

## Software



<http://paradisEO.gforge.inria.fr>

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### Introduction

ParadisEO is a C++ white-box object-oriented framework dedicated to the reusable design of metaheuristics. ParadisEO provides a broad range of features including evolutionary algorithms (EA), local searches (LS), the most common parallel and distributed models and hybridization mechanisms, etc. This high content and utility encourages its use at international level. ParadisEO is based on a clear conceptual separation of the solution methods from the problems they are intended to solve. This separation confers to the user a maximum code and design reuse. Furthermore, the fine-grained nature of the classes provided by the framework allow a higher flexibility compared to other frameworks. ParadisEO is one of the rare frameworks that provides the most common parallel and distributed models. Their implementation is portable on distributed-memory machines as well as on shared-memory multiprocessors, as it uses standard libraries such as MPI, PVM and Pthreads.

### What does ParadisEO provide ?

- Population based metaheuristics
  - Evolutionary algorithms
  - Scatter search
  - Particle swarm optimization ...
- Single solution based metaheuristics
  - Local search
  - Simulated annealing
  - Tabu search ...

- Hybridization
  - Balancing between diversification and intensification
  - Delivering better and robust solutions
- Parallelism: speedups the search to solve large problems based on three hierarchical models
- Multi-objective features
  - Enabling the Pareto approach at resolution
  - Most common fitness assignment strategies (i.e the ones used in MOGA, NSGA, NSGA-II, SPEA, SPEA-II, IBEA ...)
  - Diversification techniques (niching...)
  - Elitism (archive management)
  - Metrics for performance evaluation (contribution, entropy...)

**Design architecture**

ParadisEO is composed of four complementary modules :

- ParadisEO-EO (Evolving Objects) for population based metaheuristics
- ParadisEO-MO (Moving Objects) for single solution based metaheuristics
- ParadisEO-MOEO (Multi-Objective Evolving Objects) for multi-objective optimization
- ParadisEO-PEO (Parallel and distributed Evolving Objects) for models of parallelization and hybridization.

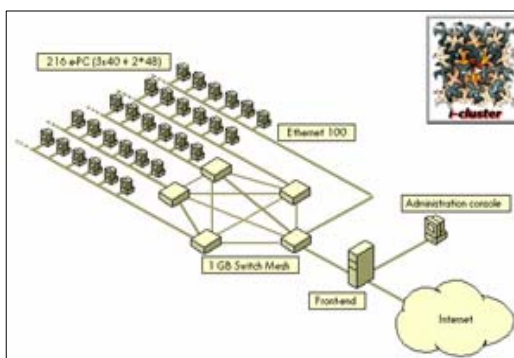


**Execution architecture**

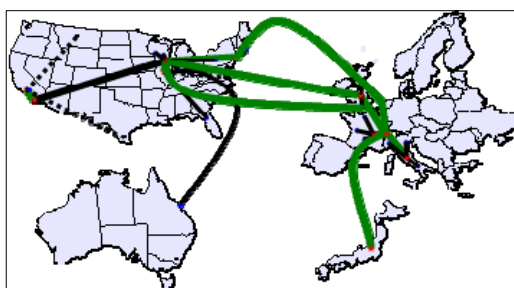
- Many advanced characteristics of ParadisEO allow different transparent and efficient execution policies:
- On sequential platforms (Unix platforms: Linux, MacOS, etc)
  - On top of underlying middlewares for high performance / high throughput computing
    - Parallel computing (SMPs) using PThreads
    - Distributed platforms (clusters) using MPI
    - Grids (Globus, Condor-G / MW)



Parallel Computing



Culster Computing



Parallell Computing High-Throughput Grid computing

