PARALLEL AND DISTRIBUTED EVOLUTIONARY ALGORITHMS

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Parallel and distributed computing can be used in the design and implementation of evolutionary algorithms for speedup the search, improve the quality of the obtained solutions, improve the robustness of the obtained solutions, and solve large scale problems.

From the algorithmic design point of view, we will present the main parallel models for evolutionary algorithms (algorithmic level, iteration level, solution level). We will address also:

- Parallel hybrid models with exact methods.

- Parallel models for multi-objective optimization.

- Illustrations solving large challenging applications in networks, logistics and transportation and bioinformatics.

From the implementation point of view, we here concentrate on the parallelization of evolutionary algorithms on general-purpose parallel and distributed architectures, since this is the most widespread computational platform. The rapid evolution of technology in terms of processors (GPUs, multi-core), networks (Infiniband), and architectures (GRIDs, clusters, Clouds) make those architectures very popular nowadays.

Different architectural criteria which affect the efficiency of the implementation will be considered: shared memory / distributed memory, homogeneous / heterogeneous, dedicated / non dedicated, local network / large network. Indeed, those criteria have a strong impact on the deployment technique employed such as load balancing and fault-tolerance.

Finally, some software frameworks for parallel evolutionary algorithms such as PARADISEO are presented. Those frameworks allow the design of parallel and hybrid metaheuristics for mono-objective and multi-objective optimization, and the transparent implementation on different parallel and distributed architectures using adapted middleware.