ETH
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Swiss Federal Institute of Technology Zurich

TIK
Institut für Technische Informatik
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Computer Engineering and
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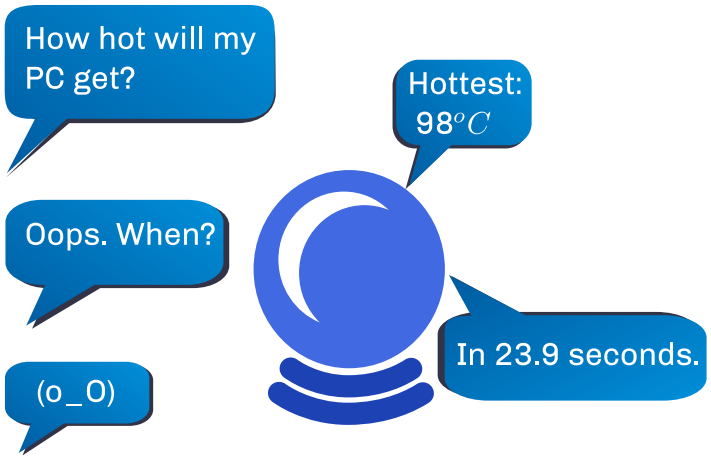
Semester/Master Thesis:

Crystal Ball, Tell me How Hot will my PC be?

Motivation and Informal Description: Computers these days feature very complex and powerful processors which can also get very hot. If a processor operates at a dangerously high temperature, or experiences rapid temperature changes over time, it is more likely to experience a thermally induced fault.

Several methods are available to keep the temperature of the processor within safe limits. One drastic method is to shut down the processor if it experiences a dangerously high temperature, causing unacceptable service disruptions. Other techniques prevent the processor from overheating by constantly monitoring current temperature and then altering fan speed, voltages and processor frequencies suitably to bring the temperature under control.



Another method is to *predict* the temperature of the processor *before* the applications are actually executed on the processor. This avoids an abrupt loss of the system, or the runtime performance loss which usually occurs with runtime temperature monitoring and control solutions. The main problem with such a method is our inability to correctly *predict* the temperature of a processor as different applications execute on it. The problem is more complex when the precise affect of cooling solutions (e.g., the fans) used in today's system is also not known.

This thesis will observe, analyze and model how the temperature of a processor is affected by various applications, their scheduling, binding as well as cooling mechanisms used in the system. The models will eventually used in the offline design space exploration process to develop clever application-to-core binding, scheduling and fan control decisions which will keep the processor within safe temperature bounds at runtime.

Task: We already have an established software and model code base which has been used to develop accurate temperature models for a Xeon server-grade processor. You will be extending the research and related software for the PC environment to also include the affect of the fans on the processor temperature. Your task will consist of the following steps:

1. Understand the current software codebase and associated temperature models.
2. Extend and improve the software codebase as necessary.
3. Develop temperature models in Matlab which accurately predict the temperature of the processor in the PC, given a set of applications, binding, scheduling and fan speed(s).
4. (Master's thesis only) Implement the control logic derived from previous steps to show the validity of the model.

Requirements: You should be familiar with C, Matlab and Java/Perl scripting. Basic knowledge of digital signal processing will be an advantage.

Interested? Please have a look at `http://www.tec.ethz.ch/research.html` **and contact us for more details!**

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