TUTORIAL

TEACHING PARALLEL COMPUTING

WITHOUT PARALLEL COMPUTERS

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In this presentation, we summarize our experience in teaching Parallel Computing as a part of a software engineering course at the undergraduate level. Parallel computing is no longer a concept that is explored only in research laboratories. Many industries have embraced parallel processing technology, and it is the responsibility of higher educational institutions to provide students with the knowledge and skills that they need to work in a parallel computing environment. But the question is: which environment?

Due to the high cost of parallel hardware, we use software tools that simulate parallel computing environments. We have selected Parallaxis to introduce SIMD style parallel programming, and transputers for MIMD style computations. This presentation argues also that because cluster computing is becoming more important, we as educators need to update our student's experience in concurrency and parallel processing to include cluster computing. Parallel Virtual Machine (PVM) and Linda are discussed as example cluster software systems to use in an undergraduate course. With the availability of free clusters software such as PVM, P4 and commercial cluster software such as Linda, students can solve computationally intensive problems on a cluster of workstations.

Another approach, especially suitable for students who are not yet very advanced, is the use of Multi-Pascal which is available with the text "The Art of Parallel Programming" by Bruce Lester. Multi-Pascal is capable of simulating both SIMD and MIMD style parallel programming through the use of several synchronization methods.

The presentation discusses what needs to be taught to prepare our students to be effective in parallel computing environment. We describe our cost-effective parallel computing environment that allows us to teach various parallel programming paradigms on different architectures. We discuss the topics taught in the course and give a sample of programming assignments.