Internship Position 2023

Title: Performance Evaluation of Admission Policies for Edge Compute Systems

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Description. Edge cloud computing is a compute paradigm that aims to reduce the latency required to offload compute tasks to the cloud by moving the cloud infrastructure as close as possible to end users [2]. The uptake of edge systems has been driven by both economic considerations, due to the cost of cloud services, confidentiality reasons since sensitive data should be stored locally and not released outside the owner's premises, as well as due to the aforementioned performance advantages. In this project, the edge application which will be the reference use case is that of a video analytics [1, 3]. Video analytics are applications that automatically analyze video streams to detect and determine temporal and spatial events included in these flows. These applications are complex in nature as they provide a series of configurations and parameters (e.g., bitrate of a video stream, resolution of the video, model used to extract information, etc.). Evaluating the impact of these choices on the infrastructure is key as it will determine the performance of the edge system under a given configuration for the available resources.

Development of an edge cloud computing simulator. The goal of the project is to develop a discrete event simulator to evaluate video analytics pipelines deployed on an edge cloud infrastructure. The simulator will permit to reproduce the dynamic of video flows arrivals onto the edge cloud infrastructure —and their informative content— and to compare the performance of different edge orchestration policies. Thanks to the simulator, it will be possible to: 1) simulate the performance of a given placement of processing functions (e.g., vision modules) in the edge infrastructure and 2) simulate the admission of mobile cameras based on their field of view and on video streaming parameters. Traces produced as part of an ongoing research project will be used to exploit and validate the simulator.

Simulation scenario. The reference scenario is that of a batch of applications deployed in a heterogeneous system comprising a certain number of areas, a set of available edge nodes, and a set of fixed cameras. A set of mobile cameras can migrate across the areas. Several concurrent applications for video analytics which are deployed in the form of a pipeline are distributed in the infrastructure. The cameras in each area collect video flows sourcing from fixed cameras installed locally as well as from mobile cameras traversing the tagged area. Several concurrent applications coexist.

Candidate Requirements.

- The candidate should have completed a qualifying program by the starting date of the thesis.
- Comfortable speaking English or French (French is not required).
- Notions of computer networks (as learned in the L3 Networks course).
- Python (other programming languages are accepted too but python is preferable).

What to submit. An up to date CV, university transcripts, and a letter of motivation clearly stating what the motivations to work on the described subject.

References

[1] F. Faticanti, F. Bronzino, and F. De Pellegrini. The case for admission control of mobile cameras into the live video analytics pipeline. In *3rd ACM Workshop on Hot Topics in Video Analytics and Intelligent Edges*, 2021.

[2] S. Maheshwari, D. Raychaudhuri, I. Seskar, and F. Bronzino. Scalability and performance evaluation of edge cloud systems for latency constrained applications. In *IEEE/ACM Symposium on Edge Computing (SEC)*, 2018.

[3] S. P. Rachuri, F. Bronzino, and S. Jain. Decentralized modular architecture for live video analytics at the edge. In *3rd ACM Workshop on Hot Topics in Video Analytics and Intelligent Edges*, 2021.