MIQModel: Predictive Model for Mobile Internet

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Introduction

Mobile Internet (MI) is the use of Internet from mobile devices (e.g. smartphones, laptops, tablets). Those devices are equipped with processing capacities, a battery and, at least, one wireless network interface to the Internet. The available data networks offer different **Quality of Services** (QoS) depending on the type of communication.

Our goal is to predict and enhance the **Quality of Experience** (QoE) for its user's depending the nature of data transfer (e.g. audio, video, applications) & the context of the user (e.g. moving between home and work). We focus on the QoE of MI of users in public transport.

Our method is to observe the availability of multiple services on **smartphones**, such as video & audio communication, chats, and games. We also observe network's QoS. From those observations, we will generate an MI model that will match the user need & enhance the QoE for the end user, while relying on the available QoS.

Our first observations are from the data previously collected by the mQoL Living Lab participants since 2012.

Predictive Model

Moving smartphones

4G   EDGE   4G

Service Povider

User Input :
- User feelings
- Needs : hedonic and utilitarian

Data Collection :
- Round-Trip Time
- Packet Loss Rate
- Throughput
- Location
- Cell IDs
- Screen Touches (Stress)
- Application Used

Prediction / Data Push

- Analysis
- Processing
- Prediction Engine

A logging application runs on the user smartphone collecting a plethora of data. The data are then send to the mQoL Cloud as input for the prediction engine. The prediction are made before a specific event. It allows the smartphone to prepare for a poor network signal and take pre-emptive action.

mQoL

Mobile Communications and Computing for Quality of Life Living Lab European Network on Quality of Experience

- Launched in March 2012.
- Currently 48 participants using transport from, to and in Geneva.
- Each participants has a smartphone (Nexus 5 or Nexus 5X) with the mQoL logging application.

European Network of Living Labs

Acknowledgement

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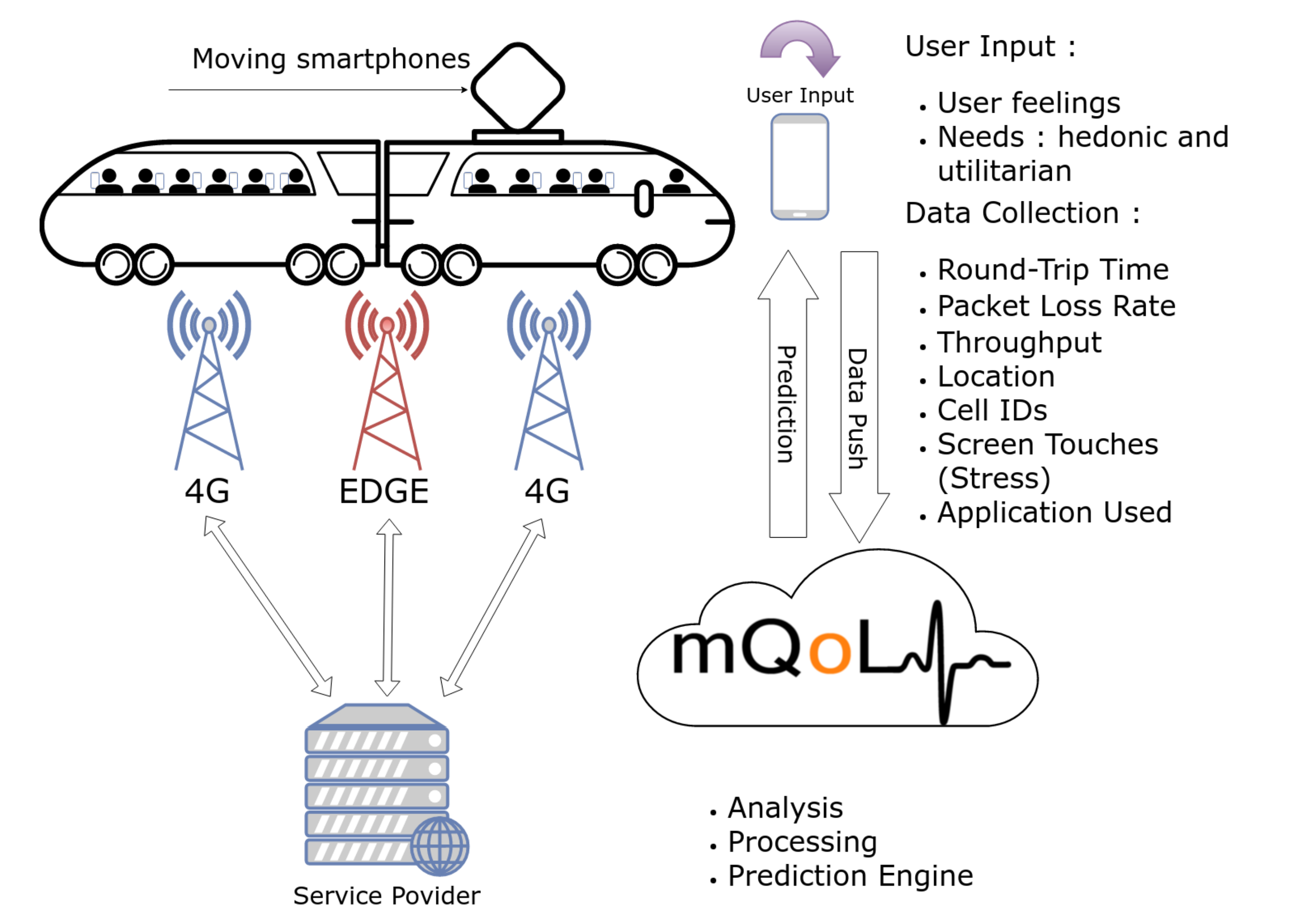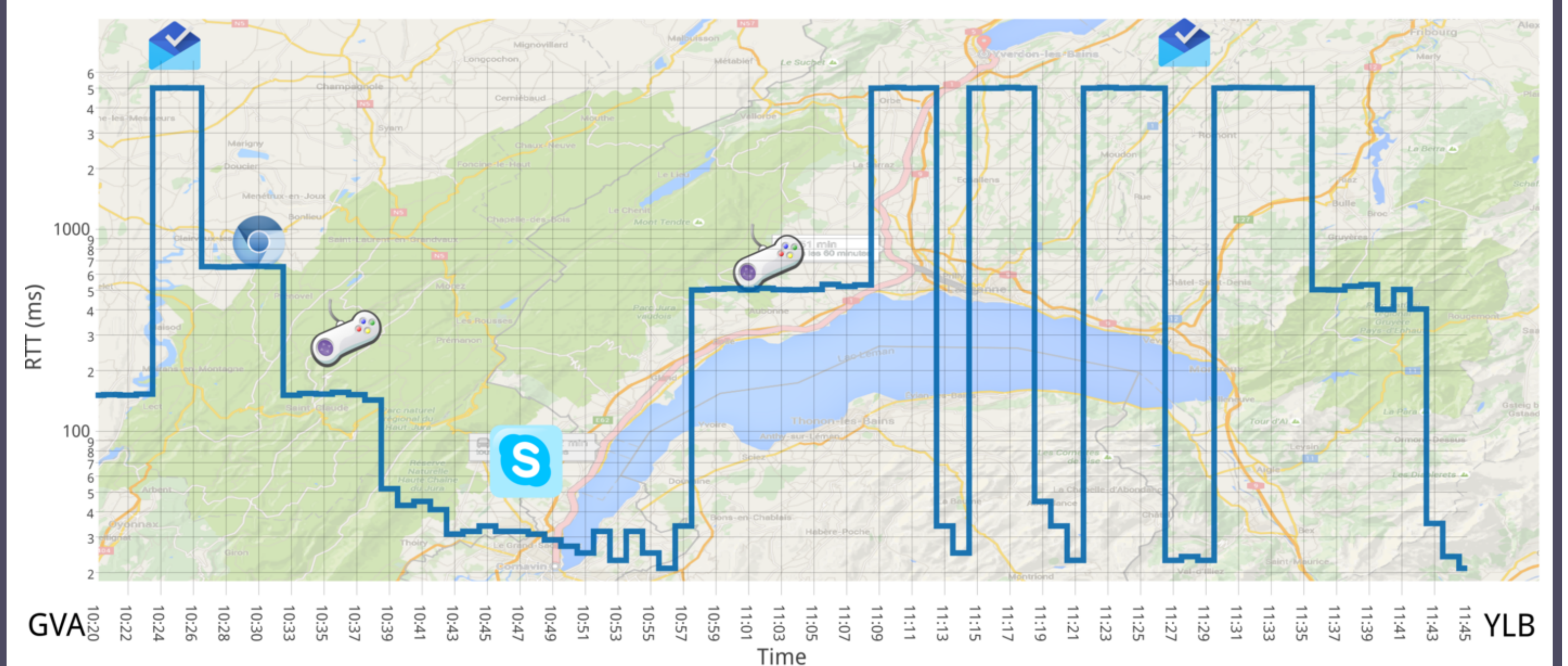**CENTRE UNIVERSITAIRE D'INFORMATIQUE**

Quality Of Service & Quality Of Experience

QoE is defined by Qualinet (European Network on Quality of Experience in Multimedia Systems and Services) [3] as the degree annoyance of the user of an application or service. It integrates the technical metrics of QoS and the perceptual feeling of the user.

The QoS metrics are important to obtain an overall view of the network state and ability to handle the load. The **Packet Delay Variation** [1], **Packet Loss Rate** & **Round-Trip Time** [2] have a important impact in interactive real-time application, e.g. Skype, Hangout, Netflix.

Depending on the data to transfer, the techniques to maximize QoS are different, e.g. for video streaming the method is HTTP Adaptive Streaming (HAS). The adaptation of the source signal to the medium of communication allows the end user to have a better experience of the media [4].

Example : User's QoE in train

The data provided by the mQoL logging application allows our system to know if the user's Internet connection is impacted by its movement. We look at the state of the user, at the metrics of the network available and the user inputs on the smartphone.

Round-Trip Time during train trip from Geneva to Yveron-Les-Bains:

The user is unable to use online application (Skype, WhatsApp, Netflix) during multiple intervals. The Quality of Experience is impacted.

Future Work

In the future the prediction engine will be deployed directly on the smartphone and will enhance the user QoE multiple: caching data, transparent handover and so on.

References

[1] Carlo Demichelis and Philip Chimento. IP Packet Delay Variation Metric for IP Performance Metrics (IPPM). Technical report, The Internet Society : Network Working Group, 2002.

[2] Michaut Fabien and Francis Lepage. Application-oriented network metrology: metrics and activemeasurement tools. *IEEE Communications Surveys & Tutorials*, 7(2):2–24, 2005.

[3] Patrick Le Callet, Sebastian Möller, and Perkis Andrew. Qualinet White Paper on Definitions of Quality of Experience. *European Network on Quality of Experience in Multimedia Systems and Services (COST Action IC 1003)*, (March), 2012.

[4] Michael Seufert, Sebastian Egger, Martin Slanina, Thomas Zinner, Tobias Hobfeld, and Phuoc Tran-Gia. A Survey on Quality of Experience of HTTP Adaptive Streaming. *IEEE Communications Surveys & Tutorials*, 17(1):469–492, 2015.

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