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Based on the OPNET Modeler V.14 NetDoctor application program package, the security policy method of switched networks

The publication is devoted to development, security of modeling technology of switched local area networks on the basis of the program package OPNET Modeler v.14. using the NetDoctor module. In this work the switched local area networks will be created using two different switching devices: hubs and switches. A hub transfers a package that has arrived at one of its inputs to all outputs regardless of the purpose of the package. On the other hand, the switch transfers the package to one or more outputs depending on the purpose of the package. In the recommended work for analysis and modeling of various networks the application program package of application program package of OPNET Modeller 14.0, performing the role of the commercial version offered free to educational use. The novelty is the method of modeling of local area networks on OPNET Modeler 14.0 with its subsequent extension and carrying out of research of modeled extended switched network.

Keywords: OPNET Modeler v.14, program package, networks, NetDoctor, traffic, modeling.

The purpose of this work is to analyze and research the simulation model in providing security for the design of switched local area networks. The development of simulation modeling in this case provides an opportunity to study the functioning of different local area networks, formed with the assistance of switches and hubs.

There is a limit on the number of nodes that can be connected with the network and the size of the area that the network can serve. Local area networks use switches to enable connection between two computers even when there is no direct connection between these nodes. A switch is a device with several inputs and outputs to which computers are connected. The main work of the switch is to accept packages that arrive at the input and redirect them to the correct output so that they can reach their recipient.

In this case, the key problem faced by the switch is the limited bandwidth of its outputs. If the packages designed to a particular output arrive at the switch and the speed of their arrival exceeds the bandwidth capacity of this output, we will get the problem of packages collision. In this case, the switch will build the packages into the queue or send them to the buffer until the problem is resolved.

In this work the switched local area networks will be created using two different switching devices: hubs and switches. A hub transfers a package that has arrived at one of its inputs to all outputs regardless of the purpose of the package. On the other hand, the switch transfers the package to one or more outputs depending on the purpose of the package.

We will further research the degree of influence of network configuration and types of switching devices on network bandwidth capacity.

We create a project to fulfill the set goals with the following actions based on the application program package OPNET Modeller 14 [1].

In the recommended work for analysis and modeling of various networks the application program package of application program package of OPNET Modeller 14.0, performing the role of the commercial version offered free to educational use. It is known that the accumulation and analysis of the passing network traffic is obligatory in the researches of various networks. The need for research on the network load arises for some reasons, including efficiency evaluation, information security, search of parts for the necessary network structure, network research, check of incoming and outgoing traffic for necessary operation of Internet connection, etc. From a small conducted information review it can be said that the application program package of the application program package OPNET Modeler 14.0 is most suitable for modeling LAN communication technology.

Due to the fact that it has a large library of various ready-made models of used equipment objects, it is possible to model almost all existing communication networks at the moment and change the model input parameters in modeling.

The Figure 1 shows the developed model of the local area network on the desktop of application program of the application program package OPNET Modeler 14.0.

The node objects are connected by a set of types of priority modules, processors, transmitters and receivers, which is a set of tools for creating, modeling and studying communication networks [2].

The novelty is the method of modeling of local area networks on OPNET Modeler 14.0 with its subsequent extension and carrying out of research of modeled extended switched network:

1. Use the application program package OPNET Modeler 14.0 and from its File menu choose New.
2. Mark **Project** by clicking on the **Ok**
3. In the **Initial Topology** dialog box, choose **Create Empty Scenario,** click **Next,** choosing Office from **Network Scale** list, click **Next** three times and then click **Ok**.
4. Close the **Object Palette** dialog box.

Network creation. We should perform the following sequence of actions for switched network creation:

1. Choose the **Topology > Rapid Configuration** menu. From the menu choose **Star** and click the **Ok** button.
2. In the **Rapid Configuration** dialog box, click the **Select Models button.** From the **Model List** menu choose **Ethernet** and click **Ok** etc.

The created network should look like shown in Figure1.

As always, you need to make sure that the project is saved.

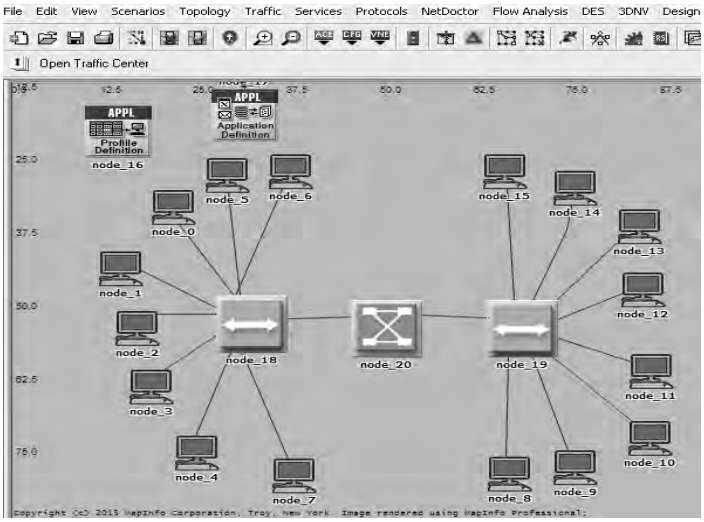

Figure 1. Switched Network

We will configure the passing network traffic

We should perform the following sequence of actions:

1. Right-click on any of the 16 stations and the Edit attributes will appear **to configure it**
2. Click the **Ok** button to close the Edit Attributes window.
3. Set by different types of traffic and its modeling

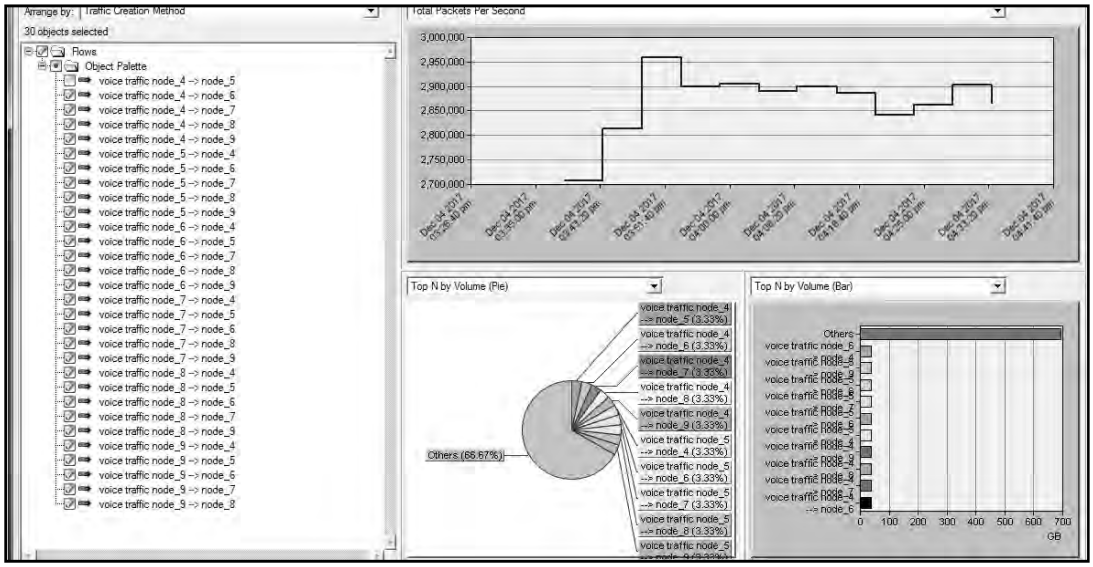

Figure 2. Modeling results of the created network

The Figure 2 shows that the transmitted load does not immediately become stable during the model time. As a result, we get Figure 3 where the results of the general modeling are visible.

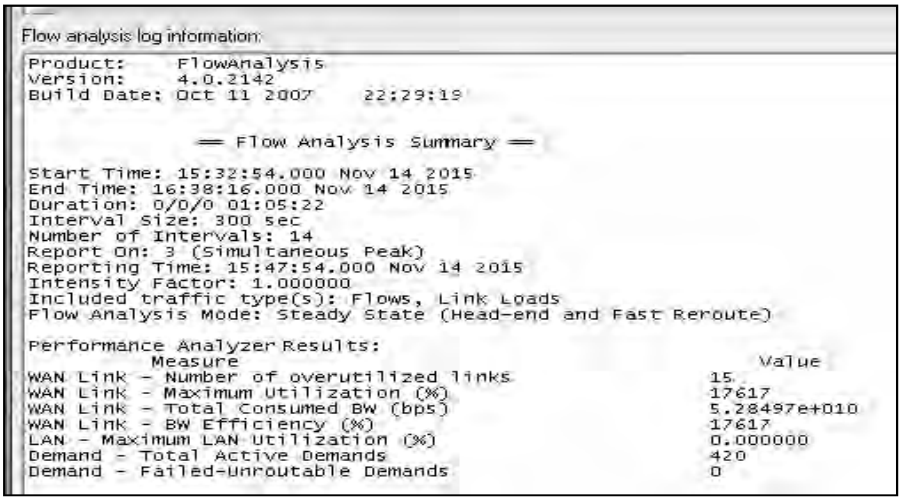

Figure 3. General Modeling Results window

In the Modeling Results window, Figure 3 shows the number of transmitted symbols over the network during the model time 5.28497e+010, the number of fulfilled requirements is –420, efficiency is –17.617 and other [3].

The Figure 3 shows that the network that was created consists of 2 hubs for connecting 16 stations and a switch. For creation of the second part of the network, we first create a network consisting of one hub and 16 stations.

From the menu Scenarios choose Duplicate Scenario.

Open **Object Palette** and make sure that **Ethernet** is chosen from the menu.

Now we will place the hub and the switch in the new scenario (Fig. 3).

For another hub addition, you need to press it to display, move the mouse to the desktop and click where you want to place the node. In the same way we will move the **Switch**. As a result, we get Figure 2.

The window for new network creation with the addition of a switch and one more hub. The results of the modeling in the new network are given in Figure 4.

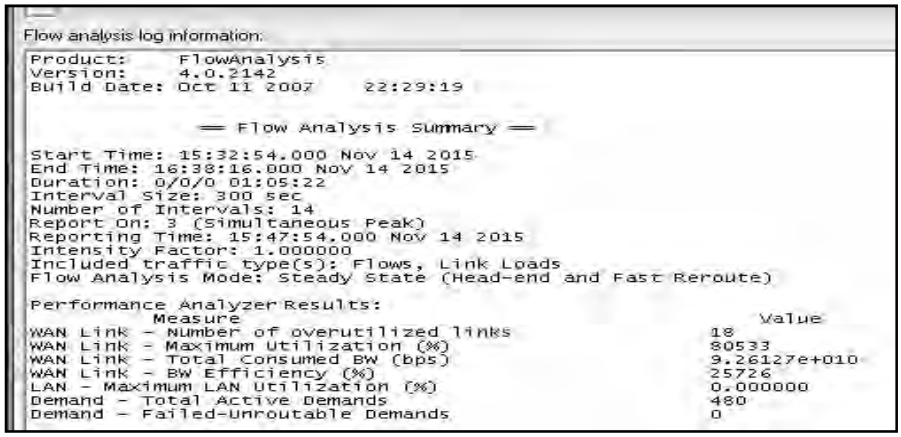

Figure 4. Modeling results in the new network

The comparative analysis between the created networks shows that the values of all parameters have grown significantly.

Now we model the **created switched network** using the **NetDoctor** module.

For its structure verification, we thereby ensure the security of the structure of its building [4]. To conduct this experiment, we will turn to the main menu OPNET Modeler and by clicking on the module NetDoctor open its window and run this module. By modeling the switched network on this module we will check its results shown in Figure 5.

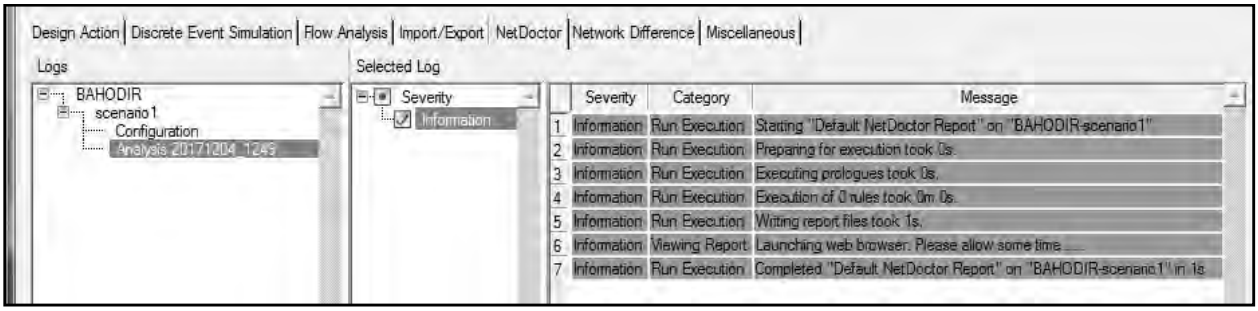

Figure 5. The modeling result of the created network on testing its security on the NetDoctor module

The Figure 5 shows that there are no errors in this network when building it, so the network is built without errors.

Conclusions

The given work can be used at carrying out of research of networks functioning with switches and at building of large switched networks. The causes when buffer becomes full are noted in the increased amount of latency on network connection (in the time of the switching table completion). The mediocre network latency decreases when the switch is added.

The modeling results using the NetDoctor module shows that the network is built without errors.

References

1 Сайт журнала «Технологии OPNET» [Электронный ресурс]. — Режим доступа: http://www.opnet.com/services/ university/itguru_acadmic_edition.html.

2 Якубова М.З. Исследование MPLS сетей на основе построения имитационных моделей / М.З. Якубова // Высшая школа Казахстана. — 2016. — № 3.

3 Якубова М.З. Имитационное моделирование коммутированных ЛВС/ М.З. Якубова // Высшая школа Казахстана. — 2016. — № 3.

4 Кислов Д.В. IP-телефония, мобильные телефоны / Д.В. Кислов. — М.: ГроссМедиа, 2007.

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Коммутацияланған желілердің қауіпсіздігін қамтамасыз ету үшін OPNET Modeler v.14.5 NetDoctor қолданбалы бағдарламасының негізінде жасалған әдістеме

Мақала құрылған жүйенің қауіпсіздігін қамтамасыз ету үшін NetDoctor модулін қолданып, OPNET Modeler v.14-те сымсыз абоненттік қатынас жүйесін модельдеуге және зерттеуге арналған. Коммутатордың негізгі кемшілігі — шығыстардың жіберу жолағының шектеулігі. Егер де пакеттер белгілі бір шығысқа арналған коммутаторға келіп түсіп және оның жылдамдығы және өткізу қабілеттілігінен жоғары болса, олардың қақтығысу проблемасы пайда болады. Бұл жағдайда коммутатор пакеттерді сақтауға немесе оларды кезекке жібереді. Бұл жұмыста екі коммутациялайтын құрылғылардың қолданылуы арқылы коммутацияланатын жергілікті-есептеуіш желілер құрылады: концентраторлар мен коммутаторлар. Концентратор кірісіне келіп түскен пакеттерді барлық шығыстарына жібереді. Әртүрлі желілерді талдау және модельдеу үшін коммерциялық түрінің қызметін атқаратын OPNET Modeler v.14.5 қолданбалы бағдарламасы қолданылды. Яғни бағдарламада дайын модельдердің көптігіне байланысты, қазіргі таңдағы барлық байланыстырушы желілерді модельдеуге және олардың кірістерін өзгертуге мүмкіндік береді. Сонымен қатар OPNET Modeler 14.0 бағдарламасы мен оның кеңейтілуіндегі жергілікті-есептеуіш желілерді модельдеудің тәсілдері мен кеңейтілген коммутацияланған желілерді зерттеу қарастырылды. Бұл жұмысты зерттеу кезіндегі желілердің жұмыс істеуін тексеру және үлкен коммутацияланатын желілерді құру үшін пайдалануға болады.

Кілт сөздер: OPNET Modeler v.14, сымсыз жергілікті желі, қосымшалар пакеті, жергілікті желілер, NetDoctor, трафик, модельдеу.

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Методика обеспечения безопасности коммутированных сетей на основе пакета прикладных программ OPNET Modeler V.14 NetDoctor

Статья предназначена для моделирования и исследования системы беспроводного абонентского доступа в OPNET Modeler v.14 с использованием модуля NetDoctor для обеспечения безопасности созданной системы. Основным недостатком коммутатора является ограниченная пропускная способность. Если пакеты поступают к выходному коммутатору, в котором скорость и пропускная способность высоки, возникает проблема — их столкновения. В этом случае коммутатор будет хранить пакеты или отправлять их в очередь. В этой работе локальные коммутационные вычислительные сети образуются с использованием двух коммутаторов: концентраторов и коммутаторов. Пакетов, поступающих в вход концентратора, направляют на все выходы. Приложение OPNET Modeler v.14.5 используется для анализа и моделирования различных сетей как коммерческого типа. То есть, благодаря большому количеству готовых моделей в программе, это позволит моделировать все существующие соединительные сети и изменять их входы. Кроме того, были обсуждены исследования OPNET Modeler 14.0 и его расширенных локальных вычислительных сетей и современных сетей коммутации. Эта работа может быть использована для проверки производительности сетей в ходе исследований и создания больших сетей коммутации.

Ключевые слова: OPNET Modeler v.14, беспроводная локальная сеть, пакет прикладных программ, локально-вычислительные сети, NetDoctor, трафик, моделирование.

References

1 Sait «Tehnologies OPNET». [Site «OPNET Technologies»]. *www.opnet.com*. Retrieved from http://www.opnet.com/services/university/ itguru_acadmic_edition.html [in Russian].

2 Yakubova, M.Z. (2016). Issledovanie MPLS setei na osnove postroeniia imitatsionnykh modelei. [Study of MPLS networks based on the building of simulation models]. *Vysshaia shkola — High School, 3* [in Russian].

3 Yakubova, M.Z. (2016). Immitatsionnoe modelirovanie commutirovannyh system LVS. [Simulation modeling of the switched LAN]. *Vysshaia shkola — High School, 3* [in Russian].

4 Kislov, D.V. (2007). *IP-telefoniya, mobilnye telephony. [IP-Telephony, mobile phones]*. Moscow: HrossMedia [in Russian].