

Internship proposal 2017/2018

Topic: Monitoring and diagnosis of Internet QoE

Duration: 4 to 6 months

Hosting team: MiMove, Inria Paris (<https://mimove.inria.fr/>)

Apply at: <https://goo.gl/forms/CUYdaBmCA4iYaYpL2>

Mentors:

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Keywords: Internet measurements, Quality of Experience (QoE), network diagnosis

Description:

As our lives become more dependent on the Internet, users are increasingly frustrated when poor Internet performance prevents them from accomplishing ever-more important online activities. The Quality of Experience (QoE) when accessing the Internet is thus a key factor for today's society. Poor Internet QoE is frustrating in particular for most Internet users who are not tech savvy and hence cannot diagnose---let alone fix---problems by themselves. Hampering attempts to diagnose QoE is the fact that Internet services and their interactions with the networks they use have become increasingly difficult to predict, e.g., due to proliferation of proxies and caches at the network core and of home wireless and 3G/4G access. It is hard even for networking experts to fully diagnose and fix problems. When users get frustrated with degraded QoE, they may stop using services, and companies get the blame (and possibly lose money). Despite the importance of QoE, we have a poor understanding of how to measure QoE or isolate the impact of network/application-layer decisions on QoE.

The goal of this internship is to develop methods to diagnose QoE impairments. Some examples of potential root causes are: client is slow or lacks enough resources; home network is congested or home wireless signal is weak; access link to home is congested; ISP is throttling traffic; interconnect between ISP and next-hop AS is congested; server is overloaded; or application is self-limiting. Distinguishing among this list of potential root causes requires instrumenting multiple vantage points and test different layers of the protocol stack.

To disentangle the root causes behind QoE impairments, we are working to design a measurement methodology that combines a variety of existing and new measurement tools to isolate potential problems. In particular, we are leveraging (1) HostView to understand low-level issues on the end host [3], (2) the Fathom Firefox plugin [1], which performs passive Web performance measurements, lightweight pings and traceroutes, as well as queries the OS for wireless quality metrics and system performance; (3) application-layer QoE statistics such as video-streaming performance from YouTube and Netflix APIs; (4) home network diagnosis tools that include an OpenWRT package that runs on commodity home routers [7] and extensions to Fathom that allow multiple devices in the home to collaborate to identify performance bottlenecks; (5) wide-area network measurements available at RIPE Atlas, M-Lab; (6) record/replay network analysis [5] using co-located server measurements, e.g., for differentiation and application self-throttling. During the internship the student will enhance existing tools and develop methods to correlate results from different tests and vantage points to narrow down the root cause. The work will progress iteratively. We will start with controlled experiments to identify strategies to combine measurement data to isolate root causes. Then, we will collect data "in the wild" to see how well such strategies work and evolve the strategies progressively.

The student should develop scientific skills on Internet measurements and data mining as well as scientific writing and presentation. 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 network measurements
- Knowledge of data analysis techniques
- Knowledge of matlab or gnu R

References:

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- [2] D. Joumlatt, J. Chandrashekar, B. Kevton, N. Taft, and R. Teixeira. Predicting User Dissatisfaction with Internet Application Performance at End-Hosts. in Proc. of IEEE INFOCOM (mini-conference), 2013.

- [3] D. Joumblatt, R. Teixeira, J. Chandrashekar, and N. Tatf. HostView: Annotating end-host performance with user feedback. in Proc. of ACM HotMetrics workshop, 2010.
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- [6] A. Molavi Kakhki, F. Li, D. Choffnes, E. Katz-Bassett, and A. Mislove. BingeOn Under the Microscope: Understanding T-Mobile's Zero-Rating Implementation. In Proc. Of Internet-QoE, 2016.
- [7] S. Sundaresan, N. Feamster, and R. Teixeira. Home Network or Access Link? Locating Last-Mile Downstream Throughput Bottlenecks. in Proc. of Passive and Active Measurement Conference, 2016.