Collaborative Research Center 912: HAEC – Highly Adaptive Energy-Efficient Computing

# Towards Characterizing Video Decoding Complexity as Energy-Utility Functions

Marcus Hähnel, Björn Döbel, Michael Roitzsch, Marcus Völp

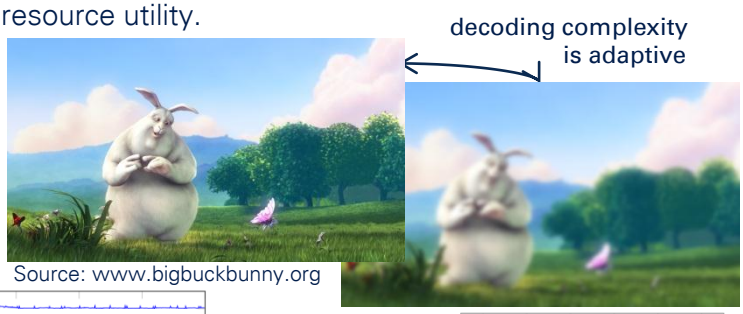
Technische Universität Dresden
Computer Science, Operating-Systems Group

The collaborative research center "Highly Adaptive Energy Efficient Systems" (HAEC) researches flexible hard- and software adaptation methods for next generation server systems. One key advantage of such high adaptivity is that the use of hard- and software resources can be tuned to the demands of various workloads and adjusted at run-time to compensate for changes in the characteristics of this workload.

Project B04 aims at characterizing the energy demand of applications and system components in terms of the utility that these applications provide. In the case of video, utility can directly be correlated to the user experience watching a particular video. Video utility is therefore a function of display brightness, resolution, sharpness and the amount of frame post-processing that is used to enhance video quality. On the other hand, video quality is easily adjustable, in particular if the video is streamed. Adjustment possibilities include sending a smaller version of the video to save network bandwidth and thereby transmission power, reducing display brightness to save display power or leaving out certain post-processing steps allowing for longer idle times and thus a reduced CPU power.

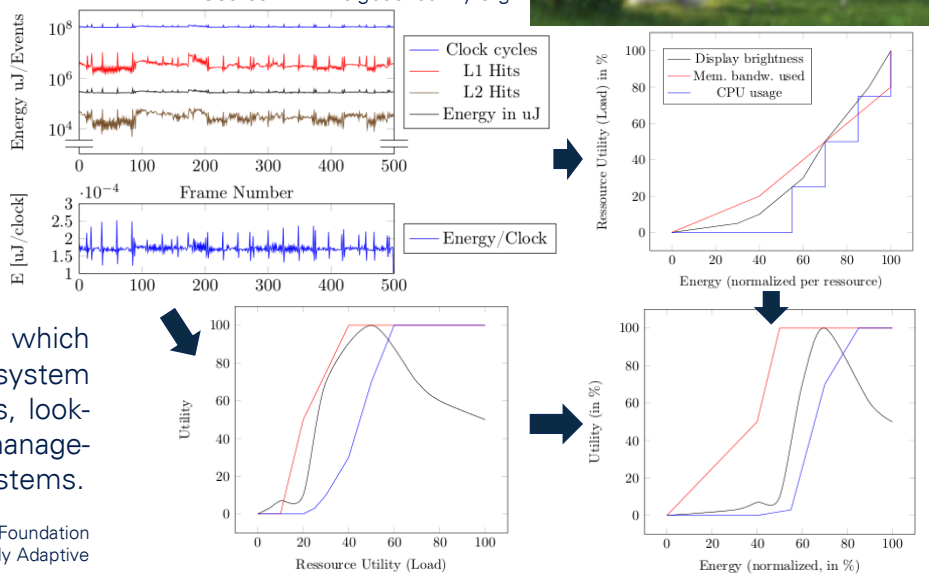
Our approach for modeling this energy-quality dependency are Energy-Utility Functions. These functions describe the utility different resource configurations may provide to an application and the energy that these configurations require. They are however also suited to describe the utility an application can provide to the user, provided it receives a certain resource utility.

As a first step towards a complete characterization of the energy utility of adaptive workloads and its resource requirements, this demonstrator shows an analysis of the energy-consumption of a video-decoding task. We show a live visualization of an energy-profile of a running video, that highlights key energy drivers




Source: www.bigbuckbunny.org

The video is presented in two different qualities. By correlating the energy effects with internal statistics obtained from the performance counters of the processor, as well as codec specific decoding information of the video, our goal is to obtain partial clairvoyance on the required energy, which would pave the way for operating-system directed hardware reconfigurations, look-ahead scheduling and power management for future energy efficient systems.

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