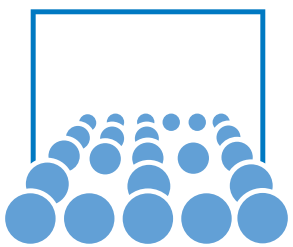
Practical Course - Future Trends in High Performance Computing

Initial Meeting

Chair of Scientific Computing (SCCS)

Summer 2016



Part I

Course Organization

About this Course

- Practical Course for:
  - Bachelor Informatics $\longrightarrow$ Bachelorpraktikum (**IN0012**)
  - Master Informatics, Master CSE $\longrightarrow$ Masterpraktikum (**IN2183**, **IN2107**)
- Language: **English**
- 10 ECTS
- $\sim$ 12 participants

Prerequisites

- Experience with Object Oriented Progamming
- Initial experience with Parallel Programming
- Numerical Programming (**IN0019**) or Modellbildung und Simulation (**IN2010**)
- A certain interest for the field of Scientific Computing and openness to new programming paradigms

Time Plan

Week	Event
1st	2 Full-day lectures: Intro to X10 and APGAS
2nd-9th	Biweekly lecture + assignments
10th-13th	Project Phase: Implement a bigger assignment
14h	Final Presentation

- Full-day Intro: 19.4. + 20.4. **10:00-18:00** IGSSE 003
- Lectures: Every two weeks, Monday **14:00-16:00**, MI 02.07.023
- Office hour every other week in lecture slot (Monday, **14:00-16:00**, MI 02.07.023)

Modalities & Grading

- Work in Teams of 3-4 students
- Assignments and Project Phase
- Last four weeks: Bigger implementation project
- Deliverables
  - Assignments
  - Implementation Project
  - Project report
  - presentation (20 min/group)
- Grading
  - Implementation $\rightarrow$ 70%
  - Final Report $\rightarrow$ 20%
  - Presentation $\rightarrow$ 10%

Part II

Content Overview

Why X10? And what is APGAS?

- X10 is a programming language that is being developed at the IBM Watson Research Center
- It follows the **APGAS** paradigm
- APGAS $\rightarrow$ **A**synchronous **P**artitioned **G**lobal **A**ddress **S**pace
- Language support for **shared memory parallelism** as well as for **distibuted memory parallelism**
- Concept of Places: Each place has its own address space
- **But:** References across address space borders possible

Why X10? And what is APGAS

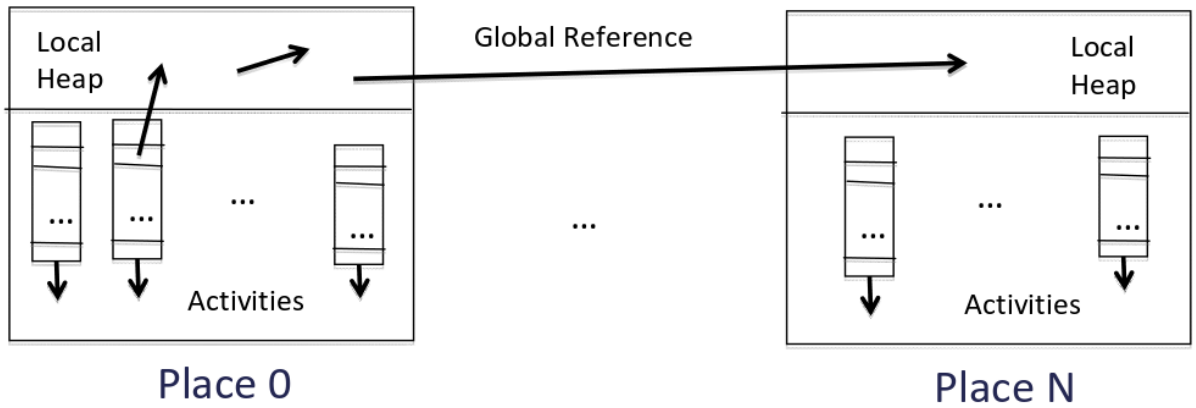


Figure : APGAS-Model. [1]

[1] From: `http://x10.sourceforge.net/tutorials/x10-2.5/APGASProgrammingInX10/APGASprogrammingInX10-slides-V8.pdf`

What are you going to do with it?

- Implement an iterative solver for Systems of Linear Equations
- Implement a solver for the Shallow Water Equations[2]
  - Add shared memory and distributed memory (and SIMD) parallelism
  - Run your simulation on real HPC hardware
  - Extend the code in the project phase (mesh refinement or CUDA-based parallelism, or other good ideas)

[2] A. Breuer, M. Bader - Accepted for Proceedings of the ISPDC 2012, to be published by IEEE. Teaching Parallel Programming Models on a Shallow-Water Code `http://www5.in.tum.de/SWE/breuer_bader_teaching.pdf`

Questions?

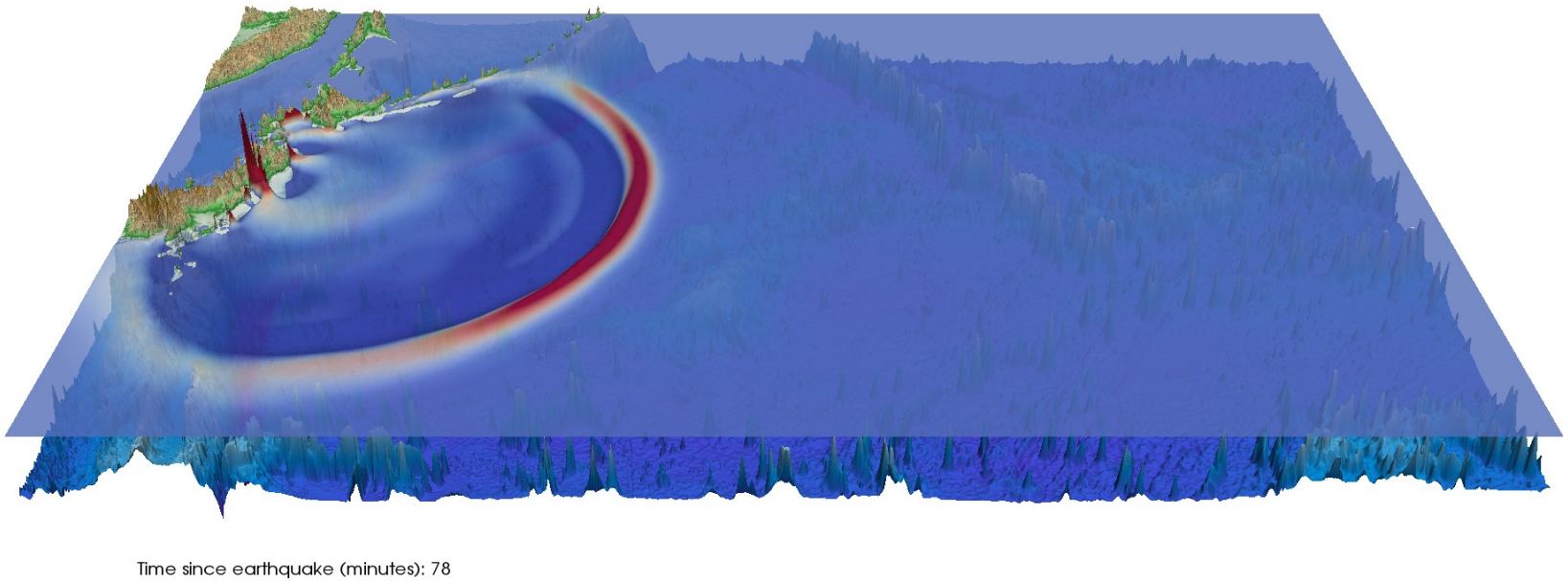


Figure : Snapshot of a simulation of the Tohoku tsunami