

Handling the Academic Institutions' Data by Heuristic Approach

Dr.G.Sreenivasula Reddy, Dr.Pandurangan Ravi, and Dr.V.P.C.Rao

Abstract—OPNET is a network simulator which was helpful. Implementation and research work which were done on “Data Transfer Management in Educational System” which will be controlling and monitoring the data traffic throughout the network. First study was made about the working, characteristics and implementation of this simulator. Networks and System Administration was helpful in designing LAN and Project Research and Development was useful. Before starting, the work was done on how to design, how to choose devices, how to create a network and how to run the simulation. When it was started, learn about the concepts involved in LAN designing, how to connect them with security issues and how to choose the devices. With the help of Star topology, a LAN was implemented by taking the suitable devices and simulated the network showing the data transfers throughout network. The main advantage of this topology is that, if there is failure at one particular node then this failure will not affect the other nodes which are in network. The network which is designed will be having three networks. All the servers will be in university network and the other two colleges will have different LAN designs in them. The three networks are connected together with the help of star topology and data flow in these two colleges will be shown in simulation process. As redundancy is an important issue in any design, in future as this version does not support redundancy concept.

Keywords— OPNET, Simulator, Data Transfer Management, Topology, OTcl.

I. INTRODUCTION

“DATA Management in Educational Systems” discussed on the traffic flow of a network. It was prepared on various different networks by combining different networking parts and studied different networking concepts. Here few parts are covered which deal with the traffic management, redundancy issues, network design, network failure and the topologies. Wired network will be used which will have three sections. First section is for university and the other two sections are for the colleges which are affiliated to this university. The main aim of this project is to show the traffic flow in network, these three networks are connected together for data flow.

Dr.G.Sreenivasula Reddy, Professor and Principal, Vignana Bharathi Institute of Technology, Proddatur, Y.S.R. Dist, Andhra Pradesh.

Dr. Pandurangan Ravi, Professor & Principal for Chaitanya Bharathi Institute of Technology, Vidyannagar, Proddatur, Y S R District, Andhra Pradesh, India.

Prof. Dr. V.P.C.RAO, Professor & Principal for St. Peter's Engineering College Dhoolapally (P.O.), Medchal Mandal, R.R. District, Hyderabad - 500 014, Andhra Pradesh, India.

It is about managing the traffic in between two colleges and a university, three networks are chosen.

The University holds all the servers University holds all the servers. The Users from colleges communicate access information and share data among themselves using these servers. Each college has their own networks and three hubs are used to which users are connected. As router plays an important role in data transfers, they are connected to the main router, so that the traffic flow can be possible between non local networks. As Database and HTTP are few applications which students use in colleges which will be accessed from university.

Changing active and passive elements in network and then observation of the difference in each module is been studied carefully. The reasons for selecting OPNET simulator are:

1. It is much easier compared to all other simulators.
2. It saves time, as in OPNET the simulation does not run in real time. Even twenty four hours of simulation process will be carried out in couple of minutes depending on the network simulated.
3. It is easy to compare the other alternative designs.
4. It is user friendly and easy to understand.

Star topology, simplicity and good performance are the main features of this topology and these are the reasons why it is used in this design. Whole network will be running even if there is a failure at one certain point as this failure will not affect the other parts (nodes) of the network. Few of the other advantages of star topology are:

- a. Good performance in network
- b. It is reliable as if an error occurs at any one particular node then it will not affect the other nodes in network
- c. It is easy to replace and remove or install other devices

A. Motivation

The topic motivated to accomplish research and put into operations are Networks and System Administration and Project Research and Development. In Networks and System Administration a network was designed. This design consists of few networking parts which are combined together and formed a whole network. We need to make sure that the network is secured in every way users should access few things according to their priority of work and another set of rules. The Project Research and Development gave a good knowledge on research work as we were asked to do a research

work on our own topic and “Firewalls” was the topic which was selected and studied the concepts of them and the importance of firewalls in network.

II. BACKGROUND WORK

A brief research was made on few topics which were related to networking and to this well. It was started with the first topic as what exactly a network means, what is the purpose of using a network, what are the network classifications and how does it work. These topics will be helpful and also useful once designing of network is started. As wireless technologies are not supported by OPNET, this idea was dropped and made to choose another topic which can be supported by this network simulator. This idea of designing came into my mind as Networks and System Administration module was helpful for me in which we were asked to set up a LAN design for 600 users for an organization. Hence, wireless technologies are not supported by this network simulator. OPNET was downloaded successfully from its home site, with the help of few websites and articles a series of steps are followed at the time of installing OPNET[11].

Earlier stage a few random devices were selected and used in the design. Simulation of the network was done for the network which was designed and it gave an error report. As I was not aware of this simulator and how to use it, after this error report a restudy was made in which few topics were covered about how to choose devices, how to connect them and how to configure them before simulation [12] [13] [14]. Initially few devices were selected randomly and connection in between them was given. Multiple systems, switches, routers, firewalls, Ethernet and PPP. Simulation process was started and in the middle of simulation an error report was given which says that the simulation process was failed because of few reasons and the reasons was about choosing devices and the method of connection[12]. By this research work we can get some knowledge was gained on OPNET. Selection was made on the devices or designing of their own devices which are usefully for the design. Once selection of devices was completed, designing of the network was the second step. This information was about selecting the devices for network, set of rules which are to be followed while designing the network and also at starting of simulation.

Expanding of this smaller network was made into a big network by taking another network and few servers. Few systems are taken and connections were established in this network as well. Three networks are named as University, College1 and College2. Light and heavy traffic loads were selected for this network so that comparison of both the networks was done. Communication in any network is an important task. Communications may be of any type telephone calls, video calls or instant

messages. The main important things are file sharing, data transfers, exchange of software and hardware and communication in between users and networking devices.

Networking is important in any organization, grouping

devices together with the help of communicational channels which allows communication in between users and will permit the

users to share resources which are available is known as networking. It is important in design as well as users need to communicate with one another in network and data transfers should be possible and this is done only if there is communication in between users and devices.

Once network part was completed, the next step was to select the topology[4]. A study was made on different types of topologies and decided to take star topology for this design. Even topology plays an important role in any network design. Out of the several topologies star topology is selected. As in this design we are using three networks, it would be better if star topology is selected and arrange these networks according to the rules of star topology. Connecting all of these three networks together is to be done and once everything is connected according to star topology.

III. DESIGN ANALYSIS

This is the section where project will be designed using a network simulator. Once the decision is made then designing issues of the project are studied and need to describe every single detail about the design, how will be the difference in traffic load when network is light and heavy, how the design is done. Explanations about redundancy of the network which is very important in any organizational network are given. There are a number of network simulators available on online and two simulators from them are selected to design and simulate. Both of these simulators are free to download and for designing the network and simulation process after network design, one from these two simulators is to be selected. When comparison is done between OPNET and NS-2, OPNET has much more advantages than NS-2. NS-2 is one among the various network simulators which are available on internet and it uses the programming language of OTcl to describe the scenario of simulation [6][7]. NS-2 has few of the rich protocols like TCP and UDP and this simulator operates in the non real time way. OPNET is easy to learn and this saves time which is very important, explanation on the concepts of various available communicational designs are given which may be any one from LAN, WAN or WLAN and own network can be designed with the help of workstations, access points, servers and routers. Reasons for selecting OPNET simulator are discussed below:

- a. OPNET is user friendly and it will take couple of minutes to finish the simulations
- b. Usability is one of the main strength of this simulator and bigger networks can be grouped together into small subnets and hence no information will be lost
- c. OPNET is easy to understand and we can compare different networks (alternative networks) with our original network
- d. Simulations in OPNET don't run in real time as hours of simulation process can be carried out in couple of minutes

e. OPNET is speed and trial-and-error methods can also be used in this simulator to achieve goals

IV. IMPLEMENTATION

We need to add Application Config and Profile Config to object pallet as both of them are to be configured here. It is used to specify the applications that are used to configure user profiles and Profile Config describes the patterns of a group or user in terms of the applications that are been used over a particular time period. After selecting Application Config from object pallet and adding those to this network in OPNET. Once we click Application Definitions in Value column, three options will be given (Default, None and Edit). Edit option is to be selected as we are changing Application Definitions. Once we click Edit option in Value column of Application Definitions, this is the Applications Definitions Table. The number of rows which are to be created should be given.

Once the names are given, description of every single application is to be changed. The very next step after Application Configuration is Profile Configuration. Once Edit Attributes is selected, we need to select Value column on Profile Configuration as shown in above figure. Three options will be given i.e. None, Sample Profiles and Edit. Edit is to be selected from those three options as changing the attributes must be done. Once Edit is clicked in Value column of Profile Configuration, a new window will be opened which is known as Profile Configuration Table. After selecting Edit option in earlier step a new window will be opened which is known as Applications Table. After this we can config the server and the client nodes to the OPNET.

All servers are in this network and they are to be configured before starting of the simulation. As this configuration was only about Database Server, we need to configure the other two Servers as well in the same procedure which we did for Database Server. this configuration was for Database server this server has two applications which are to be configured. At the time of selecting number of rows 2 rows are to be selected and configure these two applications and then follow the same process what we did for Database server.

V. RESULT ANALYSIS

The main objective of simulation is to evaluate features of a system performance or behavior. The whole simulation models are built, then subsequently logical step is collecting the required statistics and viewing the results to achieve the operation of the models. It is a numerical variable which represents the information related to behavior of a particular link. Once the simulation comes to an end and collecting the statistics are finished. Global statistics will provide the overall network statistics it means that the global statistics describes the whole network behavior including all active and passive devices and the link behavior as well. Node Statistics will explain the individual node behavior. CPU Utilization will describe how much burden has putting on CPU by accessing the resources. CPU Utilization of three servers which are used

in network are been discussed.

Web Server:

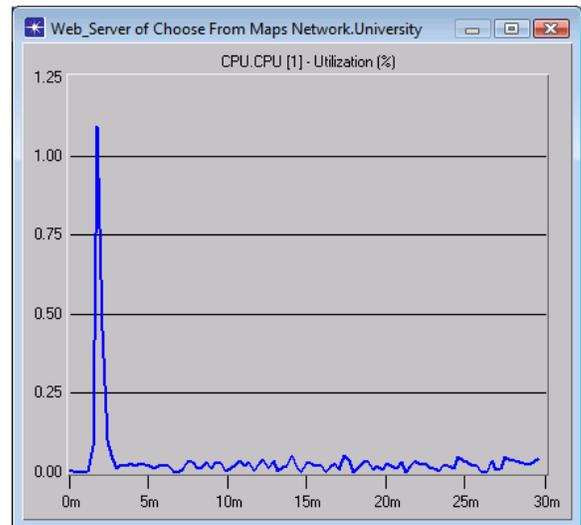


Fig.1. CPU Utilization – Web Server

Here X-axis has simulation time in minutes and Y-axis shows utilization percentage. Value is varied from 0 to 1.094 in vertically and horizontally varied from .00016 to 0.0433. Variations of the graph in different time intervals, the average of Web server utilization is 0.0363 %.

DB Server: Here X - axis has simulation time in minutes and Y- axis shows utilization percentage.

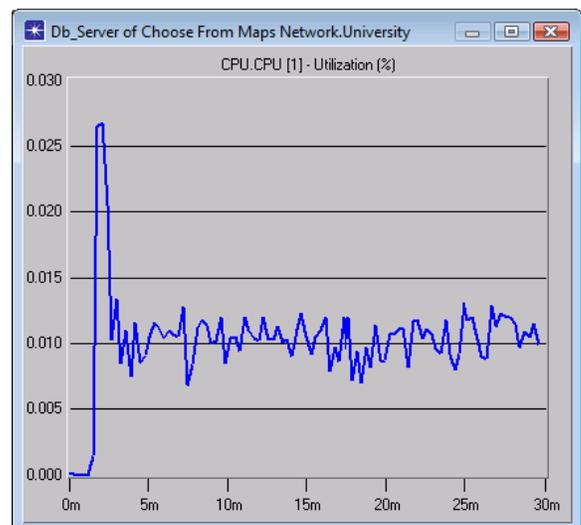


Fig. 2 CPU Utilization – DB Server

The CPU utilization value is varied from 0 to 0.0267 in vertically and horizontally varied from 0.00016 to 0.0099.

FTP Server: The graph explains about CPU Utilization characteristics of the FTP server.

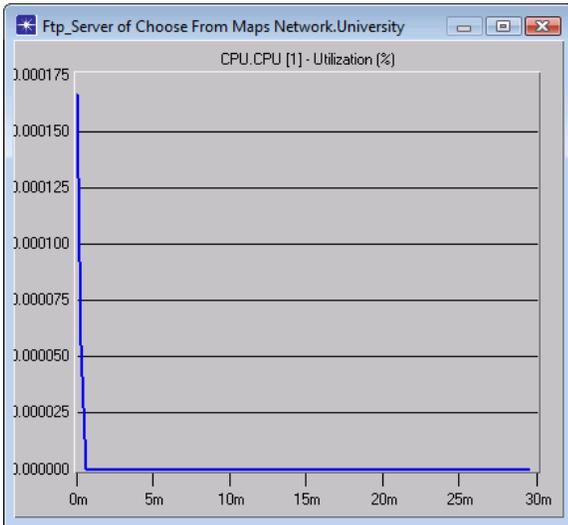


Fig. 3 CPU Utilization – FTP Server

This value is varied from 0 to 0.00016 in vertically and horizontally varied from 0.00016 to 0. Variations are very less compare to web server and DB server because FTP users are very less number (35) and FTP has only one application as file transfer. Here X axis has simulation time in minutes and Y-axis shows utilization percentage.

The Traffic flow of the network will explain how the data traffic moves from the one point to another point. The traffic flow will be measured in packets/sec or bytes/sec or bits/sec. When we want to compare results of two particular networks or two links which are connected in between university and colleges. When we select this option, a new window will be opened and there we can select the graphs which we want to see after the simulation process.

Comparisons of College1 and College2 in Light traffic network using 1000Base X: Here utilizations and throughputs of the colleges are discussed and compared with one another.

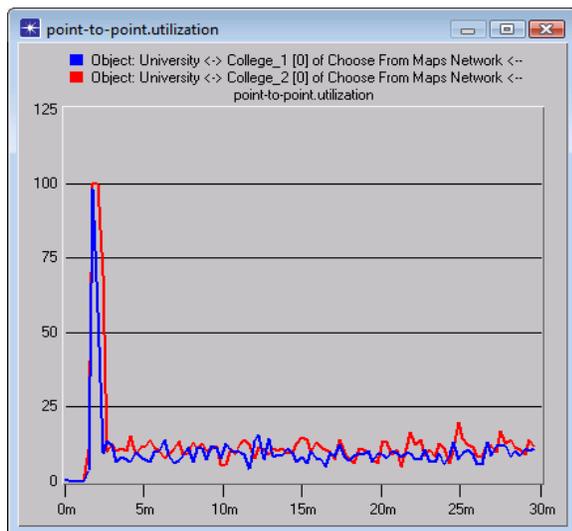


Fig. 4 Comparison of Utilizations

The graph which is about the difference in between utilization of College1 and College2. The two colleges are represented

with two different colors red and blue. Here X axis represents the simulation time in minutes and Y axis will be utilization percentage. The initial value of the graph is at 0.2833 as you can observe it in above graph and after the variations the final value is at 10.9889. The initial value of the graph is at 0.2389 and after the variations the final reached value is at 11.5409. The difference between the utilization levels of two colleges is 2.7534%. The utilization will be high in College2 when compared to College1.

Here College1 is been represented by Blue color and College2 is been represented by Red color.

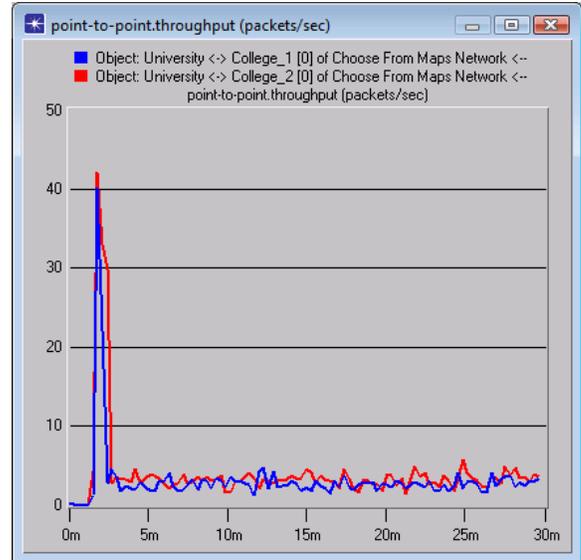


Fig. 5 Comparison of Throughputs

Here X axis represents the simulation time in minutes and Y axis will be throughput in packets. If we observe College1 graph, it started vertically from 0.0 and reached maximum till 40.1243. Coming about College2 graph, this graph vertically started from 0.0 and its peak point reached till 42.2126. By observing the above values, the difference between average throughputs of both of the graphs is 0.9372 Packets/sec.

VI. CONCLUSION

Network establishment in real time is not an easy issue and our research gave an overall idea how to create a network using on OPNET tool. The aim is to provide a solution to reviewer how to establish an efficient network to fulfill their requirement. In this paper “Data Transfer Management in Educational System”, a university network is developed with associated two colleges and discussed about data transfers throughout the network. This proposed network is similar to the real time network which has more than one branch and in few situations it will also have few additional departments in each of their branches. By maintaining data without interfere or how to segregate data of one department to other is the next important issue in real time networks and these issues are discussed in this project. The proposed will be very useful because it will make users work much more easy to understand

different corners of the network. There are several problems which may rise in network at any point of view and out of all of them. It should be make sure that gateway router should not fail at any time when network is in active state. Gateway Load Balancing Protocol (GLBP) is the concept which should be proposed in between gateway routers in the network. This protocol will also make sure that, if traffic across network is heavy then first will share this heavy traffic with the second router. As this paper does not discuss about redundancy issues of the network, they will be implemented in future

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