Meta-heuristic hybridization on peer to peer systems

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Abstract

There are a great number of practical optimization problems. The most part of them are NP-hard. Even if the complexity of these problems is reduced by the use of meta-heuristic and their hybridization, the use of grids and peer to peer(P2P) computing systems proves to be an efficient way to improve the performance at execution. In this work, we are interested in the design and deployment of multi-objective and hybridized meta-heuristics on such compuatational environments. The most part of existing P2P middlewares foster embarassingly parallelism : they are adapted to multi-parameters independent applications. Thus, they do not offer mechanisms allowing the communication (i.e. cooperation) between peers. A software extension is necessary to provide such cooperation. Our first contribution is to propose and to implement a model of coordination like Linda on one of these systems : XtremWeb [GF00]. The suggested extension was tested and validated on the bi-objective Flowshop problem [GLLK79]. The two optimized criteria are the completion date of treatment of the last job on the last machine (or Makespan) and the sum of the job's delays (or Tardiness).
In [M.B03], a resolution of this problem was proposed by a hybrid algorithm called Adaptive Genetic Mimetic Algorithm (AGMA). It combines a Genetic Algorithm (GA) and a Mimetic Algorithm (MA). AG uses two main parameters : an archive (Pareto front) PO∗ of not dominated solutions and a ratio P_{PO*} denoting the progression of the front PO∗. If a non significant progression is noticed, research is intensified by the application of MA to the current population during only one generation. The parallelization of AGMA relies on two layers: (1) the homogeneous AGMAs exchange a part or the totality of their associated archive Pareto PO∗ according to the insular model. (2) All local MA researchs will be concurrently performed according to the master-slave paradigm. The experiments were done on the network of nearly 120 *machines.*
In addition to the improvement of obtained results and the study of this scheme of hybridization between two optimization methods, this work allowed us first to evaluate the scalability of the hybrid multi-objective models, then to have a better knowledge about P2P computing systems and their limitations.

References

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