Into the Wild: Studying Real User Activity Patterns to Guide Power Optimizations for Mobile Architectures

Aim: Suggest modifications in mobile architecture to optimize power consumption

Device used: Android G1

Basic Architecture: 2 processors, one for communication purposes and one for apps. Apps processor is referred to as the CPU here after. Supports DFS.

Technique used:

1.Power consumption was monitored using a minimal logger application that was released onto the Android Market.

2. Data for consumption of power by calls (when ringing and when the phone is actually connected), CPU , EDGE( when it is simply on and when it is on with traffic over the network) , WIFI, system processes, SD card and DSP is collected.

All the data was collected when the battery was not being charged.

3. R-tool used initially to develop a regression based power model by measuring the power consumption for the phone and using the collected statistics.

4. Power consumption for each hardware component could now be estimated using this model and its parameters.

5. The model was validated by using it on other phones which shared the same build as the training device.

Analysis: By logging usage patterns and battery consumption corresponding to it, it was determined that the screen and the CPU cause the maximum battery drainage.

Result:

1. The screen is usually active for long intervals when the device is idle. So a novel technique for reducing the brightness has been suggested. This is known as change blindness. Instead of reducing the screen brightness to a minimum value instantaneously, the brightness is reduced slowly over a period of time if the screen remains idle. This lowers the battery usage and is also suitable for the user since the human eye can easily adjust to very small changes in brightness.

2. The CPU or the apps processor supports dynamic frequency scaling and this has been exploited. A new algorithm for DFS has been suggested in the paper. The CPU frequency is not only dependent on the CPU load but also on the screen brightness. As time elapses, the CPU frequency is also decreased until a minimum frequency. And the CPU frequency is reset when the screen is completely turned off.