

Energy-aware Software Product Line Engineering

Measuring and predicting the energy consumption of variable software systems

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Motivation

In times of climate crisis and rising energy costs, savings in energy consumption are more important than ever before. Software product lines make an important contribution to resource-conserving software, as they make the development of custom-tailored and sufficiency-oriented software possible. A software product line is defined from a set of variable software artifacts, which are specified by features and which can be combined to a software variant. A feature model describes the configuration possibilities and the variability of the software product line.

Problem

While resource-conserving software can already be realized today with the help of software product lines, only little is known about the energy consumption of features and variants. Developers could make use of this information to optimize the energy consumption of their software products and to eliminate bottlenecks. In recent years, researches have proposed several techniques to statically or dynamically measure the energy consumption of software. However, these techniques are not readily applicable to software product lines because of the configuration possibilities and the resulting number of variants.

Task

The goal of this project thesis is to measure and predict the energy consumption of single features and complete variants. This includes the following steps:

- Determine a suitable measurement setup (static or dynamic)
- Select a representative set of variants using sampling techniques
- Build a training and test data set; train a machine learning model
- Evaluate the prediction accuracy

