## **Evaluation of Software Energy Consumption on Microprocessors**

**Personnel** M. Osqui (A. P. Chandrakasan)

## Sponsorship

DARPA and Raytheon Systems Company and Miccioli Scholarship

The energy efficiency of wireless systems is an important issue. The goal of this research was to evaluate the factors that affect software energy efficiency and identify techniques that can produce energy optimal software. The following are some questions that this work addressed:

- How much energy do various instructions consume?
- How much variation exists in energy consumption across instructions? (i.e., is the amount of energy consumed per instruction dependent on the functionality of the particular instruction?)
- How can a program be more energy efficient with the knowledge of instruction energy profiling?
- What portion of total energy consumption is attributed to leakage currents?

Two state-of-the-art low-power processors were used for evaluation: the Intel StrongARM SA-1100 and the Intel XScale processor. A comprehensive profiling of the energy consumption per instruction was performed for the instruction set of the processors, while taking into account the different modes of operation. The results of this extensive profiling provided insightful information into the power consumption of the two processors under consideration. The results indicated that to a first-order approximation, optimizing a program for performance also optimizes energy.

The leakage current and current consumed during idle modes of the processors were evaluated and an analysis of how the impact on the overall picture of energy consumption was presented. Thus energy consumption was explored for the two processors from both a dynamic and static energy consumption perspective.