Poster: Saving Power for Mobile Phones with Partial Wi-Fi Scans

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ABSTRACT

The Wi-Fi interface is one of the major energy consuming components in smart phones. Wi-Fi scanning process contributes significantly to this. We present a solution based on partial scan, which produces full scan results, by performing only incomplete scan process. Using a decision tree algorithm, we propose such a prediction scheme, with the help of cached scan results.

Categories and Subject Descriptors

G.3 [**Probability and Statistics**]: Probabilistic algorithms; C.2.1 [**Computer-Communication Networks**]: Network Architecture and Design—*Wireless Communication*

Keywords

Wi-Fi, Scanning, Energy Efficiency, Desicion Tree

1. INTRODUCTION

We need to keep connected to the Internet, and our Wi-Fi-enabled mobile phones help us. Most of the smart phones today remember the connected Wi-Fi networks, and automatically connect to them when in their ranges. However, to seize the connection opportunities, our phones keep scanning Wi-Fi all the time, until the phone is able to connect to a network. This scanning process drains energy. Typically, a scan happens every 15 seconds, and each time it consumes about 20uAh energy, with an average power 57% more than the non-scan state, as shown in Figure 1. Many of the times the scans are unnecessary. Works such as [2] and [1] have optimized the scan interval and reduced the times of scans using cellular information or user mobility information retrieved from sensor readings.

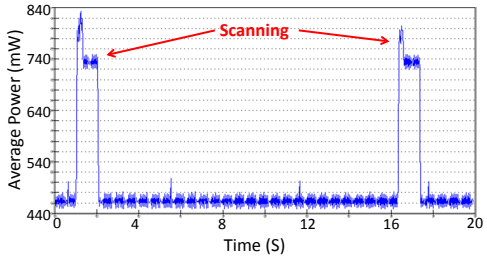

Figure 1: Scanning activity when the phone is screen-on.

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This poster attempts to solve the problem from another angle, by changing the scanning process itself. The key idea is as follows. We observe that not every Wi-Fi scan is necessary because often the Wi-Fi APs discovered from the scan are not open for free/public access. This part of the scan results are useless, and scanning them takes energy. If we can reproduce ideal scan results by scanning only a small subset of APs, we can save energy. The limited numbers of remembered networks in our phones show that we are more likely to connect to Wi-Fi networks only at certain places, such as home, cafe and office. These places always have a static set of networks, providing us the possibility to predict the rest of the scan results based on incomplete scan results.

Partial Scan - Our experiments are deployed on Nexus S phones, which use Broadcom DCM4329 chip as the network interface card (NIC). By default, the NIC listens on each of the channels (1-11) for tens of milliseconds. If during this process it hears beacons from APs on these channels, those APs are put into a result list. Then the NIC does the same process again, trying to catch some new beacons. This recurrence ends when the result list converges. We change this behavior such that the NIC stops scanning after obtaining partial results from the first round. This leads to a significantly lesser energy consumption compared to multiple (5 - 7) rounds of scan.

Prediction - If one round of partial scan contains an AP X, and if X was in the "previously connected" list, the NIC automatically connects to it. If not, we adopt a decision tree on the result set and predict the existence of an available AP in the rest of the results. If the possibility is high, we continue the rest of the full scan, otherwise, we stop this scan. For example, if a user once connected to "Starbucks" when she was in the range of "Target", later when her phone detects "Target", there will be a high chance that an available "Starbucks" network exists, even it is not in the current scan results. In this case, the phone continues the full scan. In cases where the phone does not see "Target", but see "WellsFargo", (and the user never connected to a network when "WellsFargo" shows up), the chance that any accessable network shows up is low, so the phone suppresses the rest of the scan and saves energy.

This poster shows an opportunity of utilizing partial scan results in Wi-Fi scanning. By cutting off each scan activity, we expect to extend the battery life.

2. REFERENCES

[1] K.-H. Kim, A. Min, D. Gupta, P. Mohapatra, and J. Singh. Improving energy efficiency of wi-fi sensing on smartphones. In *INFOCOM*, 2011.

[2] H. Wu, K. Tan, J. Liu, and Y. Zhang. Footprint: cellular assisted wi-fi ap discovery on mobile phones for energy saving. In *WiNTECH*, 2009.