SCHOOL OF INFORMATICS, COMPUTING, AND ENGINEERING

DISTINGUISHED SPEAKER SERIES

Uzi Vishkin

Professor of Electrical and Computer Engineering,
University of Maryland

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Single-Threaded Parallel Programming for Multi-Threaded Many-Core Design

Abstract: Technology constraints have forced the CPUs of the 21st century to evolve into multi-cores controlled by multi-threaded programs. Common wisdom presumes that: (i) it is the responsibility of the programmer and/or algorithm design to provide this multi-threading, and (ii) it is unlikely that simple multicore scaling will provide a cost-effective path to growing performance (see the Hennessy-Patterson 2019 text). The need to cope with multi-threaded programming often puts on the programmer the onus to partition the task at hand into subtasks (threads) to be run concurrently for minimizing: (a) memory accesses beyond local (cache) memories, and (b) communication and synchronization among subtasks. Other programmers responsibilities include locking, which can be tricky for fine-grained multi-threading needed for scaling, work distribution and scheduling and handling concurrent access to data structures. Establishing correctness of these programs is yet another challenge, as asynchrony may increase the number of reachable states exponentially. Indeed, too challenging for most programmers.

I will refute both presumptions by showing that even when textbook (PRAM) parallel algorithms are expressed as single-threaded programs, they can still be automatically translated into efficient multi-threaded ones. Namely, it is feasible to achieve the best of both worlds: (i) easy programming for parallelism, and (ii) strong scalable many-core performance.

Biography: Uzi Vishkin has been Professor at the University of Maryland Institute for Advanced Computer Studies (UMIACS) since 1988. Prior affiliations included Technion, IBM T.J.Watson, NYU, and Tel Aviv University, where he was also CS Chair. Per his ACM Fellow citation, he “played a leading role in forming and shaping what thinking in parallel has come to mean in the fundamental theory of Computer Science”. Later, his team’s work on his explicit multi-threaded (XMT) many-core architecture refuted the common wisdom that the richest theory of parallel algorithms, known as PRAM, is irrelevant for practice. He is an ISI-Thompson Highly Cited Researcher and a Maryland Innovator of the Year for his XMT venture.

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