The Tunnel Vision Syndrome: Challenging Computer Science Education

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Abstract: To cope with the 4 decades old Software Crisis, meanwhile exacerbated by including the Web Site Crisis, no really convincing solution has yet been found. A couple of years ago additional problem areas have come up: the Power Wall and the many-core-driven Parallelism Crisis – making the Software Crisis much worse.

Despite of acceleration factors by up to several orders of magnitude the FPGA share in the IC market is still below 2%. This paradox and the power wall, as well as the multicore and supercomputer programming dilemma require radically new solutions for designing and programming. Also the coming highly massive parallelism in extreme-scale computing demands an efficient elimination of all obstacles to meet unprecedented demands on data handling by a much deeper integration between applications and data throughout the entire system. This requires massive changes at all levels from compilers over execution devices down to all levels of storage behavior, challenging all disciplines from circuit design and test, up to architecture, system design, run time and operating systems, and programming. Overcoming the von-Neumann-syndrome-based mind set would be a fascinating job for computer science colleagues.

We cannot afford a further dominance of traditional reductionist approaches suffering from the tunnel vision syndrome. Fundamental misconceptions in algorithmic complexity block further progress. We must rethink all the basic assumptions. Not only to bridge the hardware/software chasm urgent curriculum revisions have become a massive challenge. We must radically reinvent computing and its education framework. We must introduce connected thinking to bridge the gaps between abstraction levels and different paradigms like between instruction-stream-based computing and data-stream-based computing including both: reconfigurable and hardwired resources. The history of computing proved, that such “connected thinking” projects can be extremely successful. The talk proposes a radical architecture-based approach for teaching design and programming of heterogeneous computing systems..

Biography: Dr.-Ing. Reiner Hartenstein is full professor of TU Kaiserslautern and independent expert and consultant of EDA, reconfigurable computing and system architecture. He is IEEE fellow, HiPEAC member, FPL fellow, SDPS fellow, and recipient of many other awards. He gave almost 200 invited talks, more than 40 invited courses, and 40 international keynote addresses. He has published more than 400 papers and authored, edited or co-edited 16 books.

As a scholar of Karl Steinbuch all his academic degrees are from EE at KIT (Karlsruhe Institute of Technology), where he later was an associate professor, working in image processing, computer architecture and hardware description languages. He was visiting professor at UC Berkeley. He appreciates more than a decade of very fruitful close cooperation with colleagues of the Karlsruhe Institute of Technology (KIT) and of the University of Brasilia (UnB).

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