

Energy Consumption Analysis and Verification

(Invited Talk)

Manuel Hermenegildo^{* *}

joint work with P. Lopez^{* °},
U. Liqat^{*} and M. Klemen^{*}

^{*}IMDEA Software Institute, Madrid, Spain
^{*}Technical University of Madrid (UPM), Spain
[°]Spanish Research Council
`manuel.hermenegildo@imdea.org`

We present our overall approach to the inference and verification of upper- and lower-bounds on the energy consumption of programs, as well as some results from our tools. We translate low-level program representations into a block-based intermediate form, expressed as Horn clauses, and compute abstract minimal models of such Horn clauses on abstract domains that include resource functions on data intervals and sized shapes for structured data. The computed abstract models include, for each procedure, and for each possible abstract call state and path to it, functions that return bounds on the corresponding energy consumed for any given data size, as well as the contribution of each procedure to the overall consumption (static profiling). These analysis results are compared with energy specifications for program verification or (performance) error detection. We will present results for the energy analysis of embedded programs on the XS1-L architecture, making use of ISA- and LLVM-level models of the cost of instructions or sequences of instructions, and compare them to the actual energy consumption measured on the hardware.