Networking Laboratory lab manual

In our Networking Laboratory we teach OPNET basics to the students who study Telecommunications, Computer Science and Networking degrees. This tutorial gives them a basic OPNET knowledge, and the simulation concept is presented before it to achieve a global vision over OPNET software.

The main objective of this lab manual is the implementation of a scenario with OPNET IT Guru Academic Edition in order to give the students a first approach to this tool. This tutorial is divided in two parts. The first one presents an OPNET overview, showing some of the different things they can do with it, by going through different steps to obtain results from simulations with OPNET.

After the students have been in touch with the OPNET environment, they start to configure a basic network. This basic configuration lets them discover different OPNET menus and what can be done from each one.

The scenario consist of three Cisco routers, one Ethernet hub, one switch, five workstations and two switched LANs with 25 workstations each one. The students will start implementing the following topology:

![Network Topology Diagram](image)

Then, the students are asked about some problems in this configuration and are invited to solve them. In order to sort out these problems, they should look for the features of each device. Some questions about the elements of the network are done. Furthermore, they are requested to prove layer 3 connectivity between two workstations on the same LAN, and between two workstations on different LANs. The result of the first ping is obviously successful; the second one will not succeed because the devices do no have the routing information required to route the packet to its destination. This exercise will help the students to understand ICMP traffic through the net.
The second part deals with traffic routing methods, such as static routes, default gateways and routing protocols. Now, the students have to duplicate the basic scenario to configure static routes and routing protocols in separate scenarios. This will let them compare both methods and take conclusions about their utilization.

Firstly, they will start with static routes. They have to configure static routes in each needed device to make PC3 know how to arrive to the LAN of PC5. At the moment, they are not requested to configure static routes to make PC5 know the route to PC3, so the ping will not be successful since ping works by sending ICMP echo request to the target host and listening for ICMP echo response replies. They have to find what the problem is and solve it either with static routes or default gateways.
When the first scenario works properly, they should continue with the second one, where RIP is implemented. RIP is the routing protocol chosen because of its simplicity of implementation. They have to configure RIP in all the interfaces of all the routers and try again the ping between PC3 and PC5. Of course, the ping will succeed.

Now they have to obtain some graphics for the purpose of seeing the traffic generated by this routing protocol. Also, they should notice that the time between two consecutive updates is 30 seconds, as it can be seen in the graphic below.

At last, the students are asked to get the routing table from Router2 and compare it to the table they expected to have. This will be a good exercise to clarify any doubt they could have about this subject.

When the implementation of both scenarios is done, the students are asked to take some conclusions about the utilization of static routes and RIP. They have to explain briefly which method will be better in different environments. Also, they have to make a comparison between them.

At the end of this lab, the students should be able to implement and configure a basic scenario and apply their knowledge in networking to understand it.