ACM/CS 114
Parallel algorithms for scientific applications

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Logistics

- class
  - where: 105 Annenberg
  - when: MWF from 3:00pm to 3:55pm
- instructor
  - Michael Aivazis (aivazis@caltech.edu)
  - office hours: 2-5pm, MWF
  - office: 219 Powell-Booth
  - telephone: 626.395.3424
- TA
  - Dzhelil Rufat (drufat@caltech.edu)
  - office hours: 3-4pm, TR
  - office: 333 Annenberg
  - telephone: 626.395.3551

Motivations for going parallel

- why bother?
  - *speed*: there are fundamental limits to the processing power of a single processor
  - *throughput*: time to solution is critical for many problems
  - *size*: high resolution requires lots of memory
  - *availability*: the tool exists, use it
- but be careful
  - the commercial market is unstable
  - the computing environment is somewhat primitive
  - software packages and libraries are emerging slowly
  - parallel programming is not hard, but it requires *discipline*

Scope and outline

- software engineering survival skills
- algorithms and data structures
  - specification, design, analysis
- concurrency
  - computing models, memory models, synchronization
- execution environments
  - planning, staging, launching
  - monitoring
  - data harvesting, post processing, visualization
- concurrency in practice
  - embarrassingly parallel problems
  - structured uniform grids
  - unstructured grids
  - non-local problems
  - dense and sparse matrices
- advanced application design

Syllabus

- reference material
  - class notes will be posted online
  - no preferred textbook
  - suggested reading list available online
- homework
  - five assignments, each worth 10%
  - programming is required
  - they will be posted online no later than a week before they are due
  - online submission via `bzr`; details next time
- final project
  - 50% of your grade
  - must chose one, and get approval, before February 10
  - due on March 16
  - missing these deadlines will cause an incomplete grade, unless you negotiate an extension

Class resources

- resources
  - web page: `http://acm114.caltech.edu`
  - mailing list: `acm114-class@cacr.caltech.edu`
  - computing: `shc.cacr.caltech.edu`
- requirements
  - an `ssh` public key
  - must fill out the account request form at `http://www.cacr.caltech.edu/main/?page_id=477`

Informal survey

- computing platforms
  - windows, linux, osx; anything else?
- previous experience
  - compiled languages: `C`, `C++`, `FORTRAN`
  - interpreted languages: python, perl
  - environments: matlab, Mathematica
  - concurrency: threads, `MPI`, others?
  - development: emacs, eclipse
  - projects:
    - size: lines, people
    - practices: source control, documentation
    - target audience, release schedules
- personal objectives for this class