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APPLICATION BASED PERFORMANCE MONITORING HEAVY DATA TRANSMISSION OF LOCAL AREA NETWORK

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ABSTRACT

In Computer network, many applications should be work online, these applications have been discussed in the application layer of the OSI Reference Model, the need for a high-performance network varies according to the applications used in those networks depending on the files that are transmitted through this application, for example, in the e-mail application, most of the transmitted files are a text file and this is a small file that does not need a high-performance network to move through. On the other hand, on the contrary, there is the voice application (VoIP), which needs a high-speed network to transmit it and without audio interruption, because the voice also application needs a high-performance network, unlike what is in the e-mail application.

KEYWORDS: Network Traffic, Ethernet Parameters, VoIP, Queuing delay, Throughput, Global Statistics.

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1. INTRODUCTION

In this paper, a local area of 10x10 meter network is designed using OPNET simulator, then apply two different applications to the design, these two applications used to test the network performance, because some applications required a high performance with high bit rate, and others doesn't require very high data speed for example. The researcher wants to examine deeply the maximum amount of data and use it on particular application software, also thinking that it is significant to find a way to use and execute the whole bandwidth that transfers over the network.

All computer networks suffering from some network technical problems like delay, data latency, and the slowly data reaching the destination that is because of many reasons like bottlenecks, data traffic congestions and packet collision. Application layer is one of the OSI reference model layers this means that applications used are significant and plays a greater role in measuring and determining network performance for any network because of that it mentioned in this reference model. One of the OSI (open system interconnection) layers is application layer, it includes all the application programs, programs execution software's … ext. Any program in which can be executed on the any desired operating system, so any application software executing on any machine when this machine is online can affects the overall performance of this machine on the network.

This works, when the determined results begin to reach a higher value obtained in using this OPNET simulator. In the simulator, two major components should be configured in the simulator to make the network active, the first one is the (application definition) and the second is (profile definition). In (profile definition), the required application in the simulator should be configured. Also, the application that configured in (profile definition) should be configured in all other computers to link both types (server and computer) to this application, this is important to be configured in order to let the simulation in act. In the simulator, two of the most familiar applications applied also its very usable nowadays, these two applications have very big difference in network performance factors which is the bit-stream or data rate transferred at the network, where the amount of data transferred of an email application is less than the amount of VoIP application which needs a high bit rate of transferred data to fulfil the needs of voice documents, chat, and videos. For other applications that not mentioned in this research, the network performance and its efficiency parameters varied gradually as the file sixe used, the researcher has chosen the most far applications in the comparison. These tow chosen

applications email & VoIP are sufficient to let the reader get a valuable information about network performance monitoring

2. PREVIOUS WORK

Computer network is slightly modern science and when network began to operate, after that deadlock's and problems appeared, therefore the researcher didn't find a large number of researches taking about problems in computer network data transfer simulation, but some researcher like (Ahmed, 2020), 'VoIP Performance Evaluation and Capacity Estimation Using different QoS Mechanisms, In this paper, the effect of different queuing methods on voice service quality has been examined. The paper reaches that the best queuing method is WFQ because it gives minimum voice delay variation and ETE delay. Also, WFQ has an acceptable FTP throughput compared with PQ and FIFO. In addition, the study illustrated that FIFO gives bad voice quality. From the simulation it is cleared that the best codec from the view of capacity and quality is G729. (Azzedine, K. , Alessandro, Oktay 2019), Performance Analysis of a Parallel PCS Network Simulator, Department of Computer Science, University of North TexasDenton, TX 76203-1366, USA boukerche, Center for Research in Wireless Computing (CReW) Department of Computer Science & Engineering, University of Texas at Arlington, TX 76019-0015, USA. This paper focuses on an analytical performance function simulation for PCS networks, called Simulator of Wireless Mobile Networks (SWiMNet), and determines many results using an active model executed on a portion of workstations. SWiMNet provides linear speedup, thus reducing the execution period of a PCS network simulation. Performance results shows that their simulation model matches with analytical study of this paper. Comparison on Network Simulation Techniques Xiao Zhou Dept. of Electronics and Information Engineering Beijing Jiaotong University Beijing, China Hui Tian Dept. of Electronics and Information Engineering Beijing Jiaotong University Beijing, China These researchers think that Network simulation is a cost effective method. Therefore, it can be widely used for monitoring networks. Network simulation is significant tool for the analysis of network performance and diagnose of network design. This is very effective and important when using this simulation to make analysis for larger scale network. (DIETMAR 2011), TUTSCH MARCUS BRENNER, MINSimulate, A MULTISTAGE INTERCONNECTION NETWORK SIMULATOR" Technische Universit ¨at Berlin Real–Time Systems and Robotics D–10587 Berlin, Germany used a simulator called MINSimulator to work on multistage Network, they found that in this simulator it was very easy to measure network performance on GUI easy interface, also throughput and delay can be measured her. This simulator is able to

evaluate each stage of the network individually. (Goran 2010)**,** Martinovic, Bruno Petrisevac, Drago Zagar, this paper was Work with monitoring and measurement of computer network performance. They found that the development of computer network needs a high accuracy monitoring for each of its parameters this contains the both software tools and hardware recourses. These network parameters simulated for one full day. (Jyotsna 2010), Er. Gurpreet Singh Grewalworked, "Performance evaluation of IEEE 802.11 MAC layer in supporting delay sensitive services on OPNET simulator to find network performance. using this simulator to evaluate EDCF enhanced distributed coordination function on two scenarios with same physical and MAC, they found that the performance of EDCF was better in providing QoS for real-time interactive services for example video streaming over varicose services. (Muhammad, Algirdas, Frank 2009), Network modelling and simulation tools London Metropolitan University, 66-220 Holloway Road, London N7 8DB England Cranfield University, Cranfield, Bedfordshire MK43 0AL, England, in this paper, a survey of the research work on network MS tools simulation has been done. The issues that seem to be open to further research. The overall conclusion of this paper is that parallel, very big network simulators are slightly new and still expeditiously developing field where Internet is developing. (Pankaj 2012), Prabhjot kaur, Anjali gupta, Aditi Sharma "Performance Analysis of RIP, OSPF, IGRP and EIGRP Routing Protocols in a Network" these researchers designed a network consisting of gateway connected via PPPDS3 link. The area of the computer network designed was 15X15 Km. they monitored the performance of the network according to the protocol used depending on packet delivery to the destination and the overhead of the routers. They obtained that OPSF protocol has best performance overall especially for the network throughput, and they stated that this protocol shows maximum performance over others. Douglas L. T. "LENS: The light, efficient network simulator" Rohde used simulator tool called LENS Simulator to simulate a neural network, they found that this simulator is fast, flexible, and has the ability to run on multiple variety of platforms, also it can be used for teaching network course's. (Zhiguo 2016) "Performance Analysis of HTTP and FTP Based on OPNET" School of Computer Science Communication University of China, Pan Wei School of Computer Science Communication University of China. This researches used OPNET simulator for two case studies and they chosed the average queuing delay and TCP delay to measure the performance of HTTP and FTP protocols, they found that in a small network consisting of few clients they found that, bandwidth of the link affects the performance of HTTP. algorithm designed using machine learning to get a high level of Quality of service for a proposed smart city and inspection of type of service using this algorithm to provide an efficient quality of service with a high speed network for this city.

3. THE SIMULATED NETWORK

The designed network consists of one server that provides the services of VoIP and email applications to the connected authorized computers in the network over a high speed 16 port main switch, 21 computers are connected to this switch via ethernet 1000baset cable of gigabit speed, these computers supported with port interface 1000base-x gigabit ethernet card which can provide speeds of 10 mbps, 100mbps, and 1000mbps gigabit per second, the protocols that this LAN card operates with the UDP, IP ethernet fast ethernet gigabit ethernet rip, TCP and OSPF this card works in workstations and clients. The server also connected via the same type of cable to ensure high speed to the switch as shown in Fig. 1 a and b.

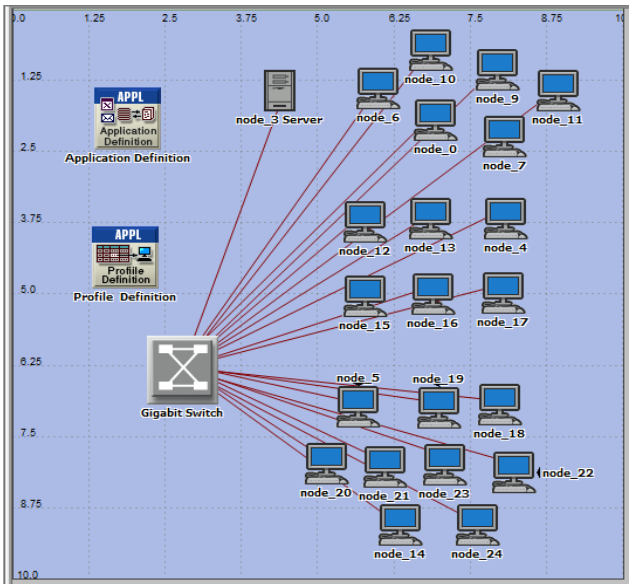

Fig. (1-a) Computer network connected as star topology simulated by OPNET.

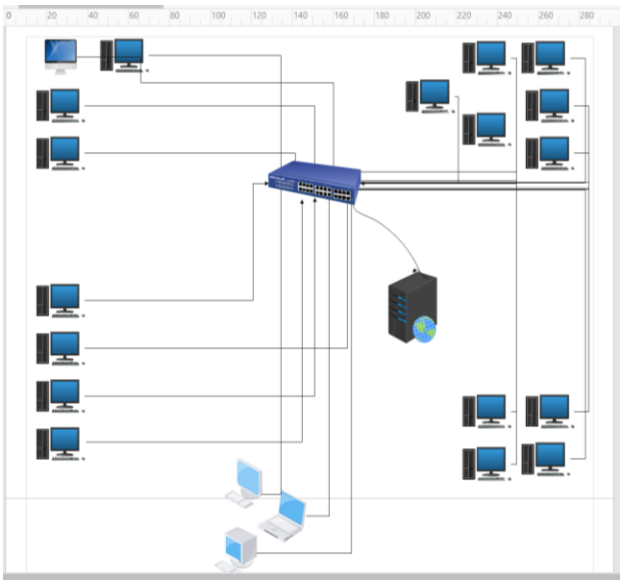

Fig. (1-b) The distribution of computer network devices on a real plan.

An algorithm in Fig. 2 shows the main steps of the computer network designed and simulated using the application dedicated to do the comparison.

4. THE COMPARISON

The main work in this research is achieved by the Comparison between Voice over Internet protocol and Email as applications activated on the local area network that suggested to be simulated by Opnet, the researcher tried to find the most dissimilar (spaced) applications that can be simulated in Opnet simulator.

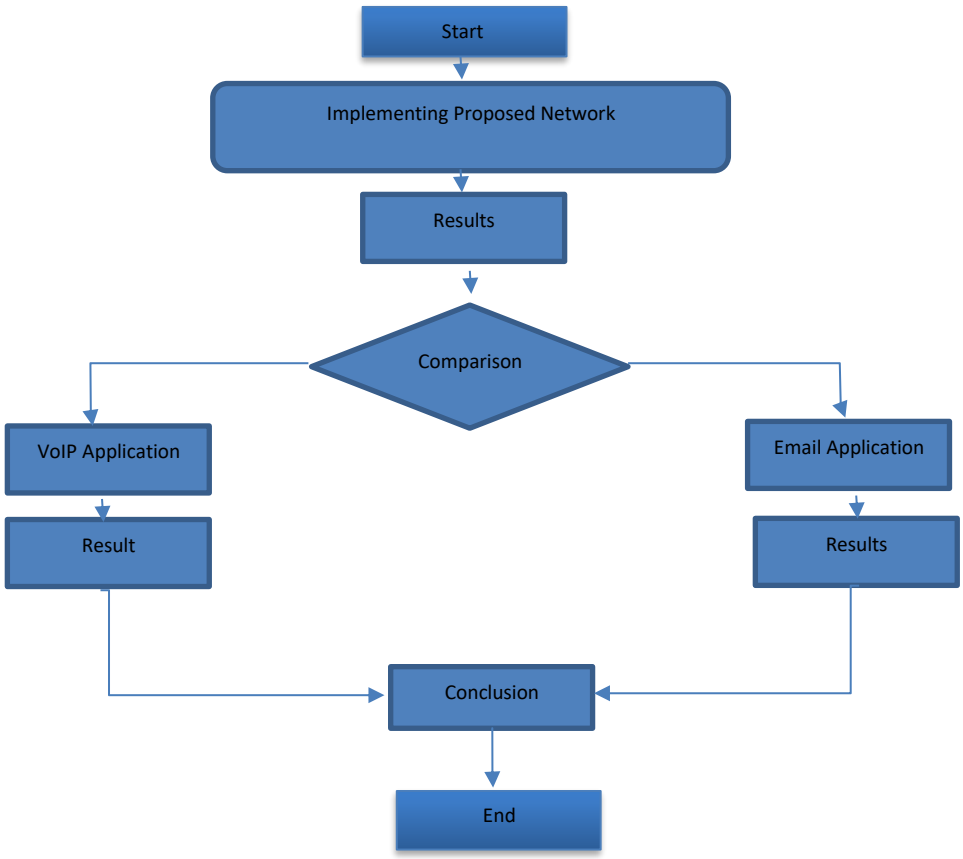

Fig. 2. The algorithm of proposed network.

Simulation:

In this paper, Opnet 14.5 Modeler used to simulate the LAN, then determine the results as curve. This simulator needs a slightly difficult setting which should be done to make the network work, the first configuration should be done on first (*Application Definition*) Fig. 1-a, in this step, the network designer should assign the applications that is needed to be simulate. Each device in Opnet has an attribute reached by right-clicking on this device, in (*attribute*) the configuration contains 16 rows each one presents an individual application. The second and most important item in any Opnet configuration process is the (*Profile Definition)*, this is more specific step of configuration in the network simulation, here the applications must be linked with the configuration in the Application Definition in all network devices Fig. 1-a. (each device should be configured to do the application which it designed for).

This research could be part of a set of experiments being done in the computer networking lab for advanced stages such as bachelor's or master's degree studies in the field of data transfer on networking, but using OPNET V-14.5 software, but using the Simulation software (Opnet). Along with a Packet Tracer for Cisco and a software eNSP for Huawei.

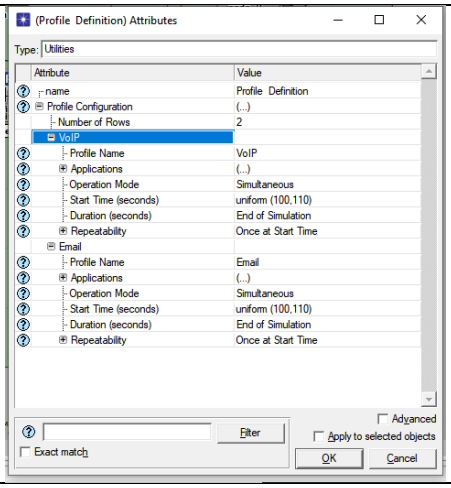

Fig. (3) The (*Profile Definition*) configuring application required to be simulated. In this figure, the VoIP application and email applications are shown as simulated applications in this object, this is obvious in Fig. (1-a). This window can be reached by right click on this object of the Opnet simulator then going through *edit attribute.*

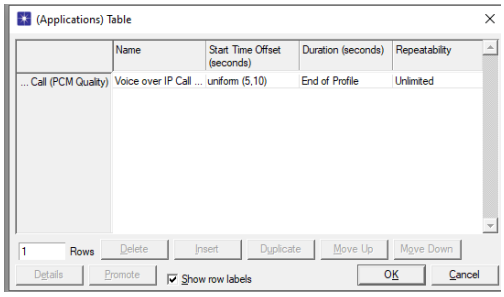

Fig. (4) The (*Profile Definition*) configuring application wanted to simulate, this can be reached by choosing edit from the application row that show in Fig. (3), there is no need to put a similar figure again hear any application can be added to the simulation, each application displayed as one row. a one digit number can be seen by a number of rows.

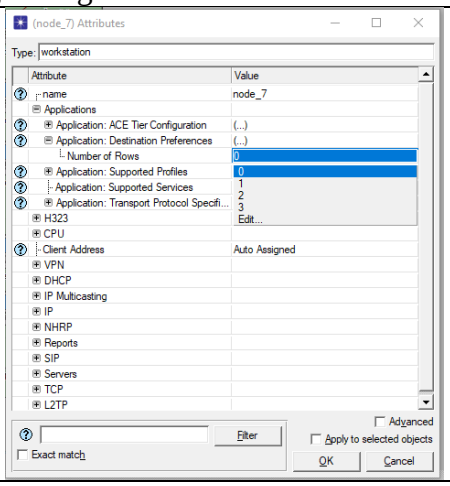

Fig. (5) shows how many rows can be configured to use each one to a specific application

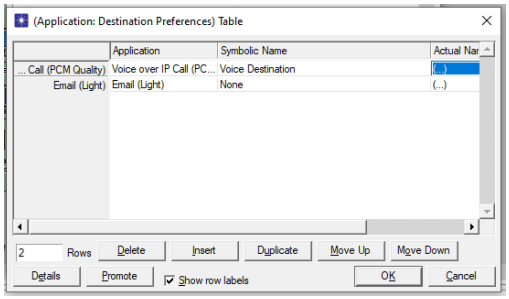

Fig. (6) This figure can be reached after entering to a menu like that in (Fig. 3) *(Profile definition)*, the two applications which used to be simulated are configured in (*Application Definition)* object as shown in Fig. (1-a)

These two applications chosen to inter the comparison, this compression depends many factors like data transfer, bit pert second byte per second, packet per second also time delay for both applications as shown in the Fig. (8).

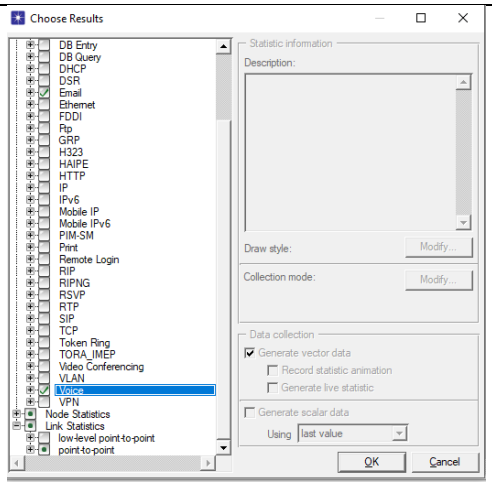

Fig. (7) shows how many results needed to be shown after the simulation finished, the VoIP and email applications has chosen as shown in this figure.

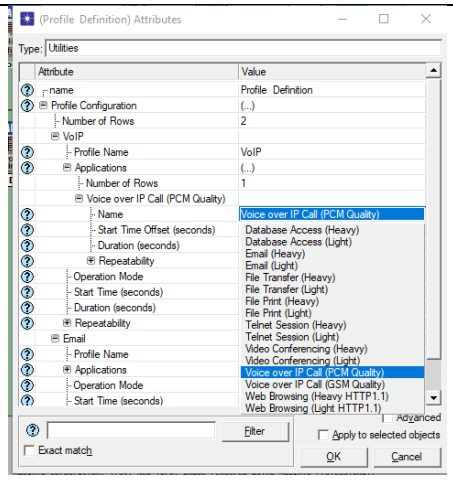

Fig. (8). This is another object that can be seen in Fig. (1-a) shows the (*Profile Definition*) object, hear the application should be chosen to link the application with the object (Application Definition), in addition, this should be done to all of the computers in the network.

5. RESULTS

From the results determined for this network, the performance can be shown by these curves. In OPNET, the result can be taken as an average, but its preferred to take the actual results and put the results in tables as well to make it easier to understand and for accuracy and reliability. The first result is of the two applications Voice Over IP and email Application as shown in Fig. 9.

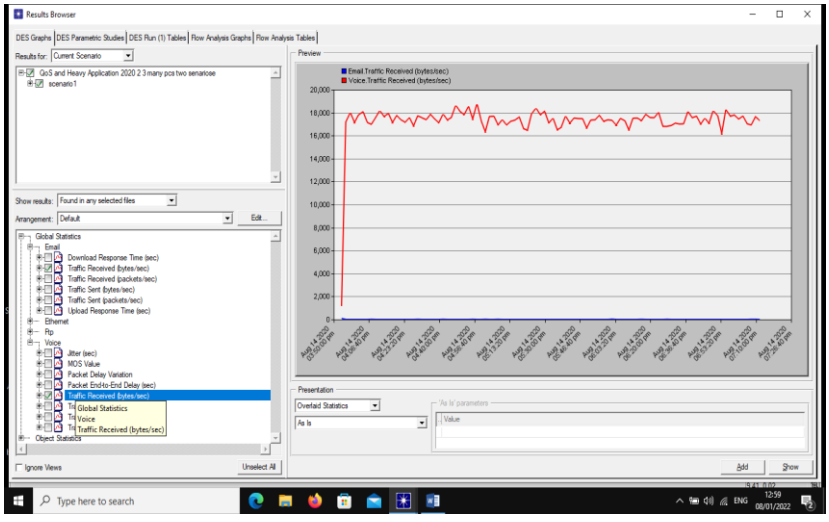

Fig. 9, Global Statistics data received measured in byte per second for both comparison applications Voice Over IP and email Application, this is the first figure that shows a majorly huge difference between the two application deterministic results although the same network resources and computer specifications mentioned, this can be seen by the blue curve which is

remaining in the bottom of the graph when plotted in the same time, on same chart with the VOIP application (red curve), thus the big difference was very obvious, That's why, sometimes the its plotted two applications individually and separately. The VOIP raised up in the beginning of the simulation and after starting the simulation by 8 minutes, typically thus the time period required to whole the network reaching applications to be operated and showing data rate. Until reaching the value of 18200Byte per second for maximum rate 18000 for stability data rate. Unfortunately, it is difficult to compare the bit rate with the results that appeared in the blue curve that for the Email application, it discussed in the other curve results. In Fig. 10 the results shown as data transferred between devices in the simulation.

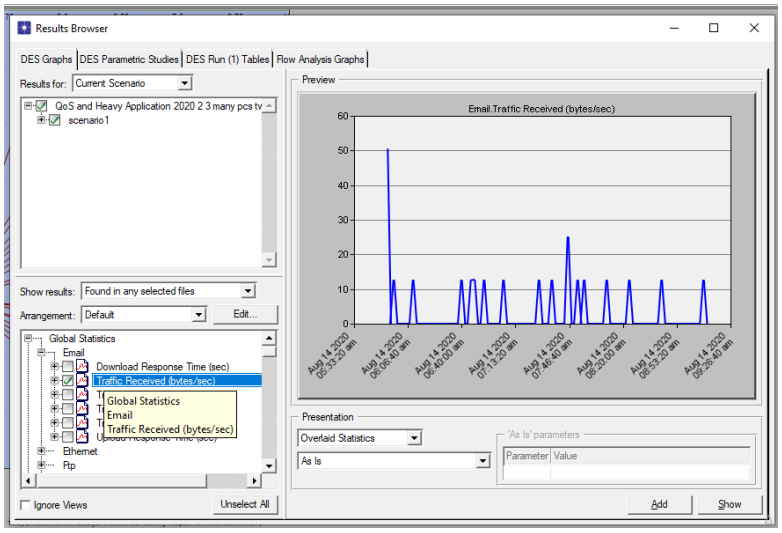

Fig. 10, Data received global statistics for an email application, measured in bytes per second in this figure the big major difference shown by the maximum value of 50 Byte per second for a very short period of time but stabilized at 12 bytes per second which it has a smaller value than same deterministic of VoIP application, therefore, it was difficult to compare two determined results by showing them on one chart as shown in Figs. 9,11 and 12. The transferred packets is also used as a part of transferred data in the simulation as shown in Fig. 11.

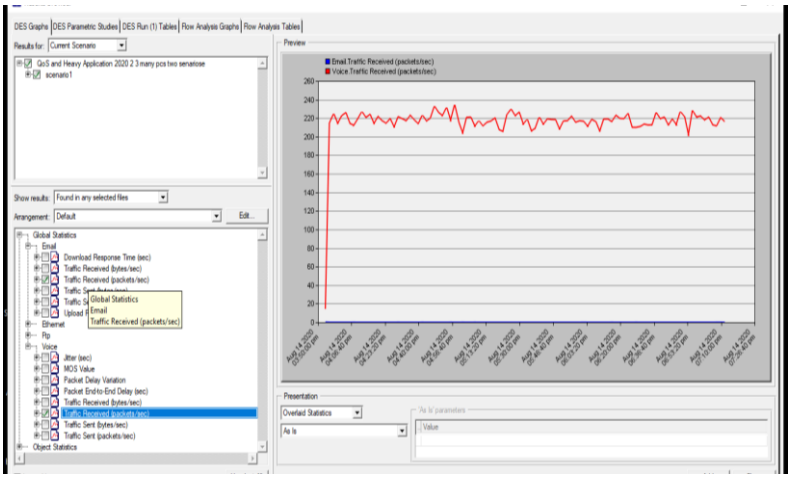

Fig. 11, Data rate for voice over IP application global statistics measured in packet per second, also the comparison is difficult because of the big difference between two applications her and this curve shows a good particular comparative value increased reaching 285 packets per second for maximum and get stabled at 220 packets per second. Data transferred as Byte has shown in Fig. 12.

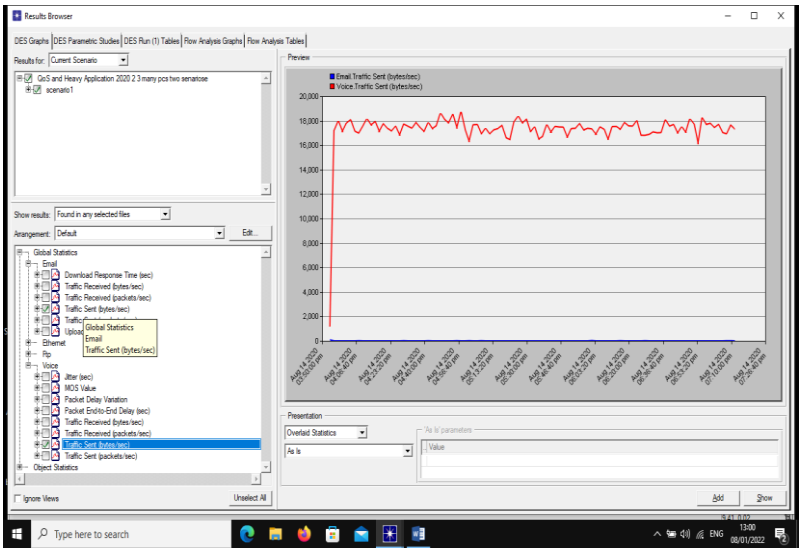

Fig. 12, These curves show a value of data rate sent rising up reaching 18000 byte per second for network global statistics determined to get stabilized at 17700 bytes per second. The blue line in the bottom represents the email application data sent, but it sticks in the bottom so the comparison is difficult. It is shown in Fig. 9 also. The jitter is one of the new factors that used to mesure the network performance in the most recent networks, jitter shown in Fig. 13.

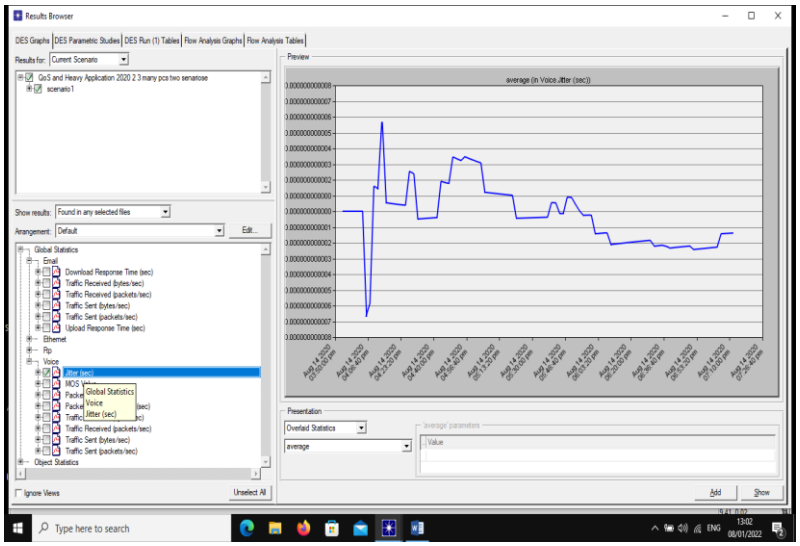

Fig. 13, Is the jitter value of global statistics measured by second of voice over IP application the maximum value was 6.7 micro-second and minimum value of 1.5micro-second. Jitter is the delay of packet received by destination, this delay varied from one packet to another even all packets belonged to the same massage, this delay causes problems specially for VoIP applications. Point-to-point transmission shown in Fig. 14 used to show the transferred data between specific devices not the whole network.

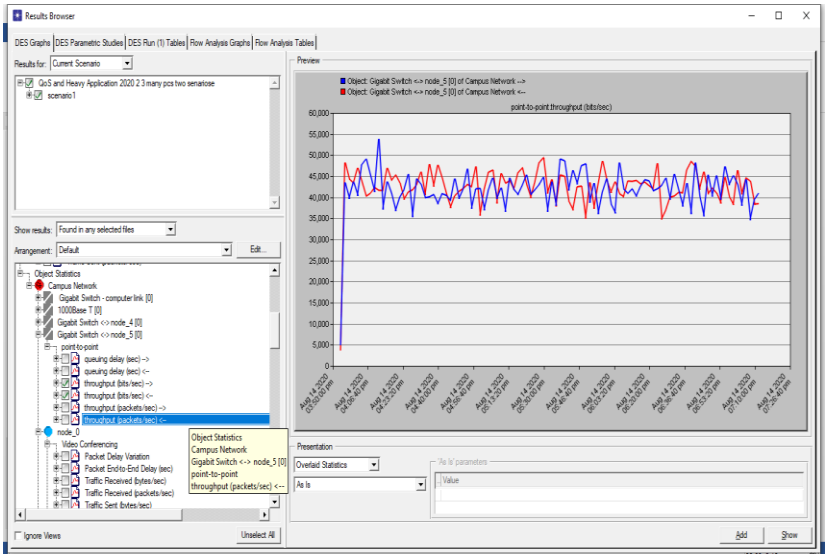

Fig 14, Point-to-point for object statistics of Gigabit switch sent/received throughput measured in byte per second, these two curves show that the network application is working at a high bit rate, that is sufficient to fulfil the application simulated especially when the gigabit switch is used for this local area network. The delay in networks is one of the main factors that affect computer networks, this factor also mentioned in Fig. 15, as shown.

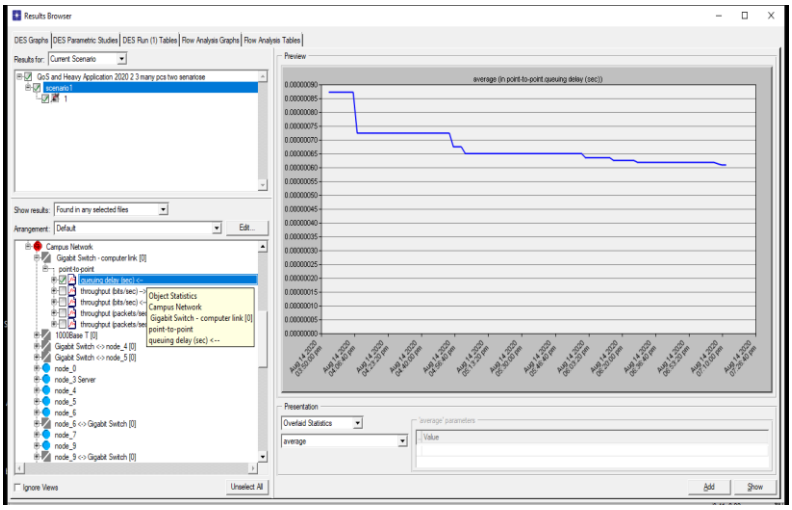

Fig. 15, Queuing delay network of (switch- computer link) point-to-point object statistics of gigabit switch starts by 0.00000089 seconds then decreases after 150 minutes to 0.00000066 second. Voip is like other application needs to measure the end-to-end network factors, this shown in Fig. 16.

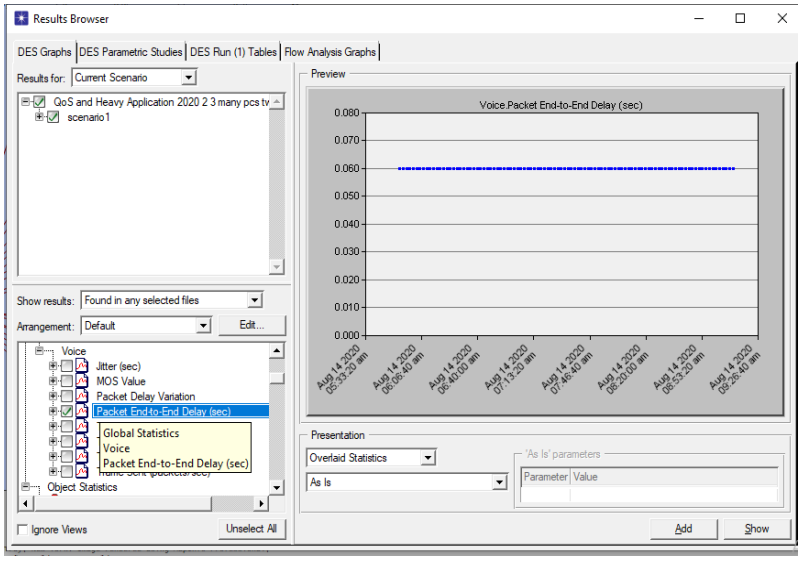

Fig. 16, End-to-End global statistics of voice over IP application delay has fixed value from the beginning to the end of simulation at the value of 0.06 seconds. Point –to- point factors shown in Fig. 17.

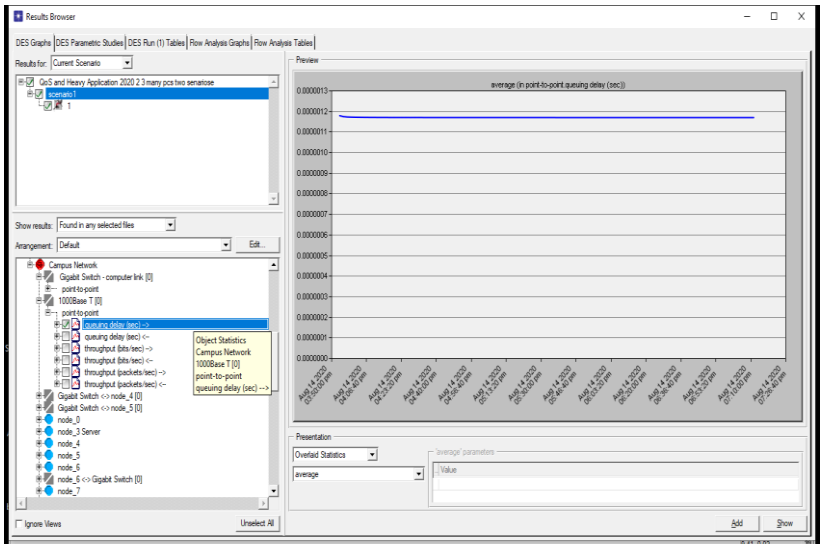

Fig. 17, Queuing delay for object statistics point-to-point of 1000 base T media cable measured in second remains at 0.000000118 seconds over the simulation time. This curve shows a different value from the value determined in the gigabit Ethernet switch as shown in this figure and Fig. 15, because of the media used. Throughput is one of the main network speed factors, is shown in Fig. 18.

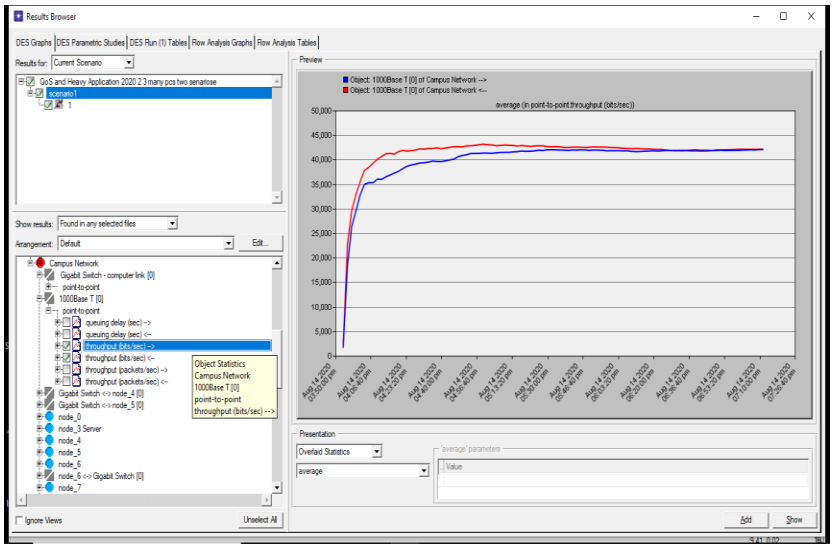

Fig. 18, Point-to-Point throughput rate of two-direction sent and received measured in bits per seconds for network object statistics of Ethernet cable standard of 1000Base T media cable starts by 2000 bit per second and increases reaching 42000 bit per the second for maximum value determined both transfer directions. End to end packet transferred is shown in Fig. 19.

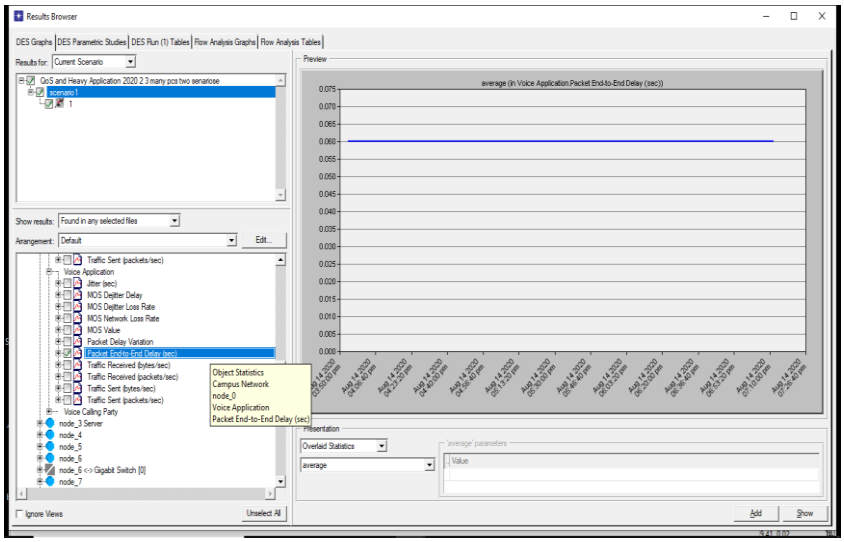

Fig. 19, Voice over IP application for object statistics end-to-end packet time delay measured by seconds, in this figure the time delay remains constant at 0.06 seconds for all the simulation time periods. This has the same result of the stabled delay of 0.06 seconds also but this time for object statistics, before this, the global statistics shows the same value. Sent and recived data for VoIP application shown in Fig. 20.

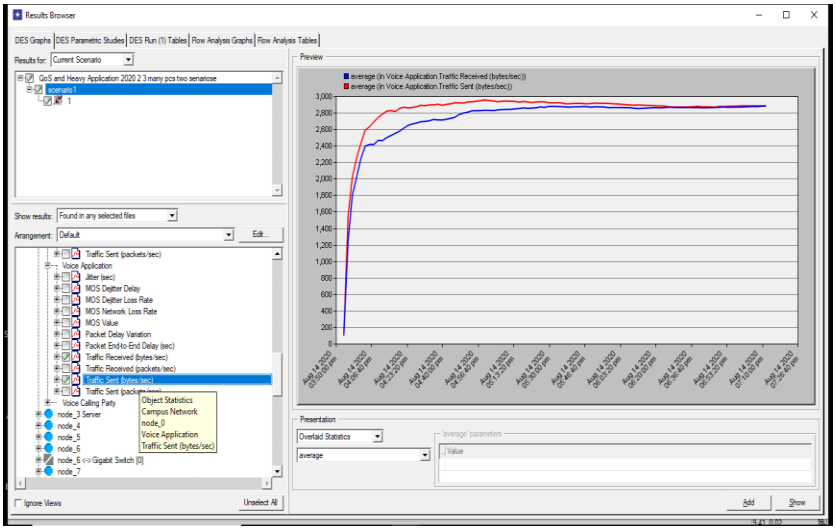

Fig. 20, Voice over IP application object statistics data sent measured by bytes per second starts with 100 then raised up to 2400/2800 byte per second for received/ sent respectively at the beginning of simulation then reaching 3000 bytes per second approximately for data received and 2850 byte per second for data sent for VOIP application, node data transmission shown in Fig . 21.

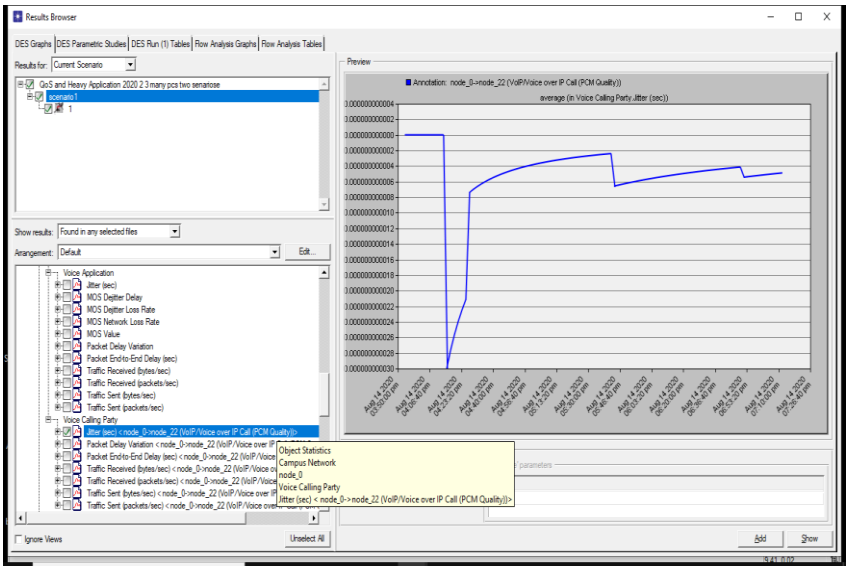

Fig. 21, Voice Over IP application for object statistics VOIP node 0 to node 22 calling party Pulse code modulation quality jitter measured by seconds the nodes can be seen in Fig. (1-a), in this figure the jitter starts by zero seconds and after slightly increasing for a short time returns decreasing to 0.0000000000002 seconds as stable value. The short interval of time that the jitter time is falling to the bottom of the curve that happened between the minute 6:12 and 4:30 of simulation caused by the short absence of calling application demand that occurs as a result of other computers to get connected call party and application. For overall, and for a connected by gigabit LAN, this result shows high performance and very effective network resource behaviours. Pulse code modulation (PCM) is determined in this simulation as shown in Fig. 22.

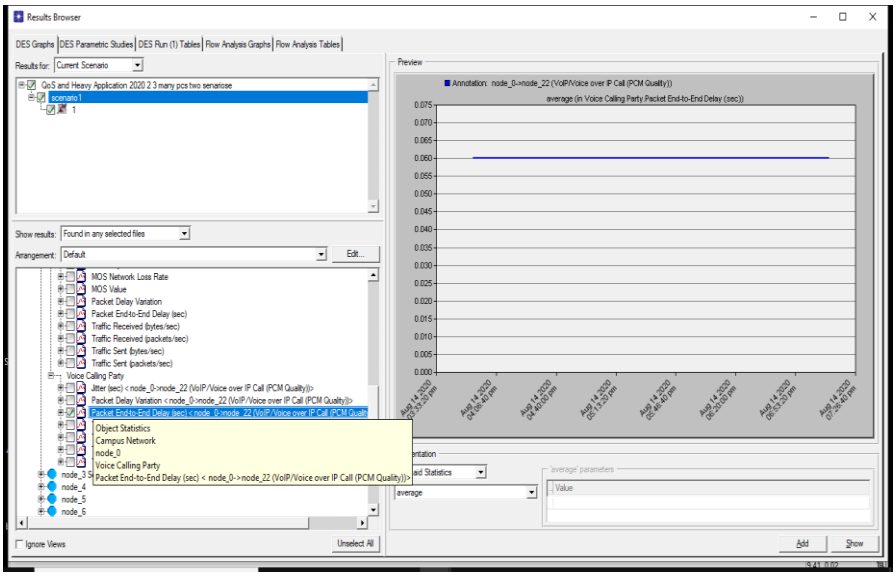

Fig. 22, Voice over IP application for object statistics VOIP node 0 to node 22 end-to-end delay party Pulse code modulation quality jitter measured in seconds also remains stable at 0.06

seconds for all the simulator period. To the end of simulation time. In the simulation, node 0 and 22 taken as example to measure data transferred as shown in Fig. 23.

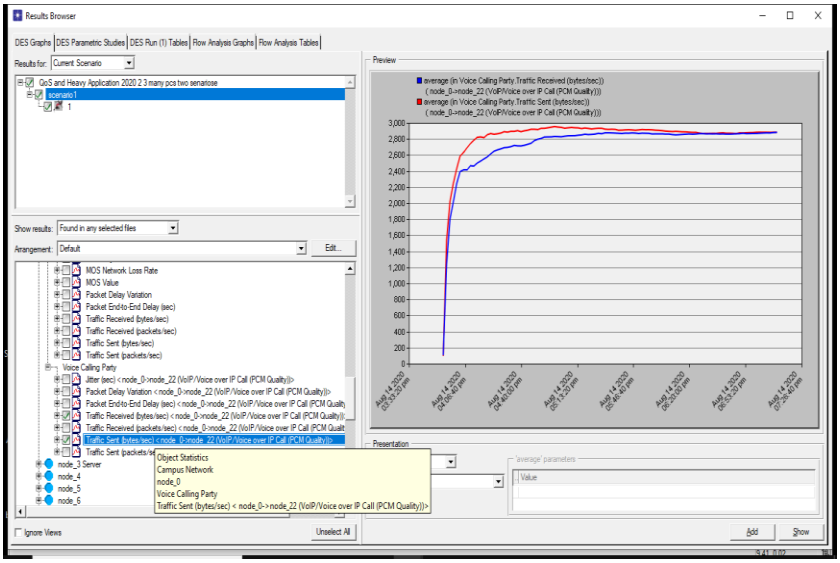

Fig. 23, Voice Over IP application object statistics data sent/ receive statistics VOIP node 0 to node 22 party Pulse code modulation quality measured by bytes per second starts with 50 seconds at the beginning of simulation then begin increasing reaching 3000 bytes per second approximately like the end another figure (20) for data received and 2850 byte per second for data sent for VOIP application. In this figure, the sent data obviously was greater that the received data in the middle of the simulation time, but in the end of simulation it reaches the value of 3000 which the same of data sent and remains stable on this value. As in seen obviously there are few figures seems like this figure, but when go through their detail it will be noticed that each one shows a significant different results showing another deterministic, this similarity in curves is because that the network performance factors has the same behaviours and all the factors of net speed soared and stabilized together except the latency and delay factors. The global statistics and object statistics has some similar behaviours also, therefor, the paper reader feels like he sees the same results again. Fig. 24 shows data sent/ received for VoIP application of two dedicated nodes or devices.

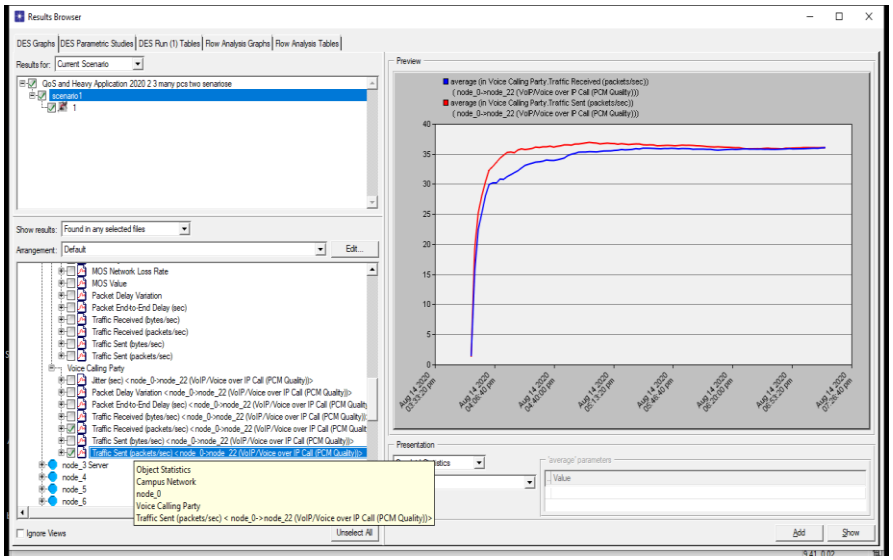

Fig. 24, Voice over IP application object statistics data sent/ receive statistics VOIP node 0 to node 22 party Pulse code modulation quality measured by packet per second starts with 2 packet per second in the beginning of simulation then begin increasing reaching 29 packet per second approximately. Also the sent packets were slightly greater than received on, but stables together. Point-to-point delay shown in Fig. 25.

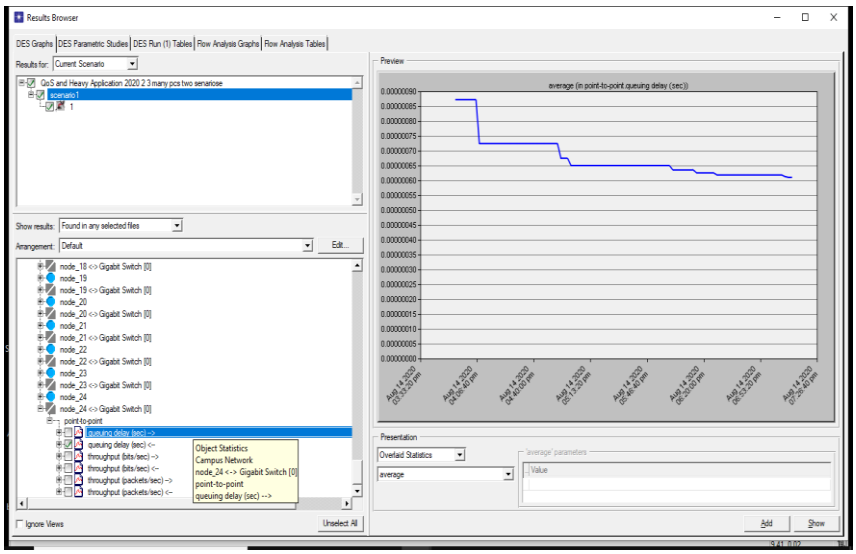

Fig. 25, In this paper, many results as curves by using Opnet, he chose some of these similar as examples that is because it will show the same results for example the Figs. 21-24 are sample results of link between node 0 and node 22 for example so her in this figure node 24 and switch 0 recognized as point -to- point sample for object statistics queuing delay measured in seconds. Starts by 0.000000875 second then decreased to 0.0000006 second in the end of the simulation. So there is no need to show all the results of all linked nodes. Delay between switch and other node like node 19 is taken as example to determine delay as shown in Fig. 26.

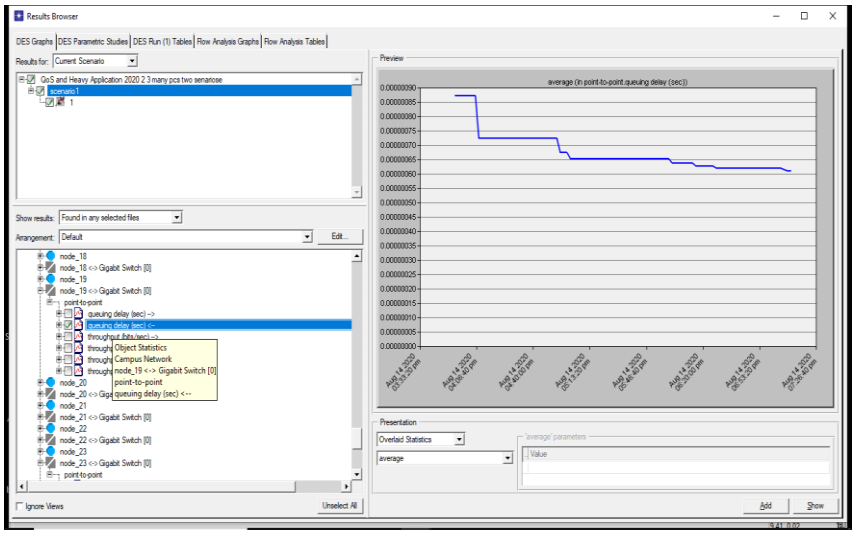

Fig. 26, Node (device) 19 and switch 0 in the simulation are recognized as point-to-point sample for object statistics queuing delay measured in seconds. Starts by 0.000000875 second then decreased to 0.0000006 second in the end of the simulation. Other nodes like node 18 in the simulation is taken as example to mesure shown in Fig. 27.

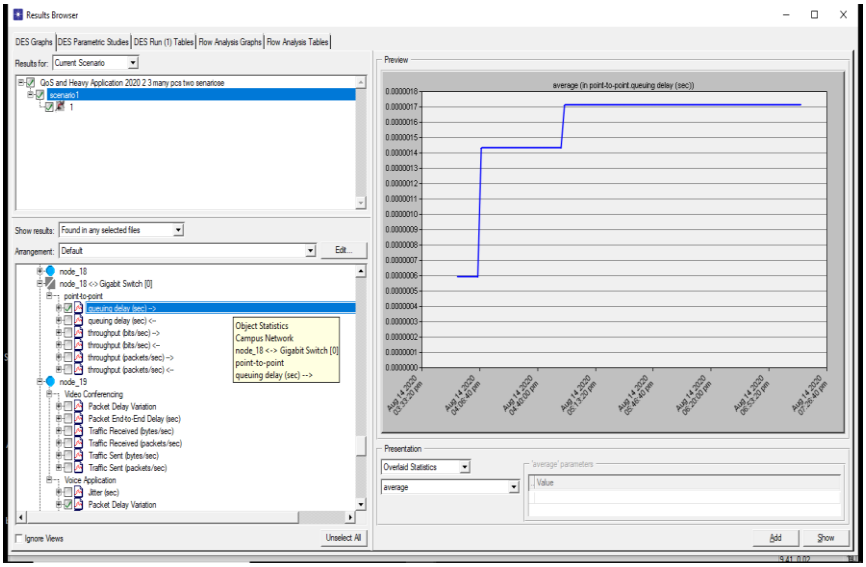

Fig. 27, In this figure node 18 and switch 0 are recognized as point-to-point sample for object statistics queuing delay measured in seconds. Starts by 0.00000872 second then decreased to 0.0000006 second in the end of the simulation.

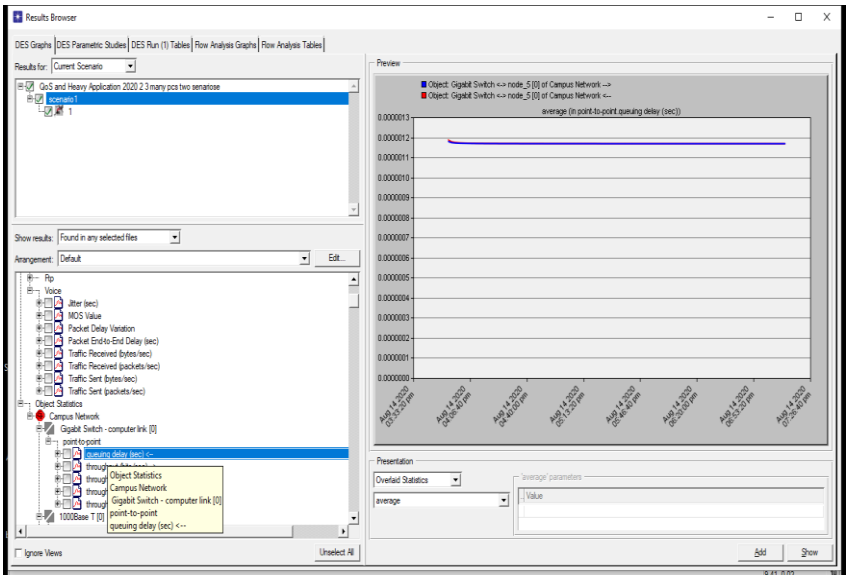

Fig. 28, Voice over IP application object statistics queuing delay for object statistics point-to-point of Gigabit switch and Gigabit media cable measured in second remains at 0.000000118 second over the simulation time. This curve shows a same value of the value determined in gigabit Ethernet switch as shown in this figure and Fig. 17. MOS also is on of the recent network factors, shown in Fig. 29.

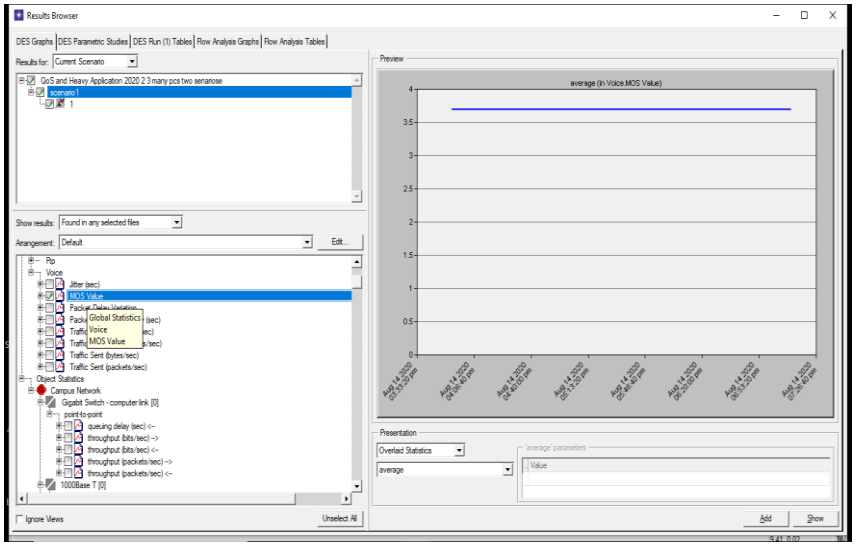

Fig. 29, Voice over IP application object statistics MOS (Mean Opinion Score) value global statistics shows a fixed value of 3.4. it is a Relatively new term in computer network design. The value of MOS depends strongly on data bit, byte or packet rate therefore it is used as a term to evaluate the efficient network or high performance computer network and ins applications like VoIP. Email application data transferred for two direction shown in Fig. 30.

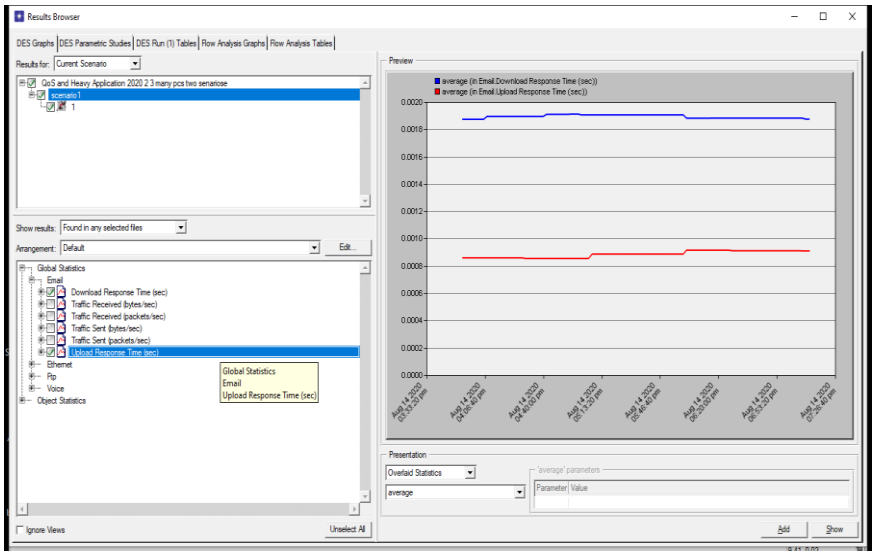

Fig. 30, Email applications upload/download response time for global statistics measured by seconds in the same chart. The download value stabilized around 0.0009 second and the upload value stabilized around 0.0019 second, that is because the upload response comes from the network device itself (stating of establishing query) but the download starts when the other device responded to the query of the first device. Although the two values are acceptable for the network overall performance. The maximum value of upload reaches 0.00092 second the minimum 0.00086 the average was 0.00082 seconds, all these values is sufficient and this little amount of delay (latency) doesn't degrease the overall network performance. Point-to-point of Gigabit device shown in Fig. 31.

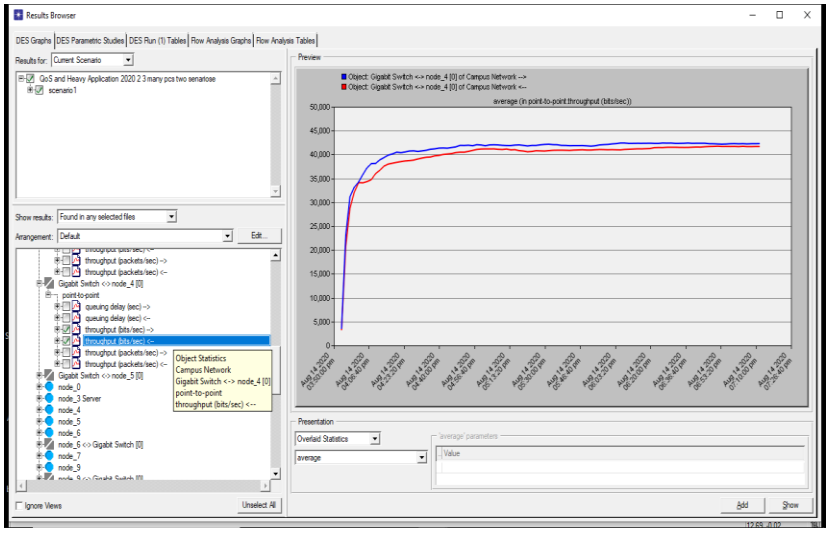

Fig. 31, Voice over IP application object statistics for point-to-point of Gigabit switch node 0 and node 4 throughput measured in bits per second. In the beginning of simulation there was a little bit difference, this difference decayed when the simulation is going through and the difference reaches Zero approximately, this mean that the two direction communication in this

sample of the network is equal and at efficient value which does make the network at high performance.

Table (1) Data traffic send/receive for global/object minimum maximum rate.

No.	Figure No.	Determined Result	Stabled value	Maximum value	Minimum value	Difference between values	Global or device statistics
1-	Fig. 4	Received Data rate byte per second	18000	18400	16000	1400 Byte/s	Global
2-	Fig. 5	Received Data rate *Packet* per second	220	236	200	38 Packet/s	Global
3-	Fig. 6	Sent Data rate byte per second	17700	18400	16000	1400 Byte/s	Global
4-	Fig. 15	Sent/ Receive Data as throughput *bit* per second for 1000BaseT peer-to-peer media.	42000 Sent 42000 received	43000 Sent 42500 received	38000 Sent 36300 received	4000 Bit/s 7700 Bit/s	Object Object
5-	Fig. 17	Node 0 Sent Data rate *byte* per second	42000 Sent 42000 received	3000 received 2850 Sent	38000 Sent 2400 received	4000 Bit/s 7700 Bit/s	Object Object
6-	Fig. 23	Node 0 Sent Data sent/ received *byte* per second for node 0 to node 22 party Pulse code modulation quality IP call	2850 Sent 2840 received	2950 Sent 2850 received	2600 Sent 2400 received	350 Byte/s 450 Byte/s	Object Object
7-	Fig. 24	Node 0 Sent Data sent/ received *Packet* per second for node 0 to node 22 party Pulse code modulation quality IP call node 0 to node 22 party Pulse code modulation quality	36 Sent 36 received	38 Sent 37 received	30 Sent 32.5 received	8 Packet/s 7.5 Packet/s	Object Object
8-	Fig. 25	Gigabit Node 0 Sent throughput sent/ received *bit* per second for node 0 to node 22 party Pulse code modulation quality IP call	42000 Sent 41500 received	42000 received 41500 Sent	35000 Sent 34000 received	7000 Bit/s 7500 Bit/s	Object Object

Table (2) Comparison result values of the determined Queuing time.

No.	Figure No.	Determined value	Stabled value	Maximum value	Minimum value	Difference	Global or device statistics
1-	Fig.15	Queuing delay for network (switch-computer link) point-to-point object statistics of gigabit switch	0.00000065 sec	0.00000089 sec	0.00000066 sec	0.00000023 sec	Object
3-	Fig.17	Queuing delay for object statistics point-to- point of 1000 BaseT media cable measured in second	0.000000118 sec	0.000000118 sec	0.000000118 sec	0.00 sec	Object
4-	Fig.19	voice over IP application for object statistics end -to- end packet time delay measured by seconds,	0.06 sec	0.06 sec	0.06 sec	0.00 sec	Object
7-	Fig.26	Node 19 and switch 0 are recognized as point-to- point sample for object statistics queuing delay measured in seconds.	0.000000065 sec	0.0000000875 sec	0.000000060 sec	0.000000275 sec	Object
8-	Fig.27	Another sample, node 18 and switch 0 are recognized as point-to-point sample for object statistics queuing delay measured in seconds.	0.00000072 sec	0.00000072 sec	0.000000060 sec	0.0000066 sec	Object
9-	Fig.28	Queuing delay for object statistics point-to-point of Gigabit and computer link	0.000000118 sec	0.000000118 sec	0.000000118 sec	0.00 sec	Object
10-	Fig.30	Upload / download response time for global statistics measured by seconds in the same chart.	0.00194 sec Download 0.0092 sec upload	0.00196 sec Download 0.0096 sec upload	0.00192 sec Download 0.0092 sec Upload	0.00004 sec Download 0.00sec Upload	Global

Table (3) Comparison result values of the determined time delay.

No.	Figure No.	Determined value	Stabled value	Maximum value	Minimum value	Difference	Global or device statistics
1-	Fig.16	End-to-end voice over IP packet delay in seconds	0.06 sec	0.06 sec	0.06 sec	0.00sec	Global
2-	Fig.19	voice over IP application for object statistics end -to- end packet time delay measured by seconds,	0.06 sec	0.06 sec	0.06 sec	0.00 sec	Object
3-	Fig.22	Voice over IP application for object statistics VOIP node 0 to node 22 end to – end delay party Pulse code modulation quality jiter measured in seconds	0.06 sec	0.06 sec	0.06 sec	0.00 sec	Object
4-	Fig.25	Voice over IP application for object statistics VOIP node 0 to node 22 end-to- end delay party Pulse code modulation quality jitter measured in seconds	0.0000000 65 sec	0.0000000875 sec	0.000000060 sec	0.000000275 sec	Object

Table 4 Abbreviations used in this paper.

Net segment speed	Mega Bit Per Second (Mb/second)
Jitter	(Jitter/ s)
Net segment speed	Bits per Second
Net segment speed	Packet per Second
Delay	Micro or Millisecond
Queuing delay	Second
Throughput	Bit/second
Packet time delay	Second
MOS (Mean Opinion Score)	% Percent
upload/download response time	Second
Global Statistics data received	Measured in Byte or bit / second

6. CONCLUSIONS

From the result obtained as curves which taken from Opnet simulator program showed that the byte per second send and received are wildly different when a particular application used over the network. Thus it is a benefit information to make choice or to choose the suitable bandwidth and desired upload/download for the network that needs to be implemented any network, this helps network designers to choose the low cost or high cost network devices and resources depending on the network demand that got from the application used for. So from this paper, the type of any application used is very important to saucepan the determined bite rate and network speed that measured by byte per second and Mbps which is mega bit per second and for most recent network it is Gbps. This is clear in the curves that shows the network speed by packet or byte per second so it is easy to determine the net speed by bit per second also. The delay of the email application in the result obtained also is less than the delay of end to end download response, upload response and packet delay occurred for the Voice application, all this helps the network designer to know that overall Email application is lighter for all network devices and resources so less network performance. Also the results of Global statistics show higher values object statistics for network performance factors throughput, data traffic sent and receive, in bits or bytes, packet per second, that is because the global results describe the overall determined values of the whole computer network which is a local area network for this research project, but the (Object) results show the values of the dedicated or specific device or media used in this network, Uundoubtedly it will show less values. In the end, the low network performance doesn't affect the low network demand applications like email application, but has a great influence on high demand network applications.

Approximately all the delay curves either it was global or object is stable or hasn't a major variation, the delay of dedicated node object of the network shows some opposite behaviours that is because of the demand for establishing connection to the main switch reaching application and competing to get to media. Truly, there are so many result curves used, it is important to show the deterministic results and details because the paper depends on the comparison made although the results of email application are fewer in compare with VoIP that is because that the simulator didn't provide so many email application results.

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