

Internship proposal 2016/2017

Topic: Causal Analysis of Quality of Service (QoS) metrics for modeling the Quality of Experience (QoE) of online services

Duration: 4 to 6 months

Hosting team: Muse, Inria Paris (<https://team.inria.fr/muse/>)

Apply at: <https://team.inria.fr/muse/join-us-2/>

Mentor:

Vassilis Christophides, Senior Researcher, Inria

Renata Teixeira, Senior Researcher, Inria (head of Muse team)

Keywords: Internet measurements, network diagnosis, network traffic, data analysis, data visualization

Description:

With the proliferation of media delivery services (e.g., VoD, LiveTV) and devices (e.g., tablets, smartphones) more and more users share and consume video content in their everyday activities, for example for education or entertainment. A high *Quality of Service* (QoS) is essential for sustaining the revenue of service providers, carriers, and device manufactures. Yet, the perceived *Quality of Experience* (QoE) of users is far from perfect---e.g., videos that get stalled or that take a long time to load. Dissatisfied users may change Internet Service Providers (ISPs) or video streaming services. Hence, the incentives for measuring and improving QoE are high. Video streaming services can instrument the player to directly measure *application QoS* metrics, such as startup delay or buffering events. However, ISPs can only monitor *network QoS* metrics, such as throughput or delay. Mapping network and application QoS to QoE is challenging. Different actors in the online video delivery chain (e.g., video streaming services, ISPs) have different incentives and means to measure and affect the user QoE.

The goal of this internship is to uncover statistically equivalent subsets of network and application QoS metrics to predict QoE. This analysis will provide actionable knowledge for building QoE predictors. To achieve this goal, we leverage recent advances on feature selection algorithms¹ to exploit available experimental evidence regarding the joint probability distributions of QoE/QoS metrics. This type of statistical reasoning will enable us to determine *local causal relationships* between a target QoE variable, seen as *effect*, and multiple network and application QoS metrics, seen as *causes*. To conduct this research, the internship will essentially extend the methodology of our previous work [1] with passive measurements obtained in the wild. In this respect, the student will analyze traces produced by HostView [2].²

The student should develop scientific skills on statistical analysis (local causal relation mining) and prediction algorithms (Support Vector Regression machine). If the student is interested, there is a possibility of staying for the doctoral studies after the internship.

Desirable skills:

- Comfortable communicating in English
- Knowledge of data analysis techniques
- Knowledge of network traffic measurements
- Knowledge of matlab or gnu R

References:

[1] M. Katsarakis, R. Teixeira, M. Papadopouli, V. Christophides Towards a Causal Analysis of Video QoE from Network and Application QoS ACM SIGCOMM Workshop on QoE-based Analysis and Management of Data Communication Networks (Internet-QoE 2016), Aug 2016, Florianopolis, Brazil. ACM SIGCOMM

[2] D. Joumlatt, R. Teixeira, J. Chandrashekar, N. Taft, "HostView: Annotating end-host performance measurements with user feedback", ACM SIGMETRICS Performance Evaluation Review, 38(3), 2010.

¹ <https://mpra.ub.uni-muenchen.de/72772/>

² <http://muse.inria.fr/hostview>