AN Lab 1 - QoS

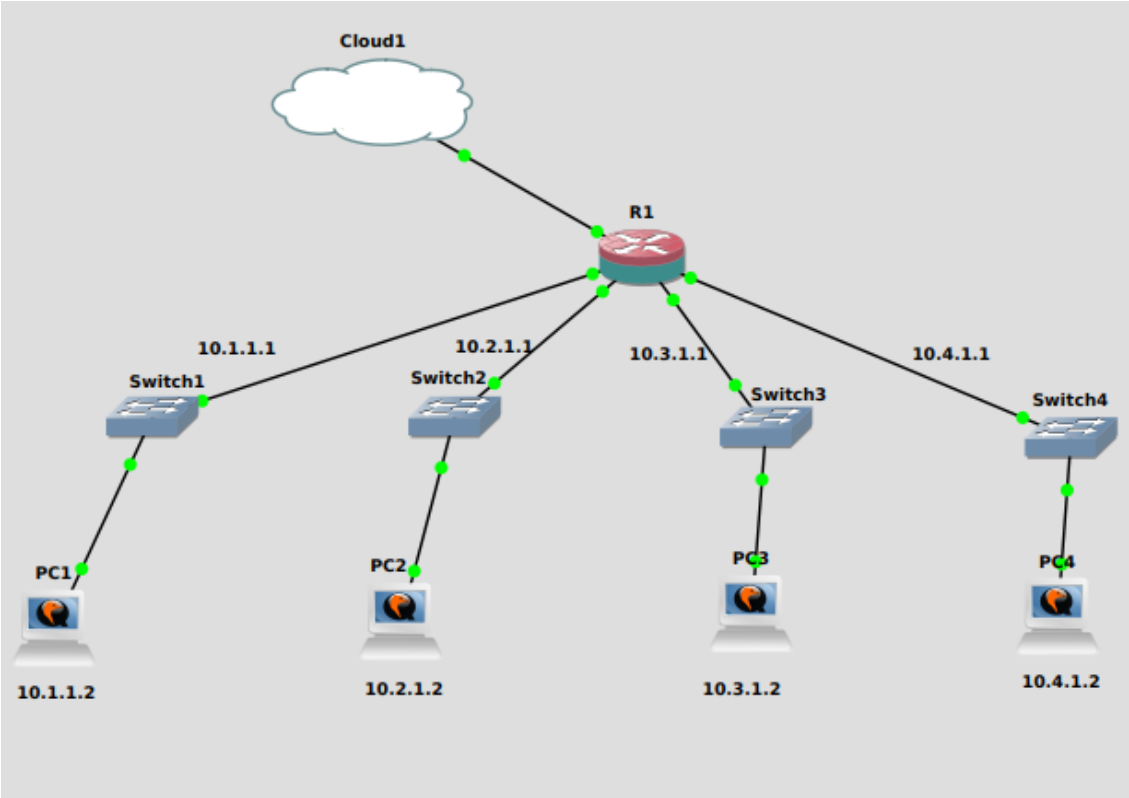
> After completing the lab, please save your project file, you may need it in the future

Overview

In this lab, you will learn one of the most important and interesting topics in Advanced Networking: ***Quality of Service****.* ***Qos*** *is a technology for providing different classes of traffic with different service priorities. You will learn speed limiting and bandwidth testing tools, Traffic shaping and Traffic Policing, traffic prioritization, learn how to apply QoS rules, learn about physical QoS metrics and answer a number of theoretical questions.*

Task 1 - Prepare your network topology

1. In the GNS3 project, select and install a virtual routing solution that you would like to use: **Mikrotik** (recommended), Pfsense, vyos and so on.
2. Prepare a simple network consisting of at least one router and two hosts. *About four hosts in the network are most optimal. You also might need Internet access for the hosts.* It may be something like this, just for the imagination:



Task 2 - QoS learning & configuring

1. Let's start with a little theory. Briefly answer the questions or give one-line description what is it: Class of Service (CoS), Type Of Service (ToS), Differentiated Services Code Point (DSCP), Serialization, Packet Marking, Tail Drop, Head Drop, The Leaky bucket algorithm, The Token Bucket Algorithm, Traffic shaping, Traffic policing?
2. Configure your network as you decided earlier. After your network is configured (don't forget to show the main configuration steps in the report), try to set a **speed limitation (traffic shaping)** between the two hosts.

*Hint: It was found that the virtual solution for the **Mikrotik router** has a "sewn" in the firmware speed limit of not more than one megabit per second, that is, in these conditions, we can only configure the speed limit of not more than one megabit per second. Try to verify this and to get around the restriction (could it have been fixed in the specific version) ? Otherwise, set the traffic limit to no more than one megabit per second.*

3. Run a bandwidth testing tool, see what is the max speed you can get and verify your speed limitation. Compare the speed between the different hosts.

   *Hint: for example, you can use **iperf3** tool.*

4. While your bandwidth test is still running, try to download a file from one host to the other host and see what is the max speed you can get. If you have more than two hosts on the network, play around with different speed values and show it.

   Hint 1: you can use any other scenario than download a file, for example, a VoIP call or streamed media.

   *Hint 2: for example, you can use **iftop** tool for speed measurement.*

5. Deploy and verify your QoS rules to prioritize the downloading of a file (or any other scenario) over the bandwidth test.

6. What is the difference between the QoS rules to traffic allocation and priority-based QoS? Try to set up each of them and show then them. In which tasks of this lab do you use one or the other? *This is mostly theoretical question.*

7. Choice and install any tool that you like for bandwidth control/netflow analysis/network control & monitoring. Play around with the tool features and show the different network metrics via GUI.

   *Hint: for example, you can use **ntopng**.*

   Bonus: try to apply and verify any QoS rule/mechanism that you are interested in (this may be your new idea or one of the QoS configuration that you set up in the lab earlier).

8. Try to answer the question: packet drops can occur even in an unloaded network where there is no queue overflow. In what cases and why does this happen?

Task 3 - QoS verification & packets analysis

1. How can you check if your QoS rules are applied correctly? List and describe the various methods.
2. Try to use Wireshark to see the QoS packets. How does this depend on the number of routers in the network topology?

Bonus - Two routers

1. Edit your network scheme to use 2 hosts and 2 routers, each one of them has a different subnet, and the 2 hosts should be able to reach each other (direct connection between the routers and static routes is more than enough) and redo task 2.
2. Do you need to write QoS rules for each router? Is there a way to let the other routers know that this packet has more priority over the other packets?
3. Try to deploy your network scheme over IPv6.