

Title: An Automated Experimental Platform to Assess QUIC in Converged Satellite-Terrestrial Networks

Objective

The scope of this project is to implement an experimental platform used to assess novel Congestion Control (CC) algorithms and other intertwined mechanisms (refer to Context) in hybrid terrestrial and satellite networks. The platform shall support the launch and control the execution of experimental scenarios, running in parallel or in sequence, collecting key performance metrics which are visualized via dedicated dashboards.

Context

The QUIC protocol has revived the interest of both academia and industry in novel congestion control mechanisms, particularly relevant when a satellite network tier is involved. Via this platform, we would like to implement an experimental environment used to assess the performance of current and new upcoming CC algorithms and their interplay with network layer ones in hybrid – terrestrial and satellite – networks. A list of non exhaustive parameters is as follows:

1. CC algorithm to be employed, e.g., CUBIC, New-Reno, BBR etc. which are already available in the linux kernel and readily used by QUIC tools such as qperf [1].
2. Type of queuing management discipline, differentiating between stateless, e.g., pfast_fifo, and stateful ones such CODEL
3. Topology of the experiment, denoting the nodes and virtual links involved, whether it includes or not a satellite segment.

No research is required on the algorithmic part, the emphasis is on the experimental platform which shall allow to assess a combination of the 1-3 parameters on well established topologies such as the one shown in the figure below.

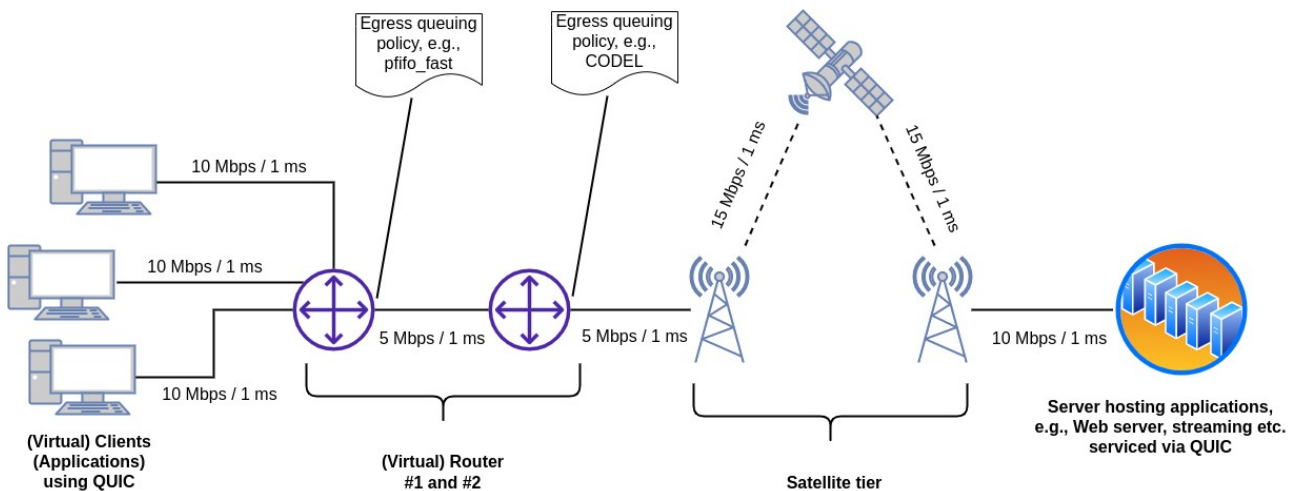


Figure 1: Reference topology.

The candidate student will be advised along the way and assisted to devise and configure the virtual network topology and its characteristics. We are interested in having a real emulated environment rather than a simulation one via e.g, NS-3 or OMNET.

Starting point

The Openbach project [2] makes for an excellent starting point, providing all the necessary wiring to automate network experiments in physical/virtualized environments. The platform comprises an experiment monitoring plane used to collect and store data, paramount to our objectives. It also includes the possibility to integrate with state-of-the-art monitoring and reporting tools such as Grafana and Prometheus.

The expected contribution is to tailor some key components of the platform to the needs of the project, along with the potential integration of reporting tools. As an optional second step, we might investigate the interplay between some of the queuing mechanisms and CC algorithms.

[1] <https://github.com/linux-rdma/qperf>

[2] <https://github.com/CNES/openbach>