

# Programming Massively Parallel Systems

Nicolas Weber // GCC // TU Darmstadt

12.04.2016 // PMPS SS16

# Description

- PMPS
  - Project Lab 6SWS (9CPs)
  - Tuesdays, 11:40-13:20 in S305/073 (no regular meetings)
  - Deadline: Friday September 30<sup>th</sup> 2016, 23:59 MES (no extension!)
  - Time calculation:
    - $9\text{CP} * 30\text{h/CP} \approx 270\text{h}$
    - $270\text{h} / 25\text{weeks} \approx 11\text{h/week!}$
- Prerequisites
  - CUDA programming (e.g. lecture PMPP)
  - basic parallel algorithms and concepts (reduction, prefix sum, sorting, ...)
  - very good programming skills in C/C++
  - **WE WILL NOT TEACH THIS IN THIS COURSE!**

# Description

- 3-4 presentations per group and topic throughout the semester
- Source Code
  - Use repository that we provide to you
  - Has to work out of the box on our Linux Pool PCs
  - <https://www.informatik.tu-darmstadt.de/en/students/studies/plagiarism/>
  - Use libraries only if they make SENSE and not if it is just convenient to use!

# Description

- Documentation
  - No page min/max limits
  - What was your assignment?
  - What have you accomplished? What works? What does not? Why does it not work?
  - How can your tool be used? How can it be extended?
  - Provide a performance evaluation. How does your code scale? What have you improved? What else could be improved and why?
  - ...

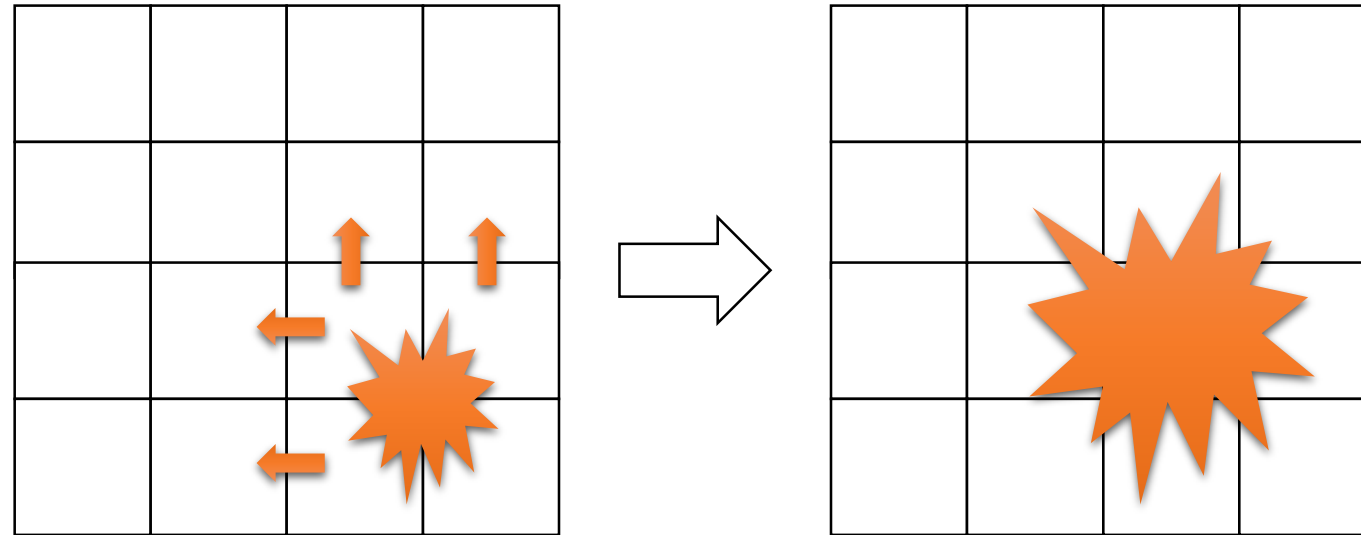
# Description

- Grading will be based on
  - Does the project work?
  - Implemented features
  - Performance
  - Documentation
  - Oral “exam” (if necessary)

# Fluid Dynamics Simulation



# Fluid Dynamics Simulation



# Fluid Dynamics Simulation

- Description:

- [https://developer.nvidia.com/gpugems/GPUGems/gpugems\\_ch38.html](https://developer.nvidia.com/gpugems/GPUGems/gpugems_ch38.html)

- Reference Code:

- [ftp://download.nvidia.com/developer/GPU\\_Gems/CD\\_Image/Beyond\\_Triangles/Fluids.zip](ftp://download.nvidia.com/developer/GPU_Gems/CD_Image/Beyond_Triangles/Fluids.zip)
- Works only on Windows and requires:
  - <https://developer.nvidia.com/cg-toolkit>

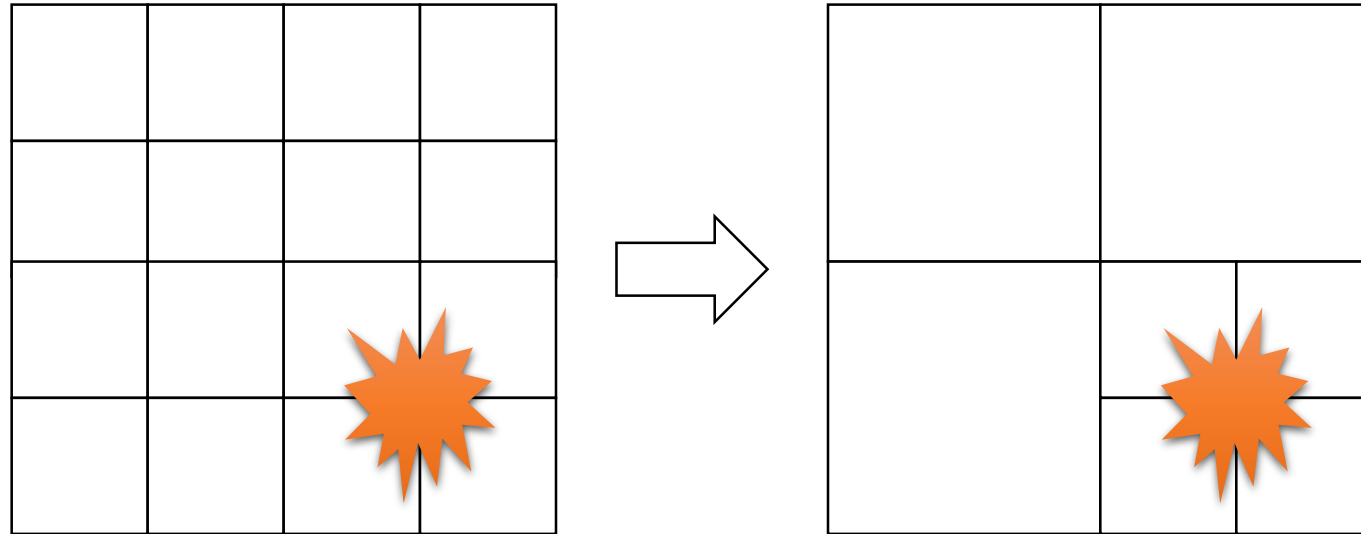


# Fluid Dynamics Simulation

- Milestone 1: Basic Simulation (*required*)
  - Get 2D FDS simulation working
  - No GUI! Store results as single images or video.
  - Only one constant flow-source
  - No user interaction
- Milestone 2: Enhanced Simulation (*required but not all*)
  - Time depending flow-sources (change intensity / direction over time)
  - Multiple flow-sources
  - Barriers (that block the flow)
  - Extend to 3D
  - Mesh Refinement
- Milestone 3: Multi-Device Simulation (*optional*)
  - Multi-GPU and/or MPI

# Fluid Dynamics Simulation

- Mesh Refinement



# Fluid Dynamics Simulation

## Topic Supervisor

- Alija Bevrnja
  - [bevrnja@gsc.tu-darmstadt.de](mailto:bevrnja@gsc.tu-darmstadt.de)

## GPU/CUDA Supervisor

- Nicolas Weber
  - [nicolas.weber@gris.informatik.tu-darmstadt.de](mailto:nicolas.weber@gris.informatik.tu-darmstadt.de)
  - Office Hours: 5:30 – 14:00  
S319/R2.2

# First Steps

- Find a team and choose topic until April 17<sup>th</sup> 2016
- Send E-Mail with names, E-Mail addresses to:  
[nicolas.weber@gris.informatik.tu-darmstadt.de](mailto:nicolas.weber@gris.informatik.tu-darmstadt.de)
- You will receive a user account which grants you access to our Windows/Linux Pool PCs and the repository
  - Account has to be initially activated at one of our WINDOWS PCs!!!
- *(Optional)* arrange regular meetings with supervisors.

# Time Schedule

- Introduction: 12.04.2016
- Select Topic/Group: 21.04.2016 23:59 CET
- 1<sup>st</sup> Presentation: 03.05.2016 (→ 2 weeks)
- 2<sup>nd</sup> Presentation: 05.07.2016 (→ 9 weeks)
- N<sup>th</sup> Presentation: on demand
- Project Deadline: 30.09.2016 23:59 CET (→ 12.5 weeks)
- Final Presentation: 11.10.2016 ( → 1.5 weeks)