

## **DESIGN AND EVALUATION OF BANDWIDTH PERFORMANCE IN A COOPERATE NETWORK**

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### **ABSTRACT**

In this work we developed a corporate network consists of two separate building with four departments on different virtual local area network (VLAN) for the security purpose. We achieved this design using OPNET technology which really helped us to revealed the traffic characteristics of network just like in a real life network, the central idea of this was focused on the choice of likely bandwidth suitable for a corporate network design, this work categorically suggested that larger bandwidth is more preferable which is capable of handling large traffic volume of traffic compared to the narrow bandwidth which usually suffers from bottle neck that limits the number of the throughput at the destination.

**KEYWORD:** VLAN, Bandwidth, IP address, Traffic and OPNET technology.

### **1.0 INTRODUCTION**

In some years ago telecommunication service uses different technologies to achieve their communication means but today most of the technologies are harmonized in a single modern technology such as global system for mobile communication (GSM), internet services or voice on internet protocol (VOIP); [3] due to these massive demand imposed on communication technology makes the structure of telecommunication infrastructure and traffics becomes more complex [4] and as a result of that; communication technologies needs adequate design and proper traffic monitoring to ensure better quality of service (QoS) more especially the bandwidth [2 &6].

In this work we will consider corporate network design that consist of two separate buildings and four separate departments; each building consist of floor one and two with each department in floor. The corporate network will have administrative, sale, technical and information department.

This maybe realize by designing the corporate network and simulating its structure using OPNET technology, [5] this simulation method is chosen because it can help design the network structure, it provide information about the traffic structure and save the cost of buying and building the entire network structure.

The entire corporate network may consist of the following components [1]; many LAN segments with backbone (for example one segment on each floor or wing of different buildings), more than network protocols, area configured with Open Shortest Path First (OSPF), Dial- up connections for users who

connect from home or while traveling, Leased-line connections to branch offices, Demand-dial connections to branch offices and Internet connections.

And finally the design could be achieved using the following processes [ 6]; Planning of the network addresses for the corporate network, Routing protocols for the corporate network, Other services for the corporate network, Configuring the corporate network and Testing the corporate network.

What is really of interest in work is the bandwidth since the traffic nature is complex in other words more attention will be paid to bandwidth since it takes care of the number of traffic that will be sent and delivered to the destination. As basically know when a large number of traffic is to be transmitted over a narrow bandwidth they will be a bottleneck in the transmission hence affects the number of the throughput at the destination, this prompted the demand for this work.

## **2.0 MATERIALS, METHODS OF THE DESIGN AND SIMULATION**

### **2.1 Materials**

These consist of Router, Switches, Application Configuration, Profile Configuration, Personal Computers and Links of different types; 10kb/s and 100kb/s.

### **2.2 Method of Design**

#### **2.2.1 Address Planning**

Here we used address planning scheme with a starting IP address of 192.168.0.0/24, also create a virtual local area network (VLAN) for the purpose of management and security on each segment.

Building 1; Floor 1 is the administrative center consist of ten host users then the IP address structure will be in a range of 192.168.1.2/24 – 192.168.1.12/24 VLAN 1 while second floor which is technical department the IP address will be in different VLAN 2 with address range 192.168.2.1/24 – 192.168.2.16/24 with fifteen host users.

Building 2; Floor 2 is the sales department which consist of twenty host users then the IP address structure will be in a range of 192.168.3.1/24 – 192.168.3.21/24 VLAN 3 while second floor which is information department the IP address will be in different VLAN 4 with address range 192.168.4.1/24 – 192.168.4.6/24 with five host users. The router that connects the two building has a separate IP address 192.168.0.0/24

## **3.0 SIMULATION RESULTS AND DISCUSSION**

After achieving the IP address plan which will help in directing the packets to their destinations; an OPNET Modeler was used to realize the entire structure of the corporate network; the Application configuration its properties was set to defaults to enable us get any packet that will be needed, Profile configuration and the server were also set to support the Application configuration while the personal computers were adjusted to support the Profile. In order to test bandwidth performance two separate scenarios were considered with the bandwidth of 10kb/s and 100kb/s.

First Scenario a 10kb/s bandwidth was used on the developed corporate network where some global statistics were imposed to see how the traffic are successfully send to their destination for example database, email, file transfer protocols and delay in the transmission was also noted while in the second scenario a 100kb/s bandwidth was used with the same volume of traffics and statistics, the details are shown in the figures below.

Figure 1; described the amount of the packets received in the corporate network where the brown color graph represent the packets received through 10kb/s bandwidth while blue graph represents packets received through 100kb/s as it can be seen the packet received through 10kb/s bandwidth which indicate that more packets are likely to be drop in 10kb/s bandwidth than 100kb/s bandwidth.

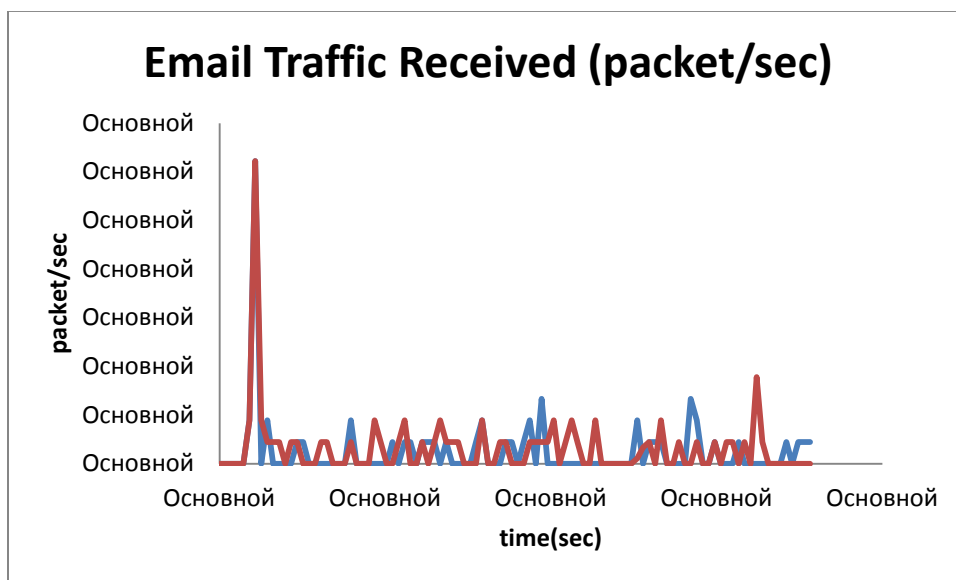


Figure 1: Email Traffic Received (packet/sec)

Figure 2 and 3; represents packet delayed during the transmission as we can clearly see that at average the packets were more delayed through 10kb/s bandwidth with a average delay of 0.004 bits/sec than thus packets arrived through 100kb/s with almost no delay

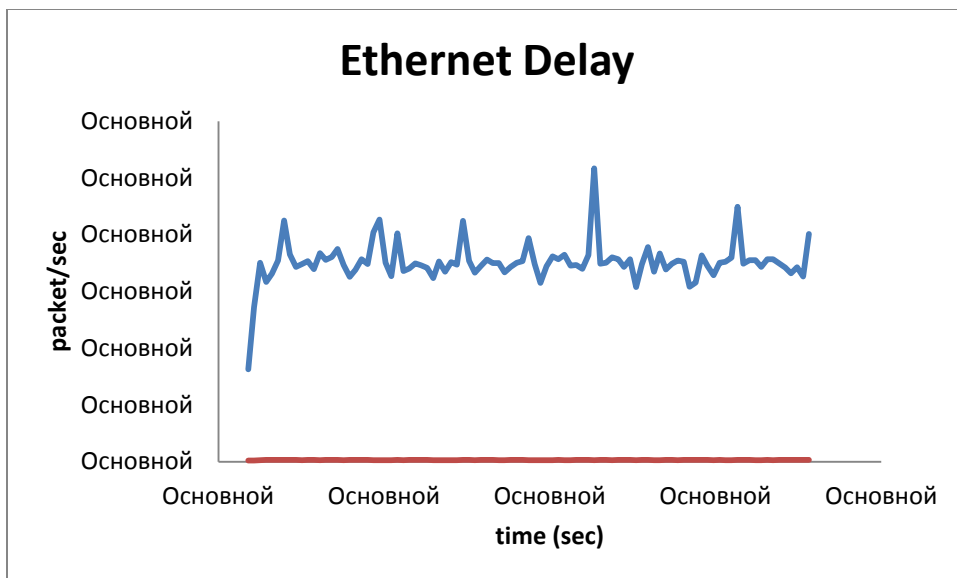


Figure 2: Ethernet Delay

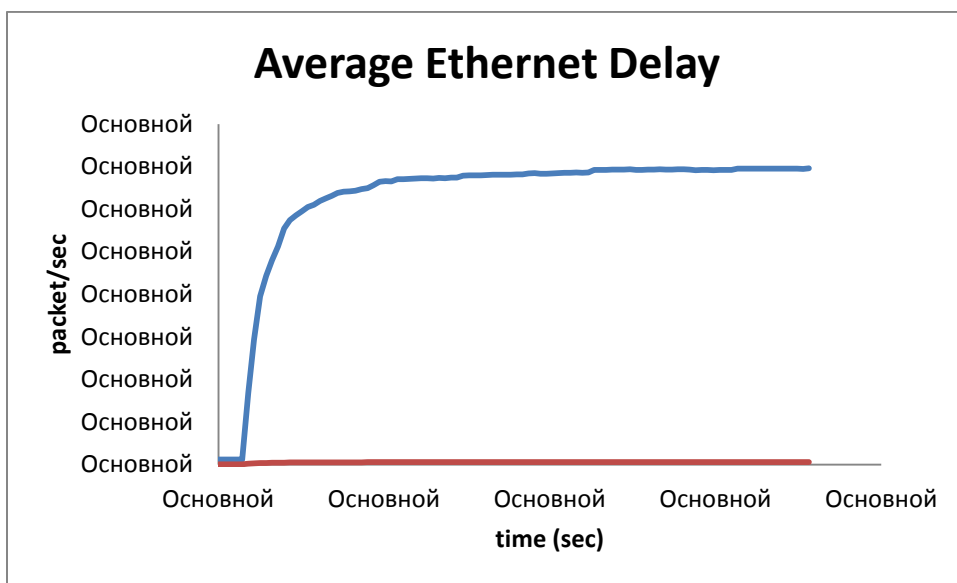
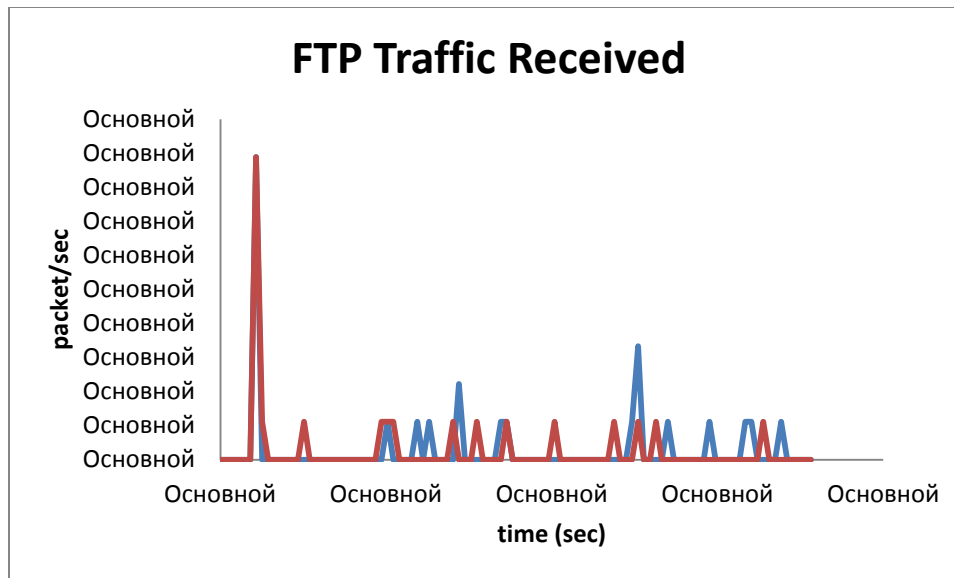


Figure 3: Average Ethernet Delay

Figure 4; represents the file transfer protocol received here also shows that packets that comes through 10kb/s more likely to be drop than the packet that comes through 100kb/s.



**Figure 4:** FTP Traffic Received

## CONCLUSION

A corporate network had been designed, simulated using OPNET modeler and various traffic such as email, Ethernet delay and file transfer protocol had been monitored, this research revealed that packet are more affected in narrower bandwidth than wide bandwidth. Therefore it is safe to say that when designing a network wide bandwidth should be considered but also do not forget to bear the cost in mind. We hope this research work has provided some useful information on a choice of bandwidth when designing a network.

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