SwarmFlocking

64-149 Praktikum Parallele Programmierung

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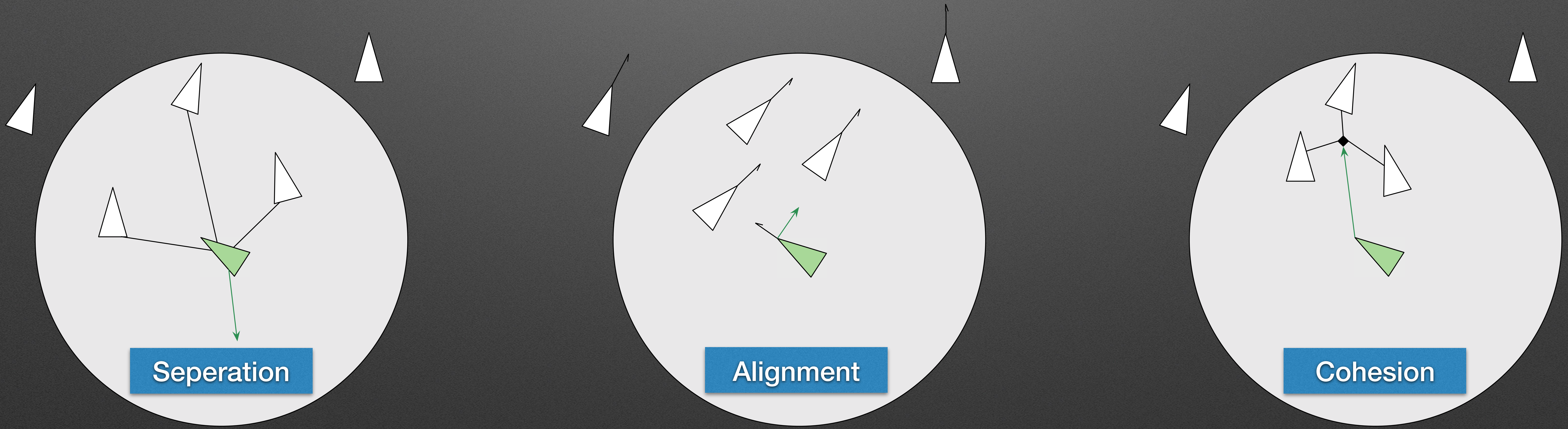
github.com/dominiklohmann/PAPO14-SwarmFlocking

Flocking Behavior



Parallelization

- Cut the world into vertical areas and distribute the swarm into partial swarms
- Each partial swarm is aware of its possibly relevant neighbors
- Neighbors communicate their local updates after each step
- Root also calculates the predator movement and therefore needs to have everything

Optimization

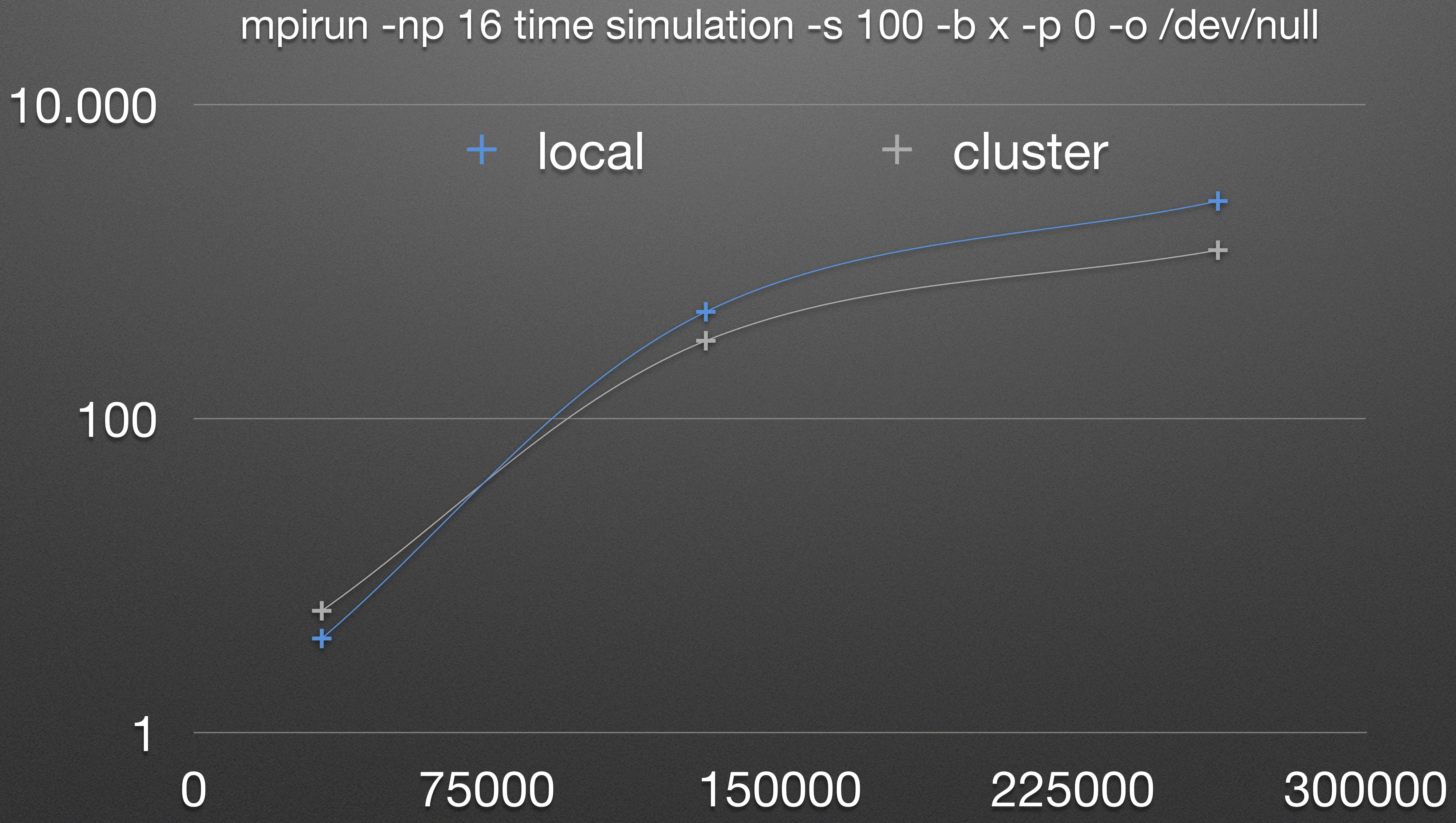
	position				velocity				
Boid	x	y	z	_	x	y	z	_	32 Byte
MPI_BOID	x	y	z		x	y	z		24 Byte (25% less)
MPI_BOID_THIN	x	y	z						12 Byte (62,5% less)

- SSE(2) instructions for 75% better performance in Vector.h
- Custom Datatype for MPI to reduce communication overhead
- Algorithm optimizations to only view boids in a neighbored PartialSwarm so boid density actually influences the performance

Command Line Interface

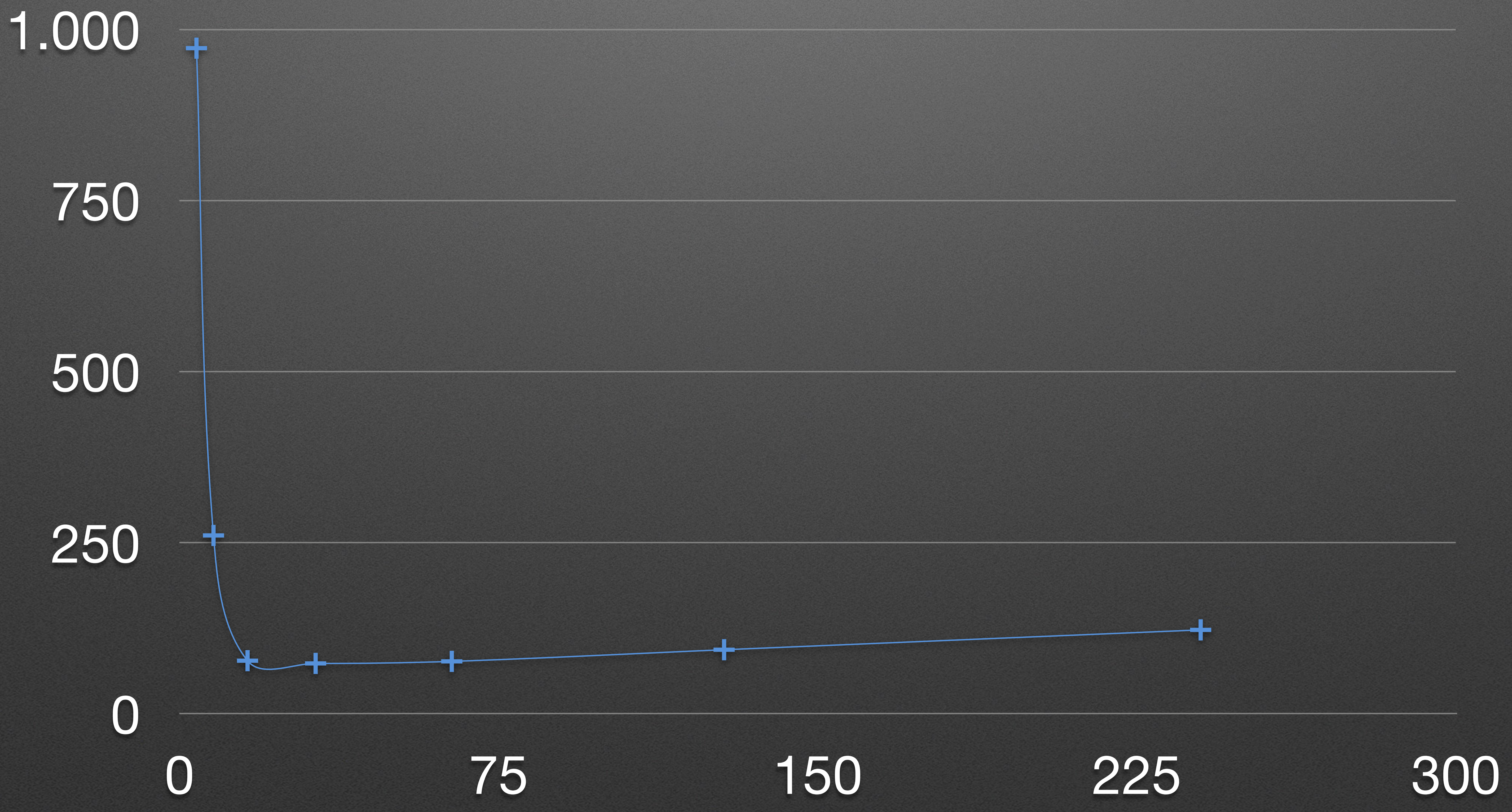
```
% ./bin/simulation --help
Options:
  -h [ --help ]                  Print this help message
  -b [ --boid-count ] arg        Number of boids to simulate
  -p [ --predator-count ] arg Number of predators to simulate
  -s [ --steps ] arg             Number of steps to simulate
  -o [ --output ] arg            Specify an output file

% ./bin/visualisation --help
Options:
  -h [ --help ]                  Print this help message
  -i [ --input ] arg             input file source
  --fps arg                      Set a custom number of frames to be displayed
                                 each second (defaults to 30)
  -s [ --single-stepping ]       Control execution of the visualisation by
                                 pressing 'space'
  --stdin                        use stdin as source (overwrites --input)
  -b [ --boid-count ] arg        Number of boids per frame
  -p [ --predator-count ] arg Number of predators per frame
```

Performance Report



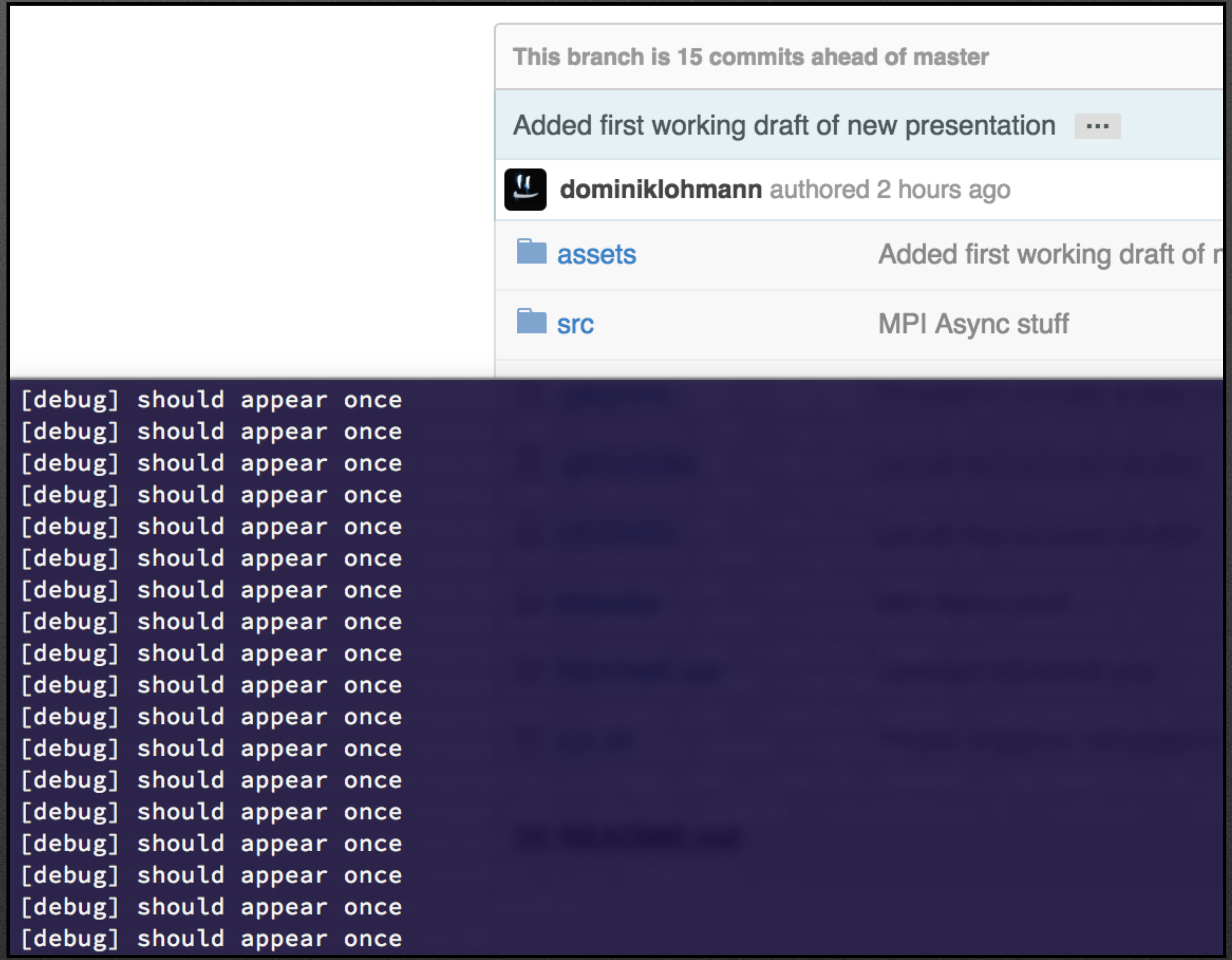
Performance Report

mpirun -np x time simulation -s 100 -b 65536 -p 0 -o /dev/null



Implementation Problems

- Outdated versions of g++, libstdc++, boost and most notably MPI on cluster coupled with local development and testing
- Trial and error development with OpenGL
- Indeterministic results (due to optimizations) make testing a lot harder



This branch is 15 commits ahead of master

Added first working draft of new presentation ...

dominiklohmann authored 2 hours ago

assets	Added first working draft of r
src	MPI Async stuff

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Demo