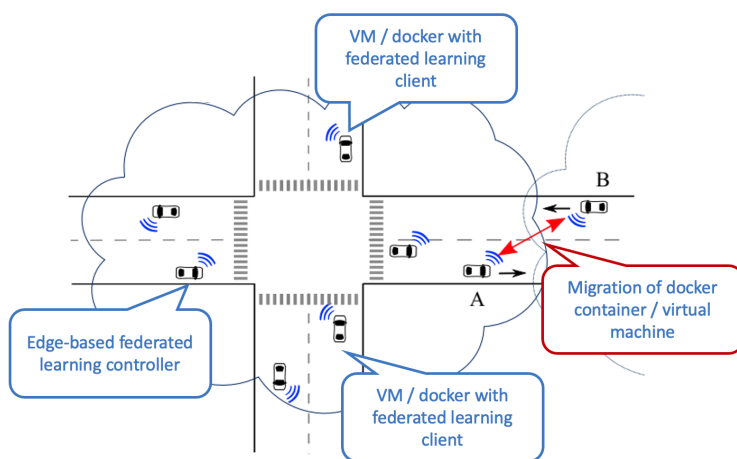


Master's Thesis

Virtual Edge Computing Testbed

Abstract

Next generation 5G/6G solutions will be based on network function virtualization (NFV), heterogeneous communication, and mobile edge computing. These new paradigms are indeed very promising to achieve ultra-low latency and ultra-high reliability, thus, enabling new services for mobile users. At the same time, vehicles are, and will ever be, equipped with new ICT capabilities and a multitude of communication interfaces. In the scope of the V-Edge concept, which aims at combining both trends, we are integrating the ICT capabilities of vehicles with those of the network infrastructure for the creation of innovative services in this domain. From a scientific perspective, we investigate the feasibility of edge-supported resource allocation and decision making for massively distributed mobile systems. Here, distributed machine learning, most importantly federated learning, is one of the most relevant applications.



Content

This thesis addresses the deployment of machine learning architectures in distributed networking environments, leveraging the NFV paradigm. The goal of this thesis is to develop a testbed, in which the mobility of users as well as the wireless communication is simulated and the application behavior is realized in form of virtual machines in a Linux environment. In particular, the thesis will focus on migrating virtual machines or containers between the Linux systems whenever users get in close proximity. As an example application, we consider a federated learning scenario.

Possible milestones are as follows:

- Literature research on containers and virtual machines as well as on 5G edge computing.
- Getting familiar with the Veins simulation framework (using SUMO and OMNeT++) and, e.g., docker containers.
- Integrating docker containers within the testbed.
- Enabling migration of docker containers or full virtual machines.
- Proof-of-concept system for federated learning as an application.
- Evaluating the proposed solutions.

Collaboration

This thesis is in collaboration with Politecnico di Torino and co-advised by Prof. Claudio Casetti. We also offer the possibility to carry out the research work partially at Politecnico di Torino in Italy.

Requirements

It will be helpful to have a basic understanding of *Telecommunication Networks*, *Virtual Machines*, *Network Simulation*, and *C++* or *Python*. In case you are not familiar with these requirements, you will need to familiarize yourself during the thesis.