

# Parallel Programming

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# Overview

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- Practicum Parallel Programming



# Parallel Programming

- Sequential programming
  - Single thread of control
- Parallel programming
  - Multiple threads of control
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  - Performance? Yes!

# Parallel Processing

- Many applications need *much* faster machines
- Sequential machines are reaching their speed limits
- Use multiple processors to solve large problems fast
- Microprocessors are getting cheaper and cheaper

# Grand Challenges

- Applications with high impact on industry or society
- Require extraordinary performance:  
1 TeraFLOP = 1.000.000.000.000 operations/sec
- Several TeraFLOP parallel machines exist  
See <http://www.top500.org>

# Challenging Applications

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General: computational science

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Computer chess

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General: computational science

Computer chess

Protein folding

# About this Course

Goal: Study how to write programs that run in parallel on a large number of machines.

Focus on programming methods, languages, applications

Prerequisites:

- Some knowledge about sequential languages

- Little knowledge about networking and operating systems

# Aspects of Parallel Computing

Algorithms and applications

Programming methods, languages, and environments

Parallel machines and architectures



## Course Outline

- Introduction in hardware, software, applications
- Parallel machines and architectures
  - Overview of parallel machines
  - Cluster computers (Myrinet)
- Programming methods, languages, and environments
  - Message passing (SR, MPI, Java)
  - Higer-level languages: Linda, Orca, HPF
- Applications
  - N-body problems, graphics, game tree search
- World-wide parallel computing (Globus)

# Course Information

## Examination

Written exam based on:

- ★ Reader
- ★ Handouts
- ★ Lectures

More information (slides, recommended books):

<http://www.cs.vu.nl/~bal/college02.html>

# Specialization *Parallel Programming & Visualization*

New specialization in 5-year Computer Science program

Official start in 2002/2003

Together with Physics-Applied Computer Science  
(Division of Physics and Astronomy)

# Courses

Parallel programming (this course)

Parallel programming practicum

Computer graphics

Scientific visualization

# Practicum Parallel Programming

Separate practicum (3 'studiepunten')

- Implement ASP + SOR algorithms in C/MPI
- Implement IDA\* search algorithm in Orca or Java/RMI
- Test and measure the programs on our DAS cluster

## More information

- Register by email to [rob@cs.vu.nl](mailto:rob@cs.vu.nl) (Rob van Nieuwpoort) now
- Starts after 7th (MPI) lecture (14 October)
- See <http://www.cs.vu.nl/pp-cursus/> for a complete description