Principles matter and can matter more: Big lead of PRAM algorithms on prototype-HW

Build-first figure-out-how-to-program-later approaches and vendor hardware that followed have repeatedly collided with quests for constituting parallel computing on a principled foundation. It had been difficult to argue for robustness/validity of principled insights pursued by NSF-funded research, when the only platforms available mandate overcoming not only fundamental obstacles, but also accidental design elements. For decades, these approaches have also led to crisis after crisis on performance and ease-of-programming, harmed the establishment of a solid scientific approach to many aspects of parallel computing, and skewed a formative stage in the upbringing of the next generation of parallel computing researchers.

I will present evidence that a principle-based foundation for parallel computing is feasible. In particular, recent experimental results demonstrate improvements by orders of magnitude on our explicit multi-threaded (XMT) platform over recent commercial platforms on: (i) completing speedups for the most advanced irregular PRAM algorithms in the literature was just reported in SPAA'12; and (ii) ease-of-programming, by allowing, for example, solving PhD-level problems in high school.

The biggest research challenge in the principles of parallel computing is to finally establish that principles actually matter and can once and for all remedy the ills of the field. Cheerleading industrial accidents is inconsistent with advocating principles. Advancing XMT into a serious new "stack" proposition will require a dual effort: 1. Applications. Now that XMT has delivered on its promise to effectively support PRAM algorithms, establish, at least in principle, that XMT can provide order-magnitude improvements on applications of sufficient scientific (and/or market) interest. 2. Wall-clock runtime. To be able to establish, in principle, that the XMT platform is attractive for applications, upgrade the current prototype to yield wall-clock speedups, making it appealing for application people to try it.