DATA - FLOW COMPUTING, EXASCALE HPC FOR eSCIENCE

Veljko Milutinovic, University of Belgrade, Serbia
Fellow of the IEEE
Member of the Academia Europaea
Member of the Maxeler Senior Advisory Bord

This presentation starts with a comparison of various supercomputer types as far as the following issues: (a) Speed, (b) Power, (c) Size, (d) Programming effort, (e) Debugging effort, and (f) Compilation time. It continues with details of the Maxeler approach to data-flow supercomputing, using a number of examples. It concludes with a projection of future trends. If finishes with an elaboration of a PHD research methodology inspired by the scientific success of Maxeler (a spinn-of of Stanford and Imperial College London).

Data-Flow supercomputers for eScience compile application code down to the gate level, which helps obtain a number of advantages over ControlFlow supercomputers of the same purchasing price. Speedups, for various applications in physics/chemistry/biology, are about 20 times or more, and up to about 200 times for specific business applications, as published by JPMorgan (a 20% owner of Maxeler). Monthly electricity bills are down for the factor of about 20, which is an important issue, since the two-year electricity bills may overpass the initial investment in the case of ControlFlow supercomputers. The size reductions go down also for the factor of about 20.

Speedup related data are shown for selected applications in physics, geo-physics, banking, and econometry. A group of PhD-student researchers in Belgrade University and Ruđer Bošković Institute Zagreb now develops code for a number of new applications not covered so far. They all follow the same methodological path, the details of which will be elaborated in this talk.

Reference:

Flynn, M., Mencer, O., Milutinovic, V., et al, "Moving from petaflops on simple benchmarks to petadata on complex benchmarks,"
Communications of the ACM, to be published in late 2012 or early 2013 (unconditionally accepted)

Coauthors of the presented slides are:

V. Milutinovic, S. Stojanovic, Z. Sustran, U. of Belgrade, Serbia
O. Pell, Maxeler
O. Mencer, Maxeler and Imperial College, London, UK
M. Flynn, Stanford University