

# Parallel Evolutionary Optimization under MATLAB on standard computing networks

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## Overview

- Motivation
- Tools
- Experiments
- Summary and Outlook

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Optimization (MATLAB)

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# Motivation

## Motivation

- MATLAB: de-facto standard in research and development
- open and extensible architecture
- use of Evolutionary Algorithms (EA) for many difficult optimization tasks (GEATbx)

### Problem:

- when optimizing large and complex systems
    - one run could take more than a day
    - but: evolutionary operations take only 2-10 minutes
    - all other time is spent evaluating the objective function
-  **parallel execution of objective function evaluation**
- utilize inherent parallelism of Evolutionary Algorithms
  - distribute objective function calls of single generation to multiple slaves (master slave system - global population model)

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# DP Toolbox

## Structure

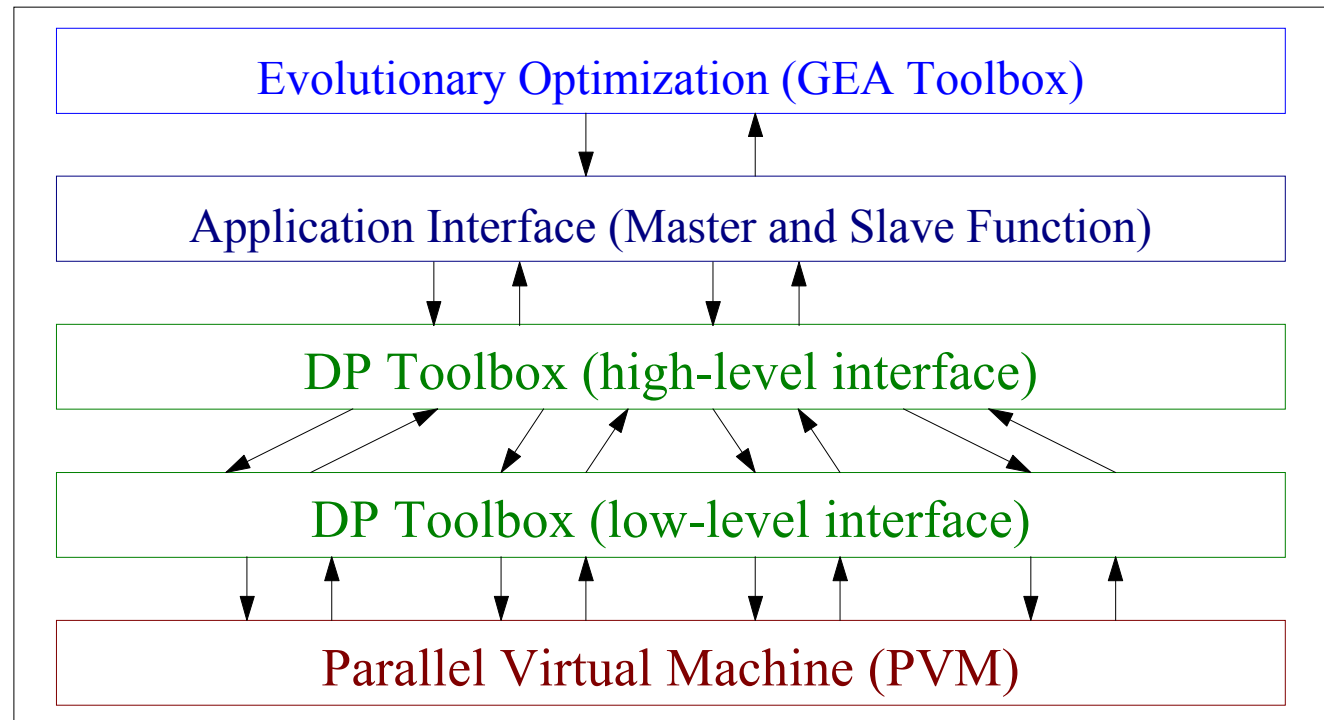
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## Distributed and Parallel Application Toolbox (DPTbx)

Tool for distributing computing tasks

- interface between MATLAB and PVM (multi level abstraction)
- runs on WinNT, Sun Solaris and LINUX (even mixed)
- application interface for straightforward application
- full integration into GEATbx



# Experiments

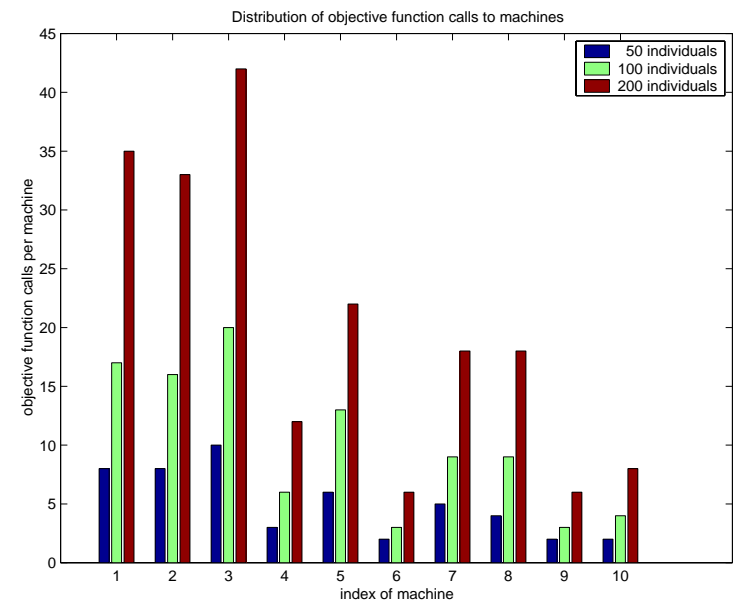
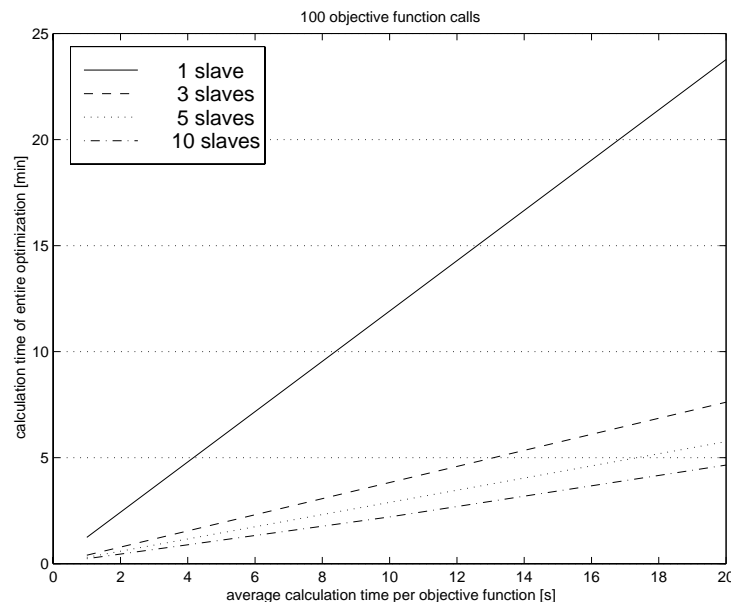
## Calculation time and distribution of tasks

### Calculation Time vs. Slaves

- linear reduction of overall calculation time (if objective function call is expensive)
- inclusion of slow slaves only useful for many tasks

### Distribution of tasks

- powerful machines calculate most tasks
- slow machines: no tasks at end of distribution (other slaves finish these jobs earlier)



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# Summary

## Advantages

- powerful tool for distribution of time intensive (evolutionary) experiments to multiple machines
  - use of standard tools: MATLAB and PVM
  - integration of DPTbx and GEATbx by application interface
  - efficient and robust distribution of tasks

### Advantages:

- straightforward application in everyday optimization tasks
- reduces long computing times considerably
- employs existent standard computer equipment
- application to real world problems proved successful
  - Genetic and Evolutionary Algorithm Toolbox for Matlab  
<http://www.geatbx.com/index.html>
  - Distributed and Parallel Application Toolbox for Matlab  
<http://www-at.e-technik.uni-rostock.de/dp/>

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# Application

## Application of parallel evolutionary optimization

- start of virtual machine

```
machines = {'plota', 'galeili', 'plota', 'plunck'};  
dpgeamain('start', machines);
```

- start evolutionary optimization

```
OBJ_F = 'objchopper';  
[xnew, GeaOpt] = geamain2(objfun, GeaOpt, VLUB);
```

- distribution of tasks by master function inside EA

```
ObjVOff = dpgeamain('master', OBJ_F, Chrom, ...  
                   ObjFunAddPara);
```

- closing the slaves at end of optimization

```
dpgeamain('kill');
```

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