Sequential Execution of Parallel Programs :). Threads Should not Play Dice. (Keynote Talk)

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ABSTRACT

Current multicore systems are nondeterministic. Each time they execute a multithreaded application, even if supplied with the same input, they can produce a different output. This frustrates debugging, limits the ability to properly test multithreaded code and hinders fault-tolerant scenarios.

In this talk I will present fully deterministic shared memory multiprocessing (DMP). The behavior of an arbitrary multithreaded program on a DMP system is only a function of its inputs. I will explore multiple deterministic execution strategies with different performance, complexity and scalability overhead. Previous approaches to coping with nondeterminism in multithreaded programs have focused on replay, useful only for debugging. In contrast, while DMP systems are directly useful for debugging, we argue that parallel programs should execute deterministically in the field as well. I will end this talk with an overview of recent efforts in improving safety of multithreaded programs.