Crowdsourcing Access Network Spectrum Allocation Using Smartphones

Extended Abstract

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1. INTRODUCTION

The rapid proliferation of smartphones creates both challenges and new opportunities for wireless networks. On one hand, smartphones compete for the same limited spectrum already crowded with other devices. On the other hand, because smartphones are *always on* but *mostly idle*, they are ideal for observing the network conditions on behalf of nearby active wireless devices. When used for continuous network adaptation, offloading measurements to inactive clients avoids disrupting active sessions, a capability that has not been adequately exploited by other systems using client-side feedback. When used for network monitoring and debugging, smartphones provide more valuable measurements than planned site surveys, since the data that smartphones provide is continuous and representative of wireless conditions experienced by users while surveys are neither. We refer to these approaches collectively as **c**rowdsourcing **a**ccess **n**etwork **s**pectrum **a**llocation using **s**martphones, or **CANSAS**.

We are currently developing a prototype system called PocketSniffer that implements CANSAS for Wifi networks. It collects measurements from passive smartphones to improve network performance. PocketSniffer also captures a variety of measurements generated naturally by smartphones as they discover and connect to networks—valuable data that is currently discarded.

2. SYSTEM DESIGN

PocketSniffer collects two types of measurements from clients—spectrum utilization, and network performance and healthiness information—in two different ways—synchronously and asynchronously. Figure 1 shows the main components of PocketSniffer.

Idle smartphones can be used to improve nearby device's network performance. For example, in Figure 1, when PocketSniffer Access Point (AP) sends a synchronous query about spectrum condition of the active device (e.g., a laptop), nearby PocketSniffer client (smartphone) will perform detailed measurements *on behalf of* the laptop. This information can then be fed into AP adaption (e.g., channel assignment, rate and power control, etc.) algorithms for better network performance—all without disrupting the current network session of the active client.

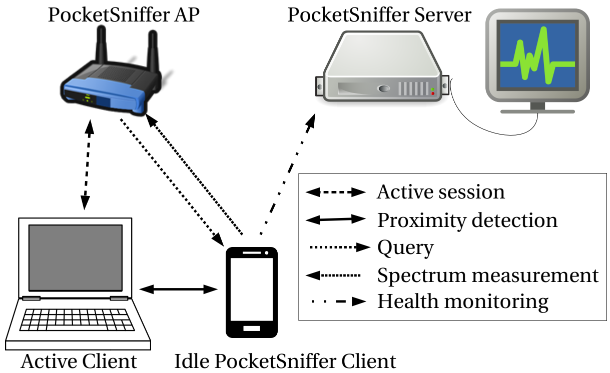

Figure 1: **System Components**

On the other hand, to cope with rapidly-changing network environment caused by mobility, smartphones already perform aggressive network exploration and thus naturally generate a flow of measurements of high temporal resolution. Harnessing this behavior for network monitoring purpose only requires to deliver the measurements to those who can make use of it. Besides, lightweight network performance tests can be conducted using smartphones' idle cycles without consuming noticeable amount of energy. All these measurements can be uploaded asynchronously in a energy-neutral way (e.g., by only uploading when phone is charging) for long-term network monitoring purpose.

3. CURRENT PROGRESS

We modified Android Wifi driver to support monitor mode, which enables the smartphone to collect detailed spectrum measurements. We have set up a group of OpenWRT APs to experiment spectrum allocation algorithms. We expect to report preliminary results to show: the value of detailed client-side measurements, the performance penalty of collecting them from active clients, and the feasibility of using smartphones to help nearby devices. We also plan to deploy our system on PhoneLab[1]—a large smartphone testbed at UB.

[1] http://www.phone-lab.org