Situations and Choices: Challenges and Opportunities in Mobile Software Power Management

Joseph Turner
Founder, VP Engineering
MiserWare, Inc.

In 2014 there will be more mobile phones than humans worldwide. A large percentage of these 7.2 billion phones will be performance-intensive, power-hungry smartphones, and this percentage will continue to grow for the foreseeable future. These phones alone will account for over a million metric tons of CO2 produced annually, and charging all mobile devices at a global scale will produce millions of metric tons of CO2 per year. This number will grow as mobile devices continue to become more powerful and more widespread.

From the perspective of traditional power management software, the new mobile architecture presents several new challenges. Heterogeneity of devices and device capabilities and decentralization of networking makes schedule-based models obsolete. The always-on nature of these devices and the changing conditions with physical movement makes timer-based approaches problematic. Finally, new application models make the development and deployment of systems software more difficult.

With these challenges come exciting new opportunities for large-scale energy reduction, both at the device level and across devices. Modern devices offer a bevy of new environmental inputs, from GPS to accelerometers. Along with the always-on nature of these devices, there is an opportunity to develop sophisticated models of user behavior. Perhaps the biggest new opportunity is user interest in their power consumption. Squeezing more life out of their phone battery is a much more important mission to most people than turning their monitor off at night.

Given the new challenges and opportunities of power management in mobile devices, what can software offer? Clearly traditional techniques won't work. Instead, it seems like new power management software will move in two new directions: better situational awareness and improved choice architecture. Situational awareness leverages the new sensors and behavioral models to make better power management decisions. Choice architecture optimizes the involvement of the user itself in the decisions.

Both of these techniques require full-stack integration, from chip design to circuits and sensors, from OS design to user software, from the towers that connect these devices to the servers they connect to, from the carriers to the software developers to the users. Cutting-edge power management software is beginning to incorporate these two ideas, but the approach is far from complete. Continued development at each level and cooperation among the levels is required to reach the full potential of software power management in mobile devices.

Specifically, the greatest improvement in power management will come from improvements in three key areas: new inputs, new power management controls, and new software models. New inputs can come in the form of new physical sensors on the device, of cheaper or better access

to existing sensors, or of off-device information like cell tower availability based on position. Frameworks for user interaction with the power subsystem also fall into this category. New controls can be new power management states for device hardware, better access to and control of existing power management capabilities, or feedback into off-device models. Together, these inputs and outputs form the bases for the creation of software models of situation and behavior. These models in turn illuminate opportunities for energy savings.

It's crucial to note that these models will not be effective without access to appropriate inputs and outputs. Likewise, from a power management perspective, the inputs and outputs are of limited use without sufficiently sophisticated models to offer effective control. The biggest challenge to software power management in mobile devices, then, may well be getting these disparate groups working together. The mobile world isn't going anywhere, and its growing impact is a global issue.