A cross-layer approach to manage power adaptation of application processor for smartphones

Yeseong Kim, Soohyun Nam, Francesco Paterna, Sameer Tilak, and Tajana S. Rosing, UCSD

**Motivation**

Power consumption is influenced by:
- Usage interaction for an application

**Need Comprehension Optimization**
- Comprehensive power adaptation scheme which considers both user phases and battery power to improve battery life without damaging user experience

**High-level Approach**

App phase-aware power adaptation

System usage diversity over user interaction activities
- An app is executed while going through diverse phases as a highly interaction-oriented device.
- We monitors function call traces for each phase on Dalvik VM.

**Low-level Approach**

Power conversion efficiency consideration

\[ \alpha = \frac{P}{P_0} = \text{model\_function}(P) \quad (\alpha \leq 1) \]

- Generate power conversion efficiency model based on CPU frequency

**Preliminarily Experimental Results**

Phase-aware power adaptation
- Changing the maximum frequency of Linux governor, so that it does not show any user experience degradation

**Cross-layer applications**

Comprehension power adaptation for AP
- Estimating possible frequency ranges for each usage phase by considering user experience
- Selecting a best frequency level based on power conversion efficiency model

Task scheduling for heterogeneous multicore
- Identifying user-oblivious usage phase based on phase recognition technique
- Assigning classified tasks for saving power consumption