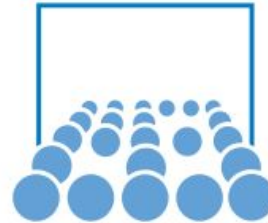# Masterpraktikum Scientific Computing

High Performance Computing Tutorial 5

Session 5: Project

Authors

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**Course of Study:** Master of Science Informatics

Repast HPC

- Agent based modeling and simulation framework
- Target systems : High performance distributed computing platforms
- Written in c++
- Used MPI for parallel operations
- Agents distributed across processes
- Support prominent modeling methodologies : shared grid, shared network and shared continuous space or combination of them
- Request and synchronization are handled automatically

Repast HPC (Before optimisation)

- In project application , agents are located on 100 X 100 grid
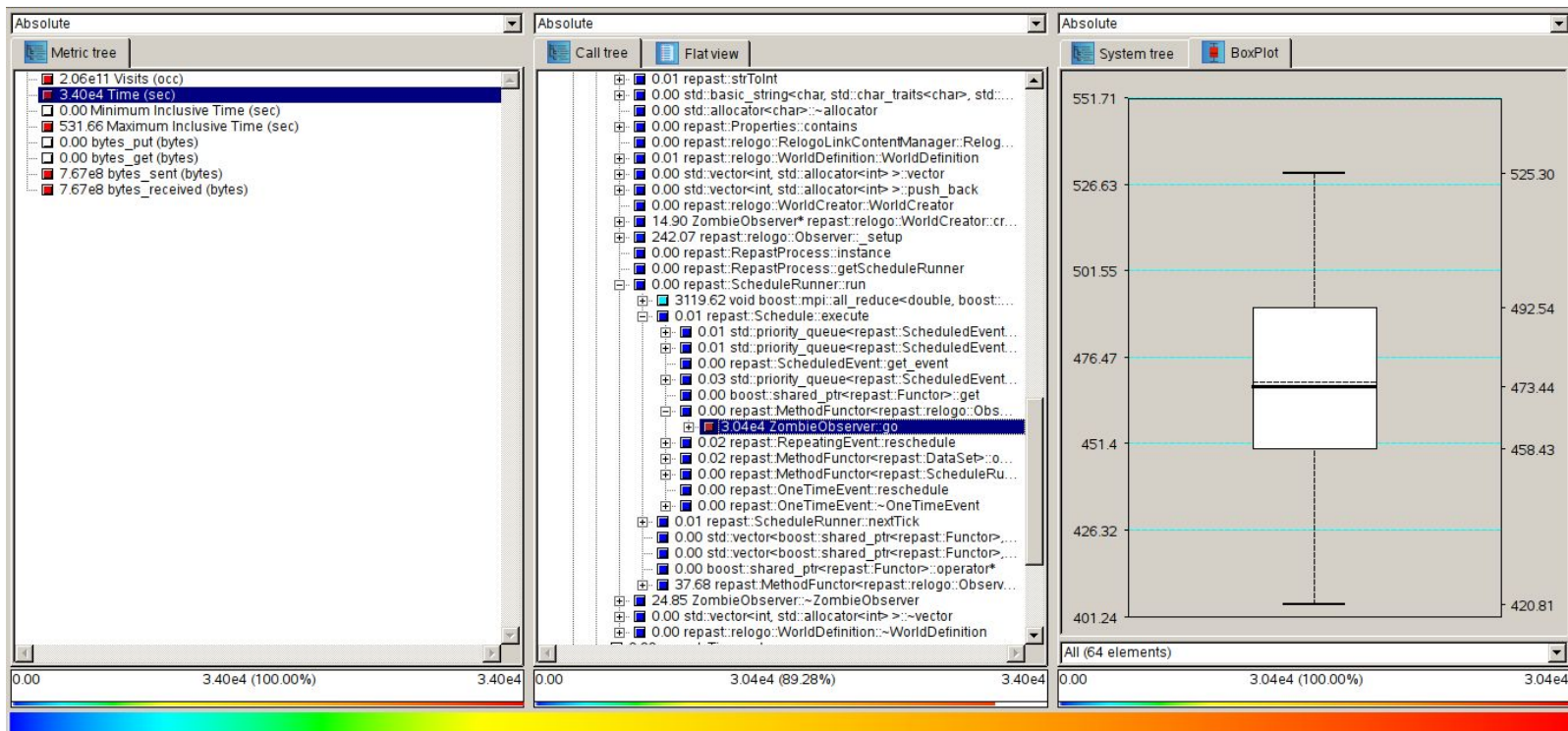- Agents are given their place randomly when simulation starts
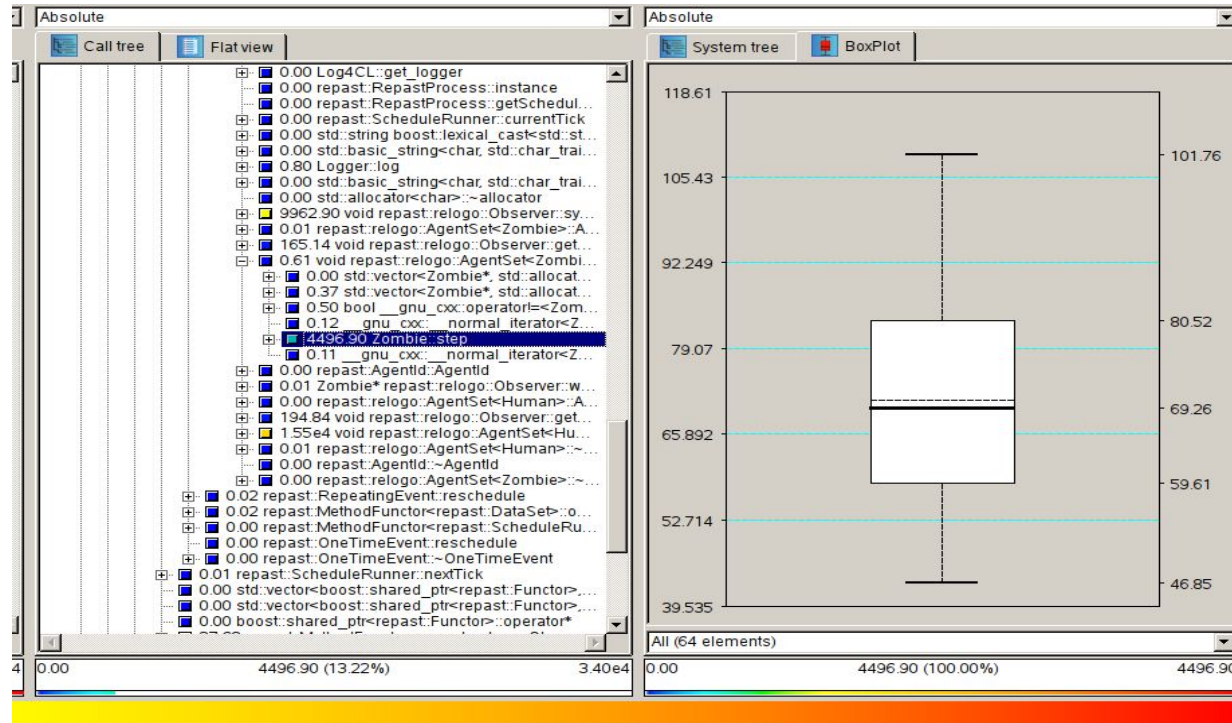
#Agents = 6000

#Processors = 2 X 2
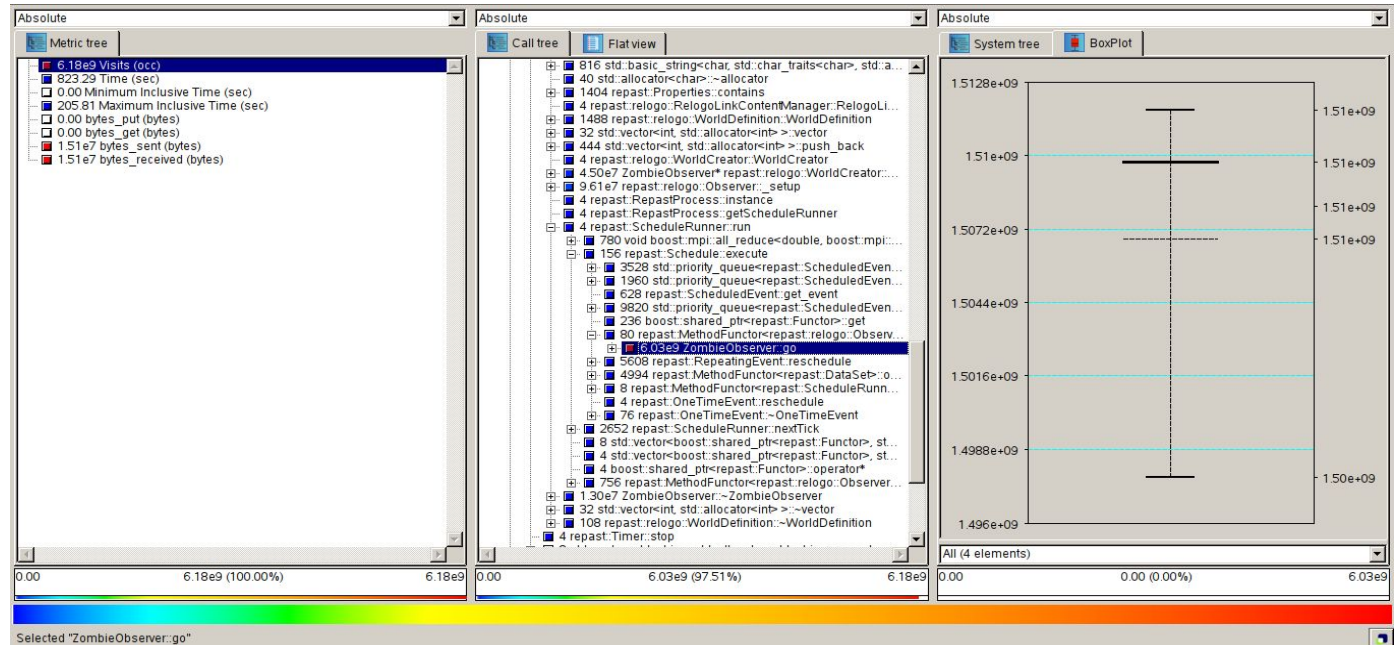
Repast HPC (Before optimisation)
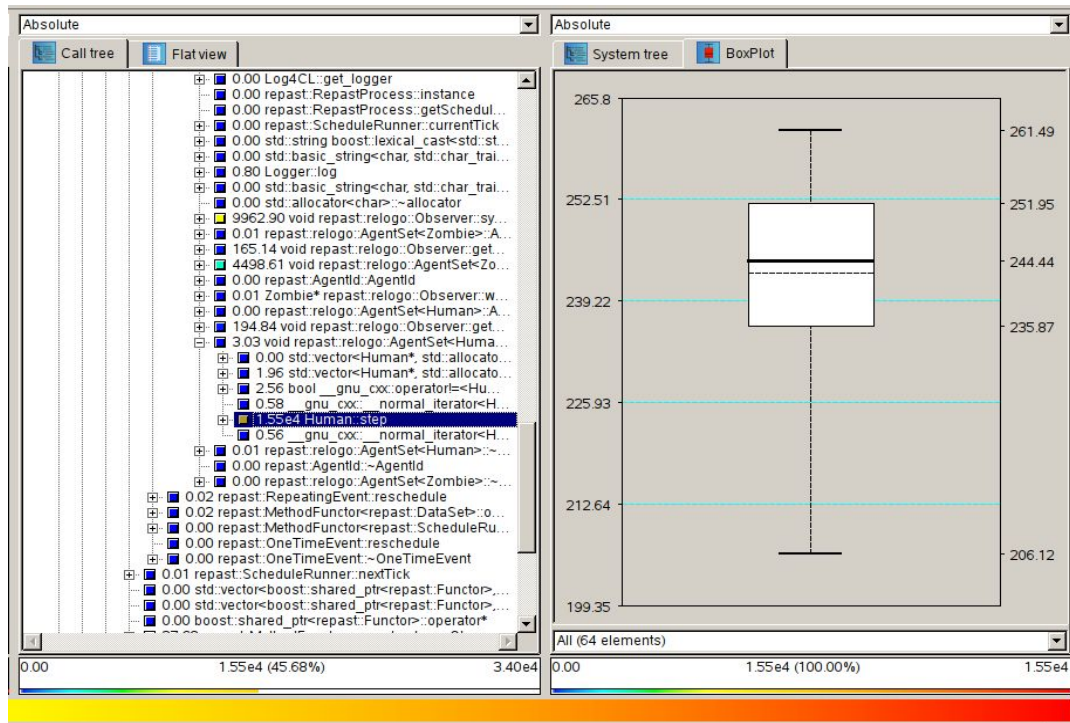
#Agents = 6000   #Processors = 8 X 8

Repast HPC (Before optimisation)

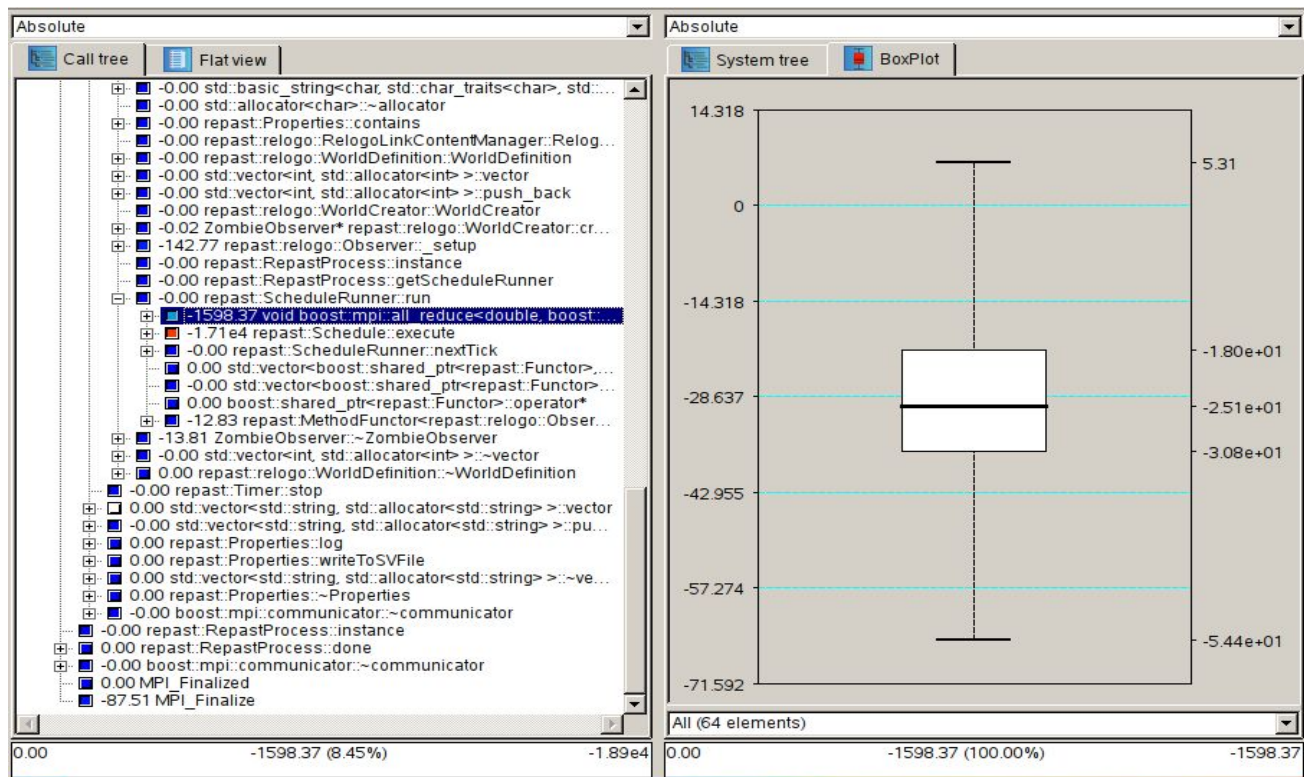#Agents = 6000   #Processors = 8 X 8

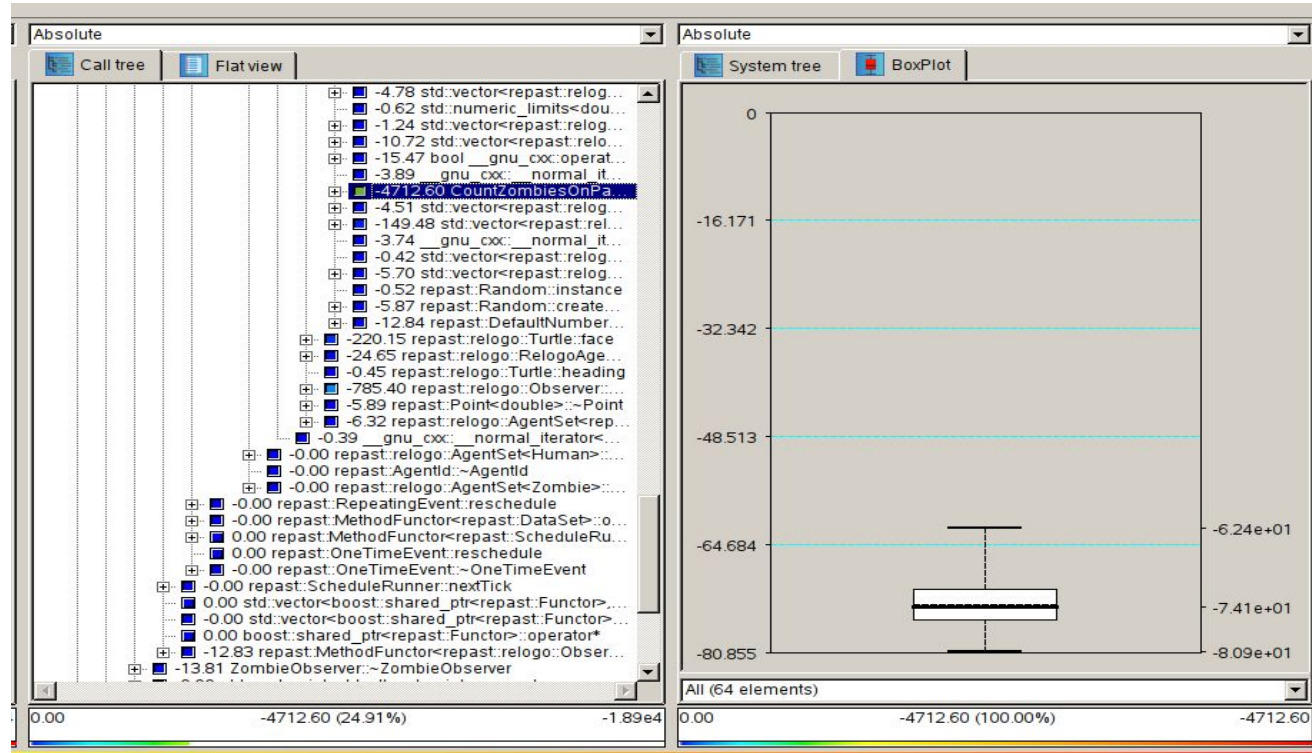# Repast HPC (Before optimisation)
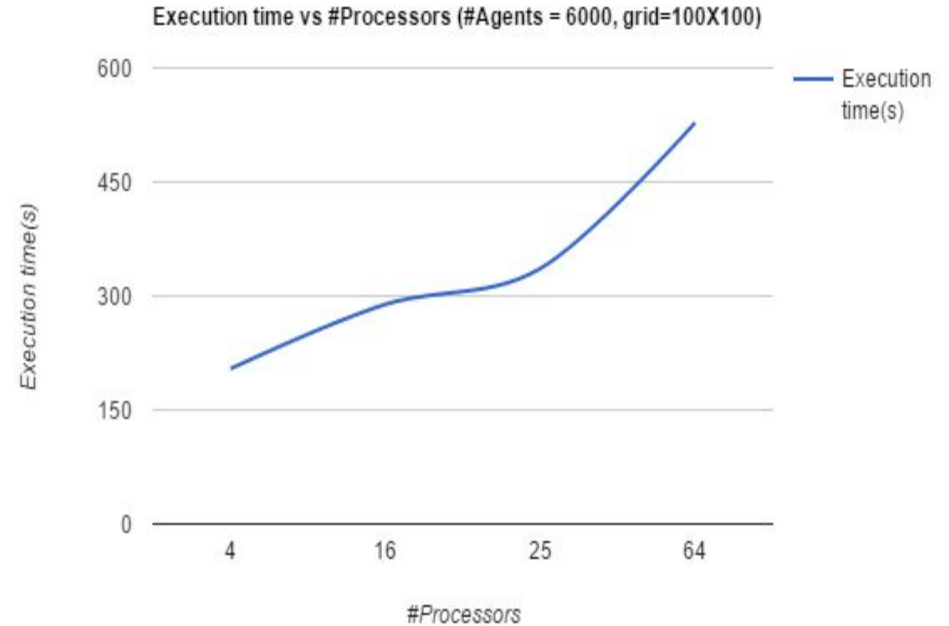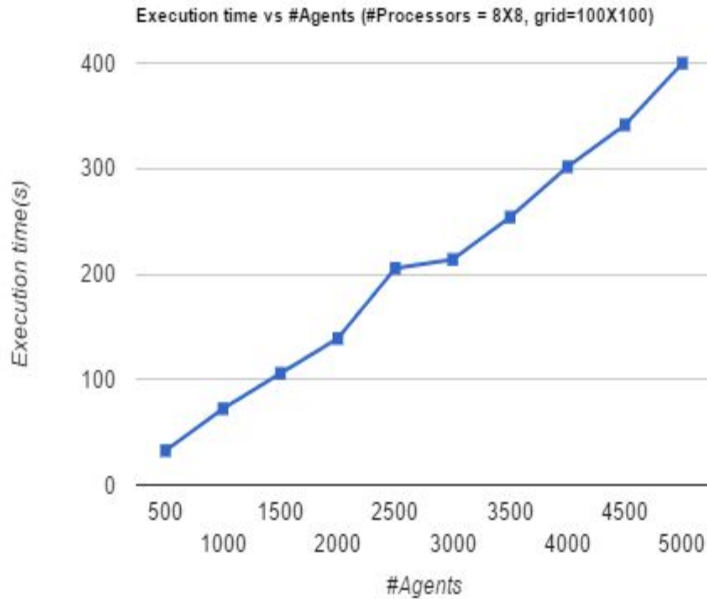
#Agents = 6000   #Processors = 8 X 8

After merging different cubex data (Before optimisation)

After merging different cubex data (Before optimisation)

Repast HPC (Before optimisation)

Conclusion

- Execution time scales almost linearly with the number of cores for mainly independent agents
- Whereas speedup drops significantly in case of highly interdependent agents

Area of improvement

Most Expensive jobs:
- Giving agents coordinates
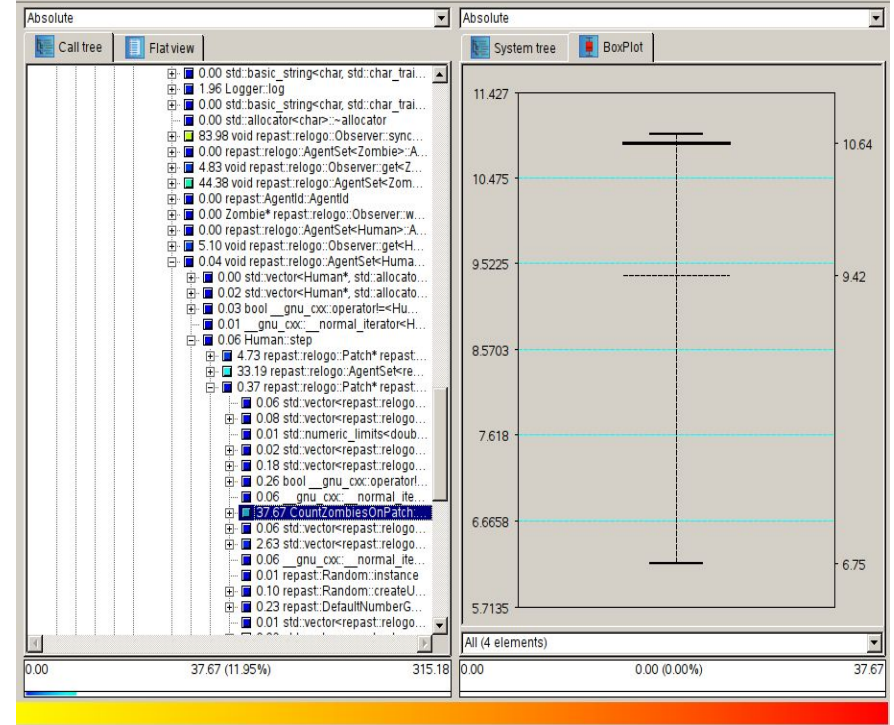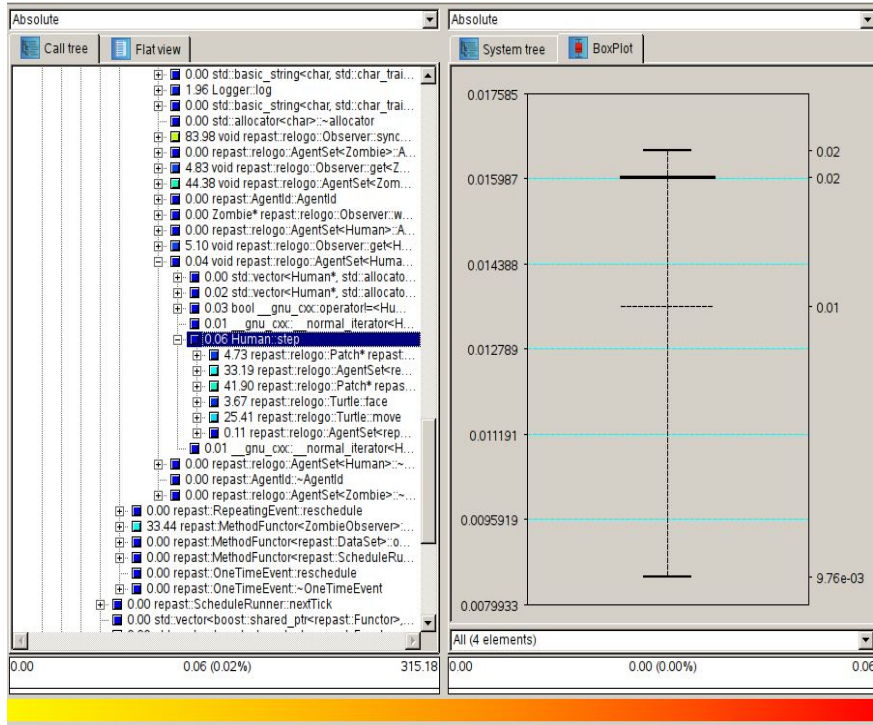- Locating agents on grid or space

In our sample application the most expensive jobs
- Zombie ::step (13.17%)
  - CountHumanOnPatch (5.76%)
- **Human ::step (45.46%)**
  - **CountZombieOnPatch (20.34%)**
- MPI_AllReduce (9.37%)
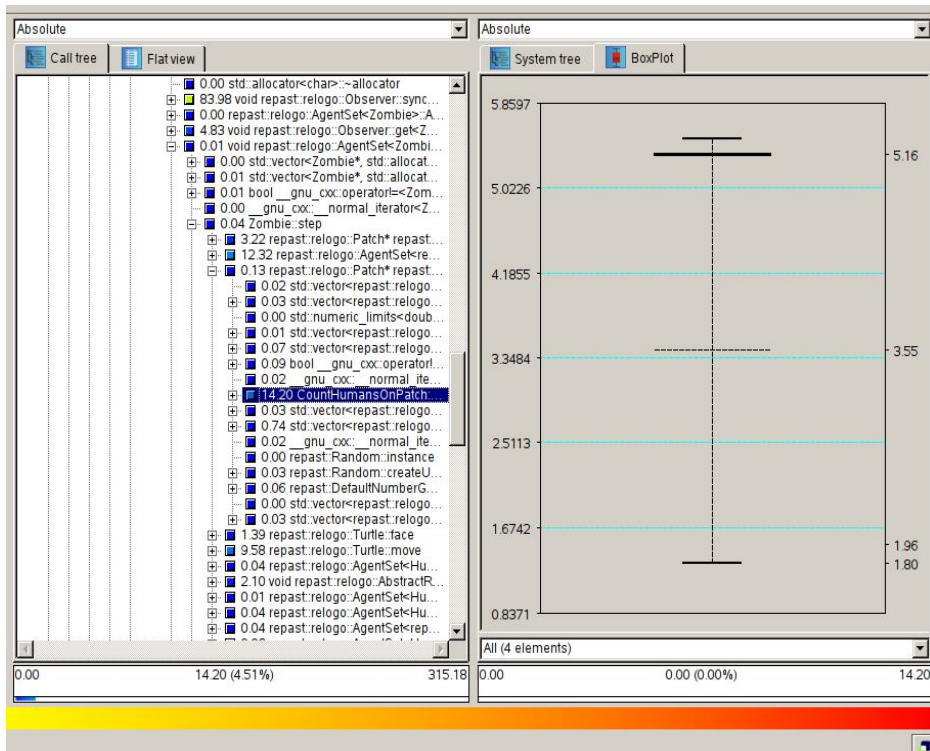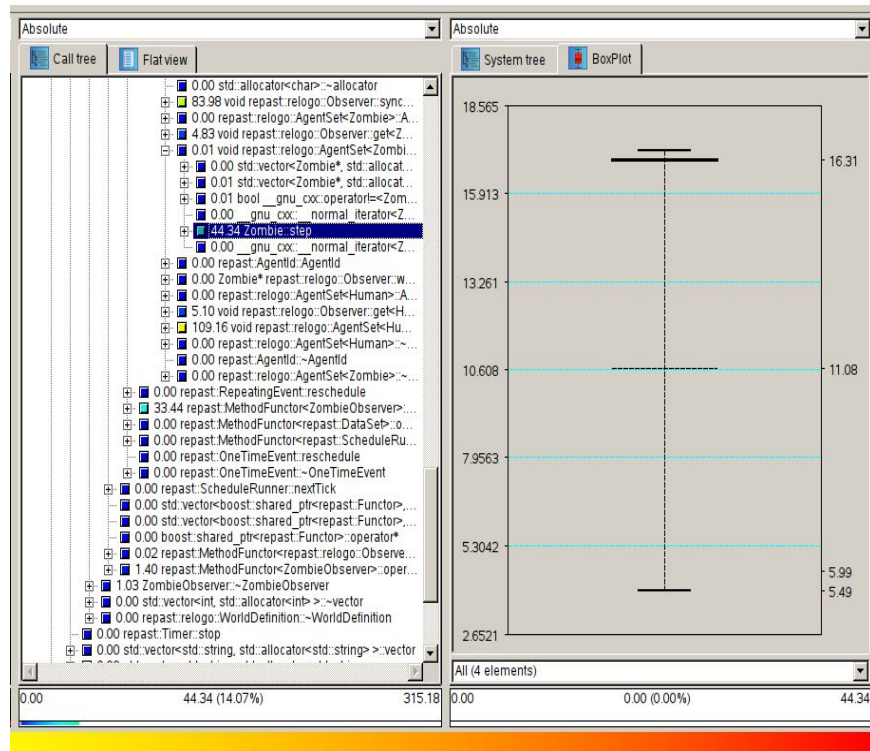- relogo::Observer:Sync (29.44%)

Optimisation Strategy
- Use HDF5 data as input
- use C++ standard library instead of Repast API as much as possible
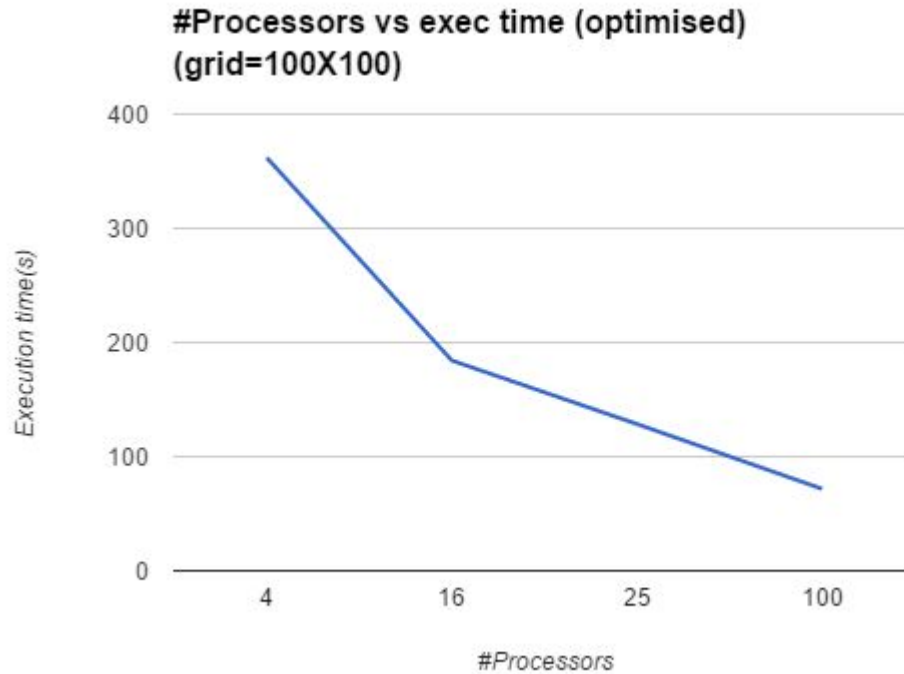- Try to design less interdependent agents

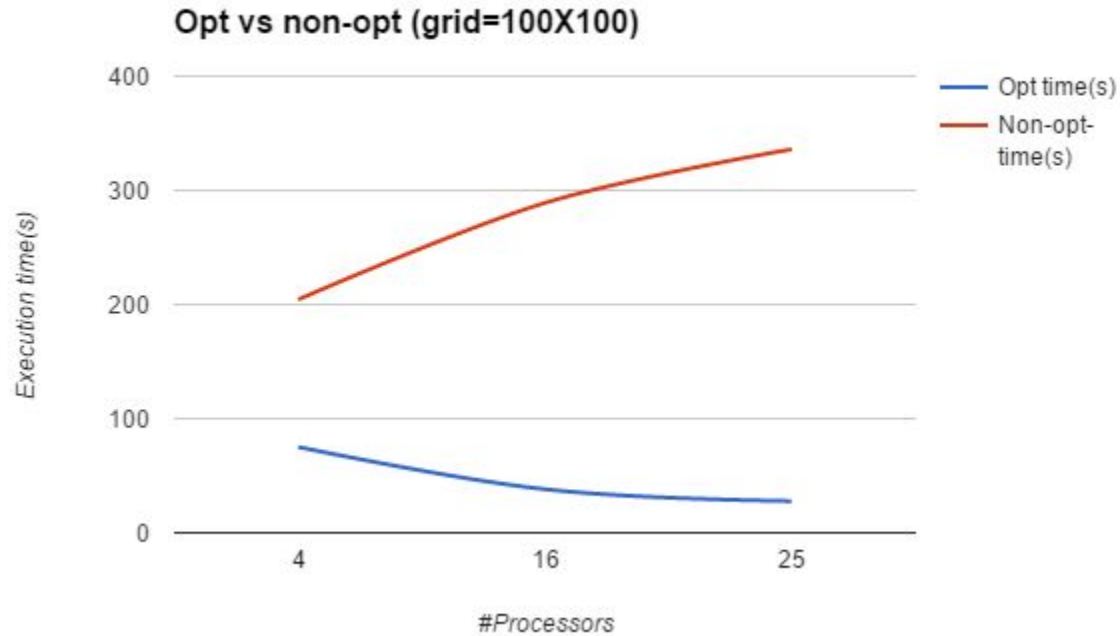# Repast HPC (After optimisation)

Repast HPC (After optimisation)

Repast HPC (After optimisation)

**#Processors vs exec time (optimised)
(grid=100X100)**

Repast HPC (opt vs non-opt)

Opt vs non-opt (grid=100X100)

Thank you!