Dynamic allocation of network resources is also required inside the data centers, and many studies address this challenge. As an example, an OpenFlow-based algorithm for allocation of bandwidth resources between virtual machines in data centers is presented in [19], while in [20] the authors describe a platform for integrated provisioning of computing, storage and network resources in data centers.

However, most of the related work focuses on the service logic for QoS-aware resource provisioning, leaving out the details of how the network resources are managed and provisioned in the data plane. In some of the papers, such as [21], the authors mention that the proposed QoS architecture dependent on traffic classification and rate limiting at the edge of the network, although no description about how the reservation of logical resources inside the SDNC enforces in the forwarding devices.

The work that is closest to the one presented here is [22], which defines a data plane QoS architecture for SDN based on similar principles (i.e. a combination of queues and rate limiters), but with different constraints for the resources. The current paper contains a definition of how the resources are managed inside the SDN in order to provide deterministic QoS.

When monitoring the QoS it is an advantage that a network problem resulting in decayed performance will affect a whole class of flows that share some properties (i.e. routed through an overloaded device and use the same QoS class). It is sufficient to monitor a representative subset of the network flows which makes QoS Monitoring eligible for sampling.

III. Description of the Existing Architectures

Existing Architectures

1. ROIA
2. Multiple Packet Scheduler
3. NOX

1. ROIA

Real-time Online Interactive Applications (ROIA) connects wide number of users who interact with the applications and with each other with proper authentication, i.e., a replication to a user's action transpires virtually and immediately. Typical representatives of ROIA are multiplayer online computer games, simulation-based e-learning, and serious gaming. Due to a large, variable number of users, with intensive and dynamic interactions, ROIA make high Quality of Service (QoS) demands on the underlying network. Furthermore, these demands may continuously change, depending on the number of users and the actual application state: in a shooter game, a high packet loss in a combat state may have fatal consequences on QoS, whereas it is less relevant when a player is exploring the terrain.

ROIA Applications has two parts, a static and a dynamic part. Static part has non-changeable and landscape objects. The other one dynamic part has non-playing characters controlled by server. These objects can change their state at any time. Figure 1 shows the structure of a ROIA.

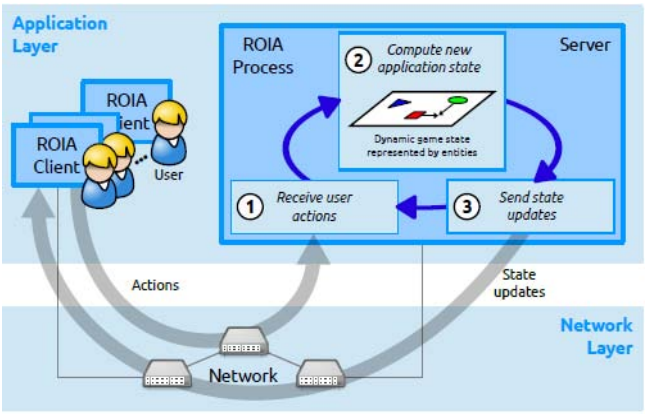

Figure 1: Structure of a ROIA and its real-time loop

In this architecture only one ROIA process serves the connected ROIA clients and a group of ROIA processes distributes among several machines. For the processing of ROIA in an infinite loop the application state executes repeatedly in real time which is called real-time loop [23]. Single loop iteration has three important steps. Firstly, the user takes input and transmits it via a network and ROIA process receives that. Then to calculate the application state we can apply the user input and processing methods to current

application state. After that, the loop transfers the updated state to the client.

2. Multiple Packet Scheduler

The Open Flow data path plus QoS modules form the QoSFlow datapath. This path is a utilizer space implementation and locates in the kernel space. The QoS module opens a channel with the kernel through Netlink and Packet socket families to connect both utilizer and kernel space. Thus, the packet schedulers can be instantiated to enable traffic shaping and enqueueing of flows. Figure 2 shows the components like Traffic Shaping, Packet Schedulers and enqueueing that constructs the QoS module of the QoSFlow datapath, and their relationships.

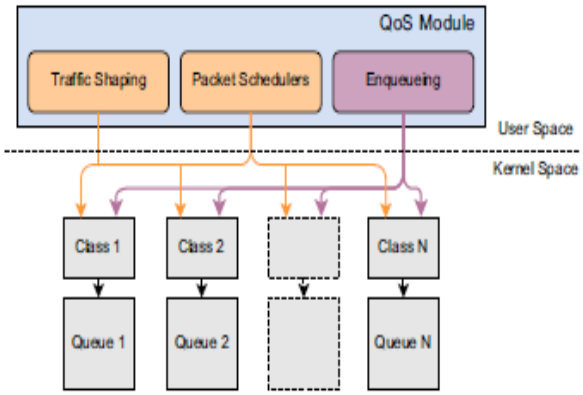

Figure 2: QoS module which has been added to the standard OpenFlow datapath

- *Traffic Shaping and Packet Schedulers:* These components use Netlink socket family to manipulate OFPT_QOS_QUEUEING_DISCIPLINE message type, which is a new extension of the message to represent the QoS messages in OF protocol.

Hence, the Traffic Shaping and Packet Schedulers components administer the QoS messages receipt from control plane by splitting the bandwidth size in queues and by attaching or detaching packet schedulers for these queues, respectively.

To connect the kernel, these components open a Netlink socket channel and send a Netlink message through it. The Netlink message is the type of message that Linux kernel accepts for network resources management. In this way, the QoS messages maps to Netlink messages.

- *Enqueueing:* It is the component responsible for operating OFPT_FLOW_MOD messages of the of protocol. This message modifies the state of the flow table, where each entry contains header fields, counters, and actions for matching packets or flow packets.

The enqueueing mechanism maps flow to queues using the skb-> priority of kernel's data structure called sk_buff. This configuration establish through the use of the SO_PRIORITY option of the Packet socket family. Since user space cannot access such data structure directly.

The QoS development strategy for OF enabling networks is to overcome the packet scheduling issues. The primary goal of QoSFlow is to allow control of multiple packet schedulers. In another word, QoSFlow brings the traffic control of Linux to become part of OF networks. Our proposal extends the OF protocol 1.0 and the standard data path based on it. This way, developers can deploy their applications, for instance, a control of bandwidth according to need with one or more packet schedulers on the network. Currently, QoSFlow provides control of the following packet schedulers: HTB (Hierarchical Token Bucket) [24], RED (Randomly Early Detection) [25], and SFQ (Stochastic Fairness Queuing) [26].

Currently, QoSFlow controls the following packet schedulers: HTB, SFQ, and RED where the HTB is a classfull, while SFQ and RED are classless queuing discipline. Thus, the current QoSFlow features come from these Linux kernel packet schedulers.

- *HTB:* It allows splitting the bandwidth according to the size of the network. By default, the Linux kernel automatically attaches a FIFO packet scheduler to each bandwidth segment. It creates logical links which are slower than the physical link.
- *SFQ:* This belongs to fair queuing algorithm. The SFQ schedules the packets transmission based on information about the IPv4/v6 source and destination address, and TCP/UDP source port to assign each flow to each hash bucket, on the enqueueing phase.
- *RED:* It drops packets in a queue gradually. It performs a tail drop like FIFO, but smartly. Such packet scheduler has a threshold value to mark packets to be discarded after queue length becomes greater than the threshold value.

3. NOX

Network operating system (NOX) enables management applications to be constructed as centralized programs over high-level abstractions of network resources as an inverse to the distributed algorithms over low-level addresses [22, 23]. The network operating system does not manage the network itself; it provides a programming interface with high-level abstractions of network resources (e.g., memory, disk storage volume, CPU processing power, disk storage volume, link capacity, etc.) that enable network application programs to perform complicated tasks safely and efficiently on a broad heterogeneity of networking technologies [22]. The NOX, however, fails in giving the necessary functions for QoS-guaranteed Software Defined Networking (SDN) [24] service provisioning on bearer grade provider Internet, such as

QoS-aware virtual network seating, end-to-end network QoS measurement, and cooperation among control elements with other domain network.

IV. Comparison Among the Existing Architectures

1. ROIA

a. *The Response time of ROIA*

Figure 3 shows the graph of the calculation of Response Time with ROIA [1] of Table 1.

Table 1: Calculation of the Response Time with ROIA

Number of Clients	Response Time (ROIA) ms
5	1.03
10	1.19
15	1.22
20	1.35
25	1.29
30	1.07
35	1.48
40	1.21
45	1.34
50	1.09
55	1.42
60	1.3
65	1.15
70	1.45

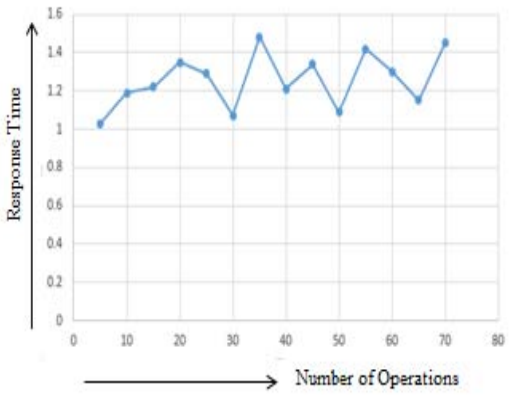

Figure 3: Response Time of ROIA

b. *Throughput of ROIA*

The Figure 4 shows the graph of the calculation of Throughput with ROIA [1] of Table 2.

Table 2: Calculation of the Throughput with ROIA

Number of Clients	Throughput (ROIA) in milliseconds (ms)
5	0.97087
10	0.84033
15	0.81967
20	0.74074
25	0.77519
30	0.93457
35	0.67567
40	0.82644
45	0.74626
50	0.91743
55	0.70422
60	0.76923
65	0.86959
70	0.68965

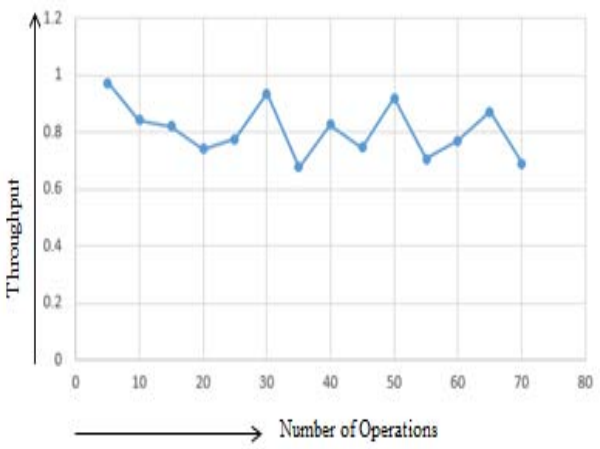

Figure 4: Throughput of ROIA

2. Multiple Packet Scheduler

a. *The Response time of Multiple Packet Scheduler*

Figure 5 shows the graph of the calculation of Response Time with Multiple Packet Schedulers [2] of Table 3.

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a. *The Response time of Multiple Packet Scheduler*

Figure 5 shows the graph of the calculation of Response Time with Multiple Packet Schedulers [2] of Table 3.

Table 3: Calculation of the Response Time with Multiple Packet Schedulers

Number of Clients	Response Time (HTB) ms	Response Time (SFQ) ms	Response Time (RED) ms
5	1.28	0.1	0.55
10	2.56	0.2	1.1
15	3.84	0.3	1.65
20	5.12	0.4	2.2
25	6.4	0.5	2.75
30	7.68	0.6	3.3
35	8.96	0.7	3.85
40	10.24	0.8	4.4
45	11.52	0.9	4.95
50	12.8	1	5.5
55	14.08	1.1	6.05
60	15.36	1.2	6.6
65	16.64	1.3	7.15
70	17.92	1.4	7.7

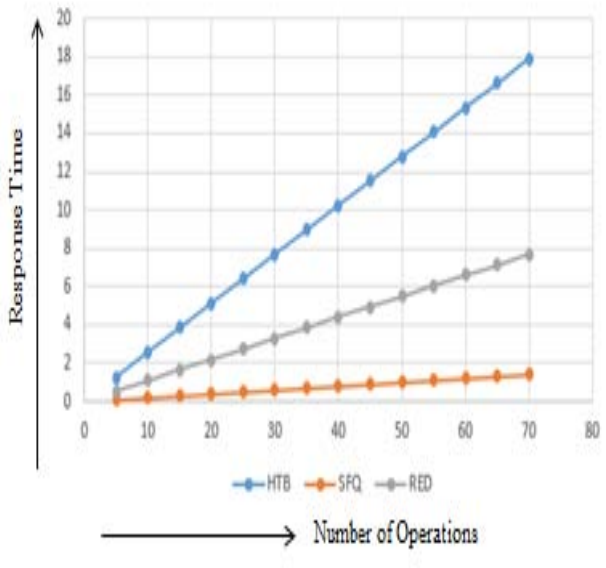

Figure 5: Response Time of Multiple Packet Schedulers

b. *The Throughput of Multiple Packet Scheduler*

Figure 6 shows the graph of the calculation of Throughput with Multiple Packet Schedulers [2] of Table 4.

Table 4: Calculation of the Throughput with Multiple Packet Schedulers

Number of Clients	Throughput (HTB) ms	Throughput (SFQ) ms	Throughput (RED) ms
5	0.12206	0.15625	0.0284
10	0.244125	0.3125	0.05681
15	0.36618	0.46875	0.08522
20	0.48825	0.625	0.113635
25	0.6103125	0.78125	0.14204
30	0.732375	0.9375	0.17045
35	0.8544375	1.09375	0.19886
40	0.9765	1.25	0.22727
45	1.09856	1.40625	0.25567
50	1.220625	1.5625	0.28408
55	1.34268	1.71875	0.31249
60	1.46472	1.875	0.340905
65	1.58678	2.03125	0.36931
70	1.70884.	2.1875	0.39772

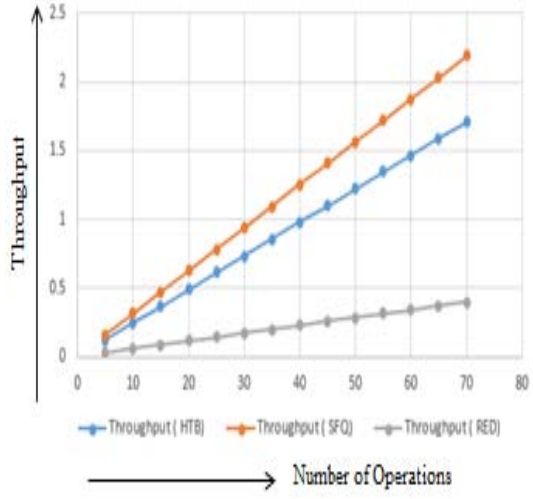

Figure 6: Throughput of Multiple Packet Schedulers

3. NOX

a. *The Response time of NOX*

Figure 7 shows the graph of the calculation of Response Time with NOX [27] of Table 5.

Table 5: Calculation of the Response Time with NOX

Number of Clients	Response Time (NOX) ms
5	0.7948
10	0.983
15	0.8542
20	0.808
25	0.888
30	0.899
35	0.9585
40	0.97
45	0.787
50	0.9095
55	0.755
60	0.7777
65	0.842
70	0.7888

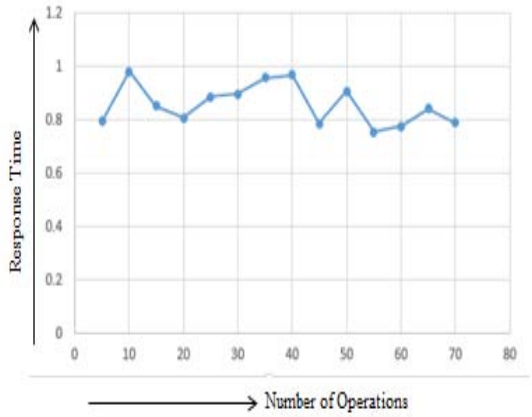

Figure 7: Response Time of NOX

b. *Throughput of NOX*

Figure 8 shows the graph of the calculation of Throughput with NOX [27] of Table 6.

Table 6: Calculation of the Throughput with NOX

Number of Clients	Throughput (NOX) ms
5	0.09
10	0.091
15	0.08
20	0.075
25	0.0859
30	0.0848
35	0.079
40	0.082
45	0.072
50	0.0797
55	0.0976
60	0.0776
65	0.0923
70	0.0948

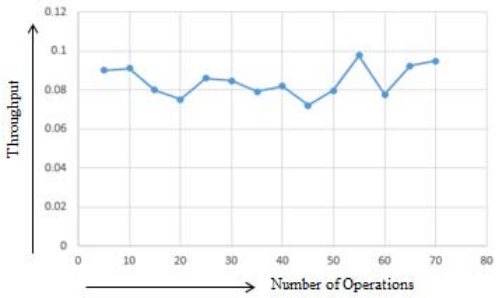

Figure 8: Throughput of NOX

V. Comparison among ROIA, Multiple Packet Scheduler, and NOX

a) Response Time

The response time of HTB is better than the response time of ROIA, NOX, SFQ and RED packet scheduler shown in figure 9.

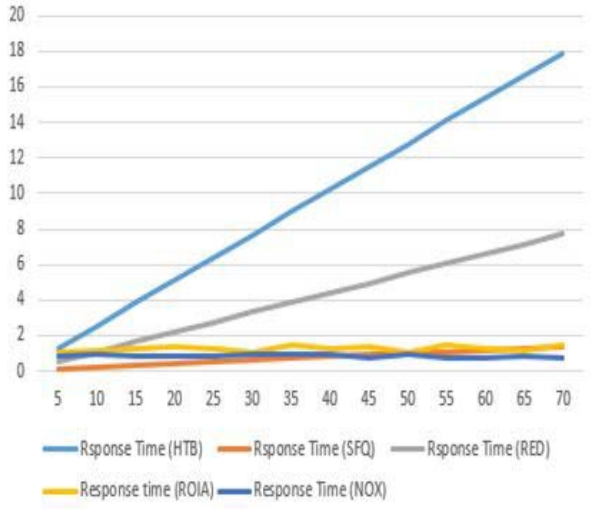

Figure 9: Response time of Existing Architectures

b) Throughput

The throughput of ROIA is better than of HTB, NOX, SFQ and RED packet scheduler in the transmission of first 24 packets, for other 46 packets Throughput of SFQ packet scheduler is better than ROIA, NOX, RED and SFQ packet scheduler shown in figure 10.

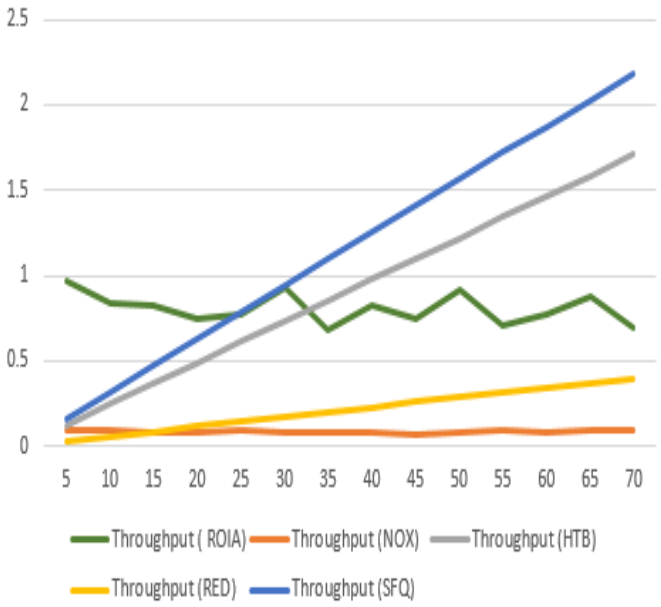

Figure 10: The throughput of Existing Architectures

VI. Conclusion and Future Work

Software Defined Network is an emerging topic for the modern era. It is an idea which has recently reignited the interest of network researchers for programmable networks. Enabling added-value services is the major target for this work. Not only this but also ensuring the security is another purpose for this work. Software Defined Networking (SDN) enables an easy and flexible realization of existing dynamic Quality of Service (QoS) mechanisms in today's communication networks. Although SDN and, in particular, OpenFlow claims to provide a standardized interface, the existing diversity of OpenFlow enabled switches leads to different behavior for the same QoS mechanisms. As compared to the response time of existing architectures HTB packet scheduler is better. In case of throughput, SFQ packet scheduler is better. We will improve Quality of Service (QoS) in SDN by designing an efficient architecture and implement that in any network emulator. In the future, we will work with Switch Capacity, Number of Queues Impact, QoE Evaluation, and Bandwidth Isolation.

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11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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