

Poster: Context-Triggered Mobile Network Measurement

Shichang Xu* Ashkan Nikravesh* Hongyi Yao* David R. Choffnes† Z. Morley Mao*
*University of Michigan †Northeastern University

ABSTRACT

While the availability and accessibility of cellular network connectivity have improved in recent years, our ability to diagnose and debug network problems in this environment has not. One key challenge is that many of the network problems occur near the edge of the network where only mobile devices can perceive them, but network and battery resources to conduct measurements from these mobile devices are scarce. Traditional network measurement approaches that use continuous, periodic, or random measurements are either infeasible or ineffective in this environment.

In this work, we propose an alternative approach: triggering measurements based on relevant device context such as signal strength and historical performance data, which can inform decisions for when to measure current network performance. This context can be collected locally on the device as well as aggregated at a global scale to schedule measurement based on data collected from multiple devices. By carefully selecting when to conduct a measurement, and using prediction to improve the likelihood that triggered measurements will succeed, we can more reliably measure important network phenomena with less overhead. Using Mobilyzer [3] as a platform for evaluation, we propose an architecture that is sufficiently general to support a wide range of triggered measurement experiments. We demonstrate the use of this framework for measurements on mobile platforms that are traditionally difficult to capture, e.g., handoff measurement. Further, we can use the global scheduler to predict which devices will likely satisfy the preconditions for the triggered measurement to improve the measurement success rate.

Compared to previous work [2, 1, 4], ours is the first to propose a general framework to enable context-triggered mobile measurement, leveraging both local and global visibility into context while ensuring low overhead.

1. DESIGN

We design a framework that supports triggered measurement based on device context, including location, signal strength, movement and historical performance data collected from previous active measurements and passive monitoring. Figure 1 shows how the global scheduler can trigger measurements based on global context,

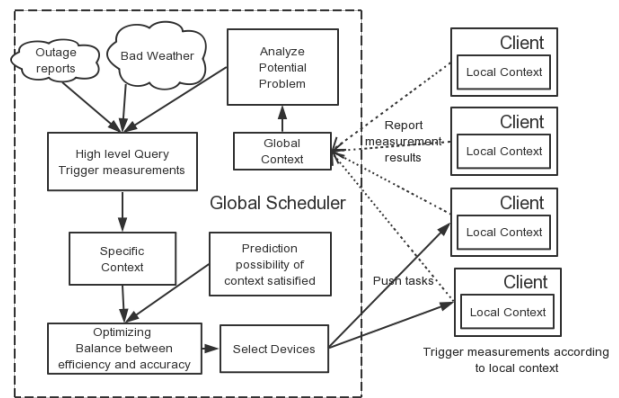


Figure 1: Framework for context-triggered measurement.

including data from multiple devices and events from external sources, such as outage reports. After receiving measurement tasks from the server, clients will listen for corresponding context-based events and trigger measurements once the precondition is satisfied.

2. USE CASE

Context-triggered measurements facilitate efficient capture of transient events. For example, handoff between different cell sectors or different access technology can have non-negligible impact on network performance metrics such as throughput and delay. Since handoffs are determined by the signal strength received by the device from each cell, we can predict the handoff by monitoring the signal strength context and trigger measurements only just before the handoff occurs to understand its impact.

3. REFERENCES

- [1] M. Allman and V. Paxson. A reactive measurement framework. In *PAM*, 2008.
- [2] A. Gember, A. Akella, J. Pang, A. Varshavsky, and R. Caceres. Obtaining in-context measurements of cellular network performance. In *IMC*, 2012.
- [3] A. Nikravesh, H. Yao, S. Xu, D. Choffnes, and Z. M. Mao. Mobilyzer: An open platform for controllable mobile network measurements. In *Mobisys*, 2015.
- [4] M. A. Sánchez, J. S. Otto, Z. S. Bischof, D. R. Choffnes, F. E. Bustamante, B. Krishnamurthy, and W. Willinger. Dasu: Pushing experiments to the internet's edge. In *NSDI*, 2013.

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage, and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s). Copyright is held by the author/owner(s).

MobiSys'15, May 18–22, 2015, Florence, Italy.
ACM 978-1-4503-3494-5/15/05.
<http://dx.doi.org/10.1145/2742647.2745905>.