From Organic Computing to Reconfigurable Supercomputing

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Abstract: Google's yaw-dropping hit rates illustrate the pervasiveness of Reconfigurable Computing (RC), mainstream in embedded systems already for years, and now being adopted by supercomputing (Cray, sgi, etc.). From FPGA usage as accelerators, speed-up factors by up to two orders of magnitude are reported, as well as floor space requirements and electricity invoice amounts reduced by one order of magnitude. About 3 orders of magnitude and more is obtained by using coarse-grained reconfigurable datapath arrays (rDPAs) available from a number of start-ups.This is astonishing, since FPGAs and rDPAs have a substantially lower clock speed than microprocessors. Algorithmic cleverness is the secret of success, based on software to configware migration mechanisms, striving away from memory-cycle-hungry instruction-stream-based computing paradigms. The main benefit of RC platforms - having replaced the use of hardwired accelerators - is their flexibility by non-procedural programmability. This also contributes to those concepts of Organic Computing, which rely on processes of evolution, self-organization, adaptation and fault tolerance. The main hurdles on the way to heart-stopping new horizons of cheap highest performance are CS-related educational deficits causing the configware /software chasm and a methodology fragmentation between the different cultures of application domains. Current CS curricula do not sufficiently meet their transdisciplinary responsibility. The talk gives a survey on fundamental issues in RC and on new directions in CS-related curricula, focused on a dual paradigm organic computing approach.