Thesis Overview:

Parallel Computing in Local Area Networks

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In this thesis, parallel computing on installed local area networks (LAN) is focused, analyzing problems and possible solutions taking into account the main factors of computing and communications. More specifically, LAN are characterized as parallel computers in the context of linear algebra applications, proposing parallelization guidelines which are: specific for parallel computing on LAN, and simple enough to be applied to a wide range of problems.

Proposed parallelization guidelines are specifically applied for the matrix multiplication operation in the context of the BLAS (Basic Linear Algebra Subroutines) library. Also, the performance of resulting algorithms is verified by experimentation on homogeneous and heterogeneous local area networks. Acceptable performance is obtained in most of the experiments, using most of the available computing and communication facilities in the local area network.

In the specific context of homogeneous LAN (or clusters), the proposed approach performance is compared with the obtained by the ScaLAPACK (Scalable LAPACK, or Scalable Linear Algebra PACKage) library, which is the library with the most optimized algorithms for parallel computing on distributed memory parallel computing. Parallel matrix multiplication as well as parallel LU matrix factorization operations and/or algorithms resulted from the parallelization guidelines are compared with those implemented in ScaLAPACK. Algorithms proposed in this thesis outperform ScaLAPACK ones with percentage gains between 25% and 80%, showing that parallelization guidelines result in very good algorithms from the point of view of global performance on homogeneous clusters.

Also in this thesis a broadcast message routine is proponed and implemented, specifically oriented take advantage of the Ethernet networks which is commoly found in the LAN interconnection. It is shown by experimentation that this approach obtains most of the available performance of the interconnection network, maintaining a high degree of portability.

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