Challenges of Smarter Power Management on Smartphones

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Problem Statement

Current State

Modern mobile phones are multifunctional programmable computers.

Many applications run in the background and collect context information:

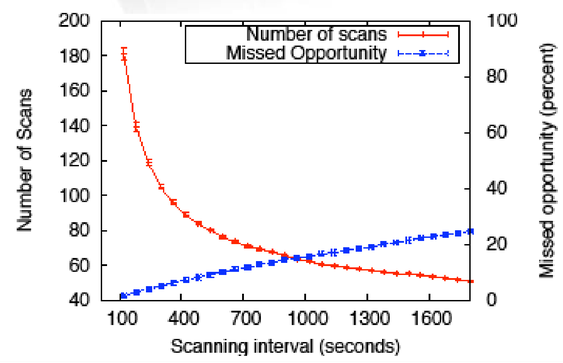
- Campaignr
- Nokoscope

Both reduce battery life to less that 12 hours.

Energy and performance trade-off

Significant power saving potential lies at the application layer. There is an intrinsic trade-off between quality and energy consumption.

Decreasing *fidelity* and *operation rate* leads to lower energy consumption, but this trade-off should be managed by the application to avoid undesirable output.



What Is Smart Power Management?

We argue that pervasive applications on smartphones should be able to adapt their operation rate and fidelity based on **users' battery life expectations.**

Users and energy management

- Users need not constantly keep track of the battery
- Users cannot be expected to manage how background applications run
- Specifying how long should the phone *run* seems reasonable expectation from the user

A smart power management system

Translates the user's battery life expectation to energy signals for *adaptive* applications.

Required models:

- Battery discharge
- Legacy applications (e.g., phone calls)
- User's charging behavior
- Energy-performance trade-off of pervasive applications

Technical Challenges

Initial study

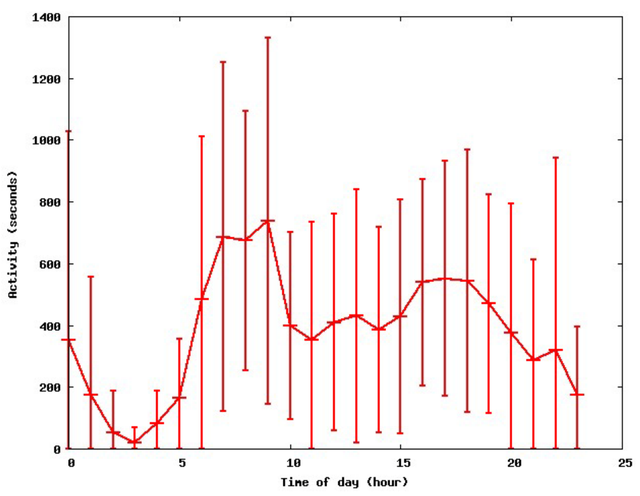
Experiment setup

- Six volunteers installed Nokoscope (Nokia Research Lab's logging platform)
- We recorded system information every 10 seconds:
  - Screen inactivity time
  - Battery level
  - List of processes

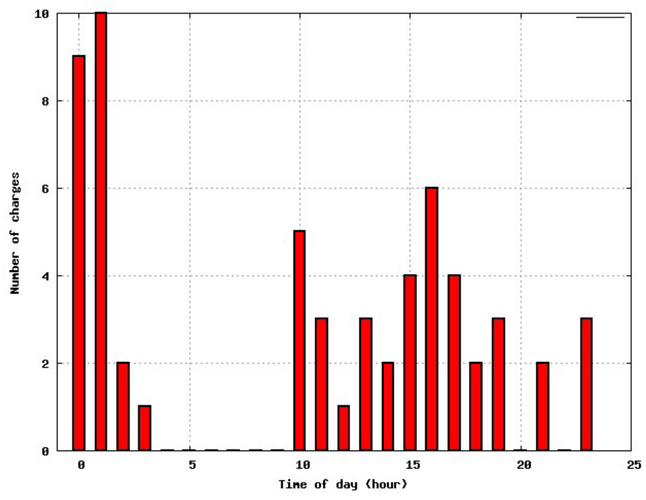
Initial findings

- To accurately model users' interaction with their smartphoens parameters other than time of day need to be considered
- Some phones return fairly granular battery information. More system support is required to build the proposed system

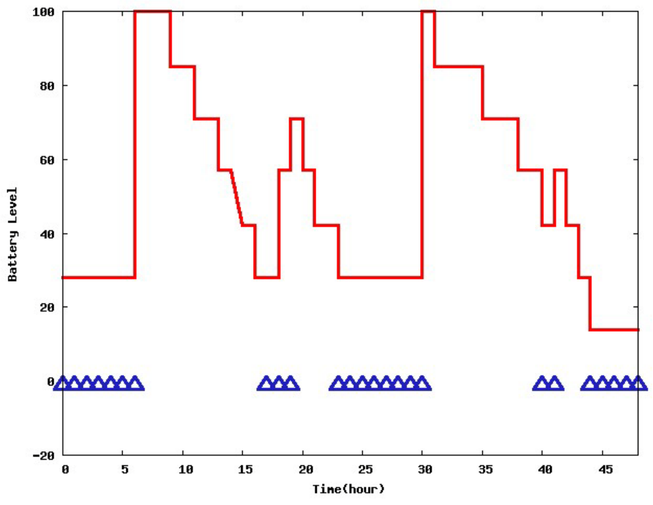
User interaction times



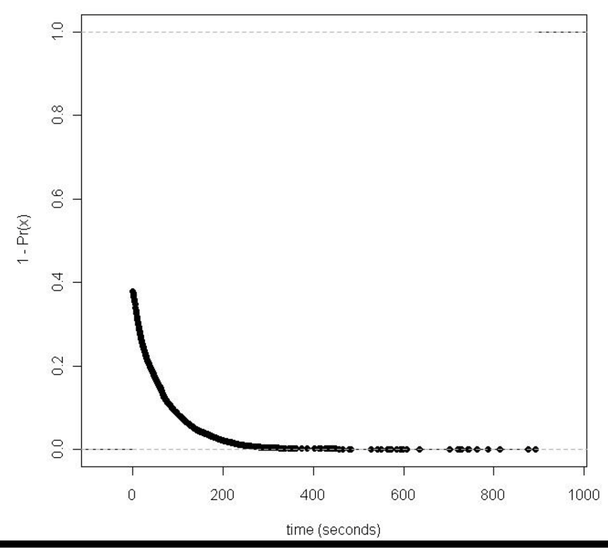
Charging behavior



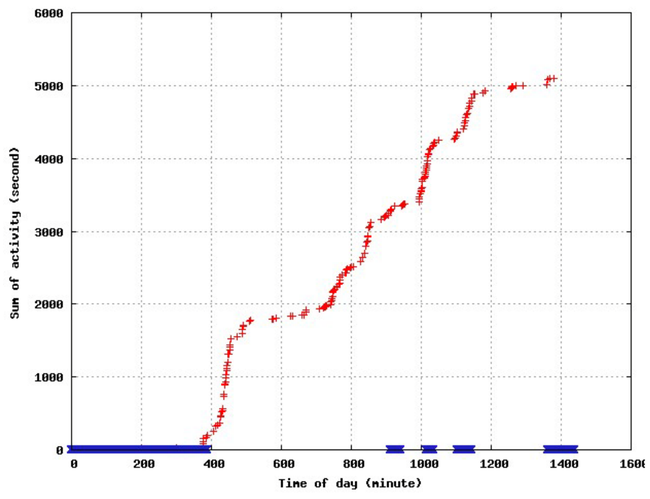
Battery discharge



CCDF of interaction times



Cumulative interaction time in a day



Future directions

- Use off-line energy profiling to augment inaccurate battery status information
- Novel methods to predict interactive usage
- Use statistical patterns of users to optimize energy consumption