Towards Adaptive MPI Programs

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Standard parallel programs are based on MPI, OpenMP/Posix threads, or a mixture of both in the case of clusters of multicore nodes. Both the current architectural trends and the non-predictable behavior of HPC applications require adaptivity from the parallel programs. Typically, the load has to be balanced at runtime, according to the CPU, Memory or Network necessities. However, the classical way to program an application with MPI/OpenMP is to divide the work among a fixed set of communicating processes (one by CPU), with inner OpenMP or threads parallelization (one thread by core). The load balance is based on the internal data structures of the program.

We will explore the different ways that MPI and/or Threads can be used to go beyond this programming model, in order to provide adaptability and dynamic control on the granularity of the parallel tasks. Two approaches will be presented and discussed: first, the use of the dynamic spawning of MPI processes, and then the online control of the mapping of MPI tasks to processes or threads. Experimental results obtained on benchmarks will also be provided. These subjects have been studied in Master and Phd thesis of the Federal University of Rio Grande do Sul (UFRGS), Brazil.

About the author:
Nicolas Maillard has graduated in 1996 in Applied Mathematics and Computer Science, at the French "Grande École d'Ingénieur" ENSIMAG (École Nationale Supérieure d'Informatique et de Mathématiques Appliquées de Grenoble) - INPG. He has obtained a Master degree in Applied Mathematics and Parallel Computing, at the University Joseph Fourier (Grenoble I), and a PhD in Information Sciences and Technologies at the same university, in 2001.

He is currently Assistant Professor at the Federal University of Rio Grande do Sul, Porto Alegre, Brazil. I am teaching Compilers and Parallel Programming. His research is in the area of Parallel, High Performance Computing. He is advising two PhD students and has advised some 10 Master students. He has published 11 papers in international conference with editorial review and 3 in international journals.
He has been referee for the journal Parco since 2007, for IEEE Trans. on Parallel and Distributed Systems, and for various conferences of HPC (Europar, CCGRID, HiPC, etc.). Finance chairman and member of the Organizing Committee of SBAC-PAD 2007.

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