Dynamic Process Migration in Agent-Based Simulation

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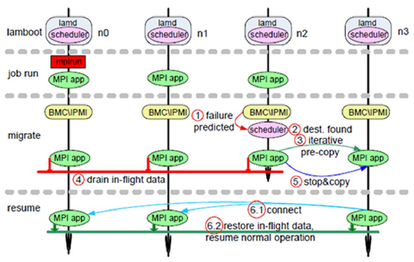
abstract

The purpose of this research is to create an algorithm to help more efficiently perform high performance computer simulations. The research concentrates on the difference in simulation time experienced by variables in computer simulations. Issues with simulation time between variables may cause issues with interactions of those variables. In this project we will create an algorithm in C++ to combat the issues of differing simulation time in agent based simulations called the TIme Warp Algorithm. The anticipated outcome of this project is to create an algorithm that effectively reduces simulation times. This algorithm may be used to help create more sophisticated simulations on high performance computers in the future.

introduction

- High Performance Computers (Super Computers) and Nodes
- Agent Based Simulations and rollbacks
- Muse and RescueSim
- Simulat :hm

Live Job Migration



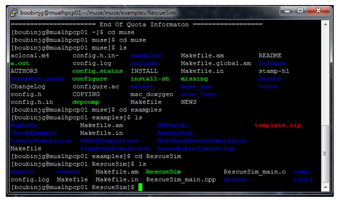
objectives

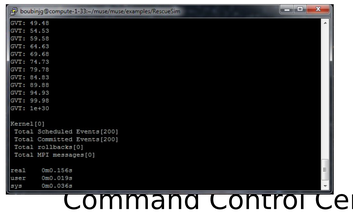
- Create an agent based simulation that works properly on one node
- Run this simulation on multiple nodes and compare differences in simulation time
- Develop an algorithm that decreases rollbacks in the simulation
- Test the simulation using the new algorithm on

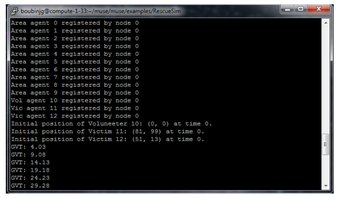
methods

- Program a simulation in C++ to run on the high performance computer on one node
- Adapt the simulation to run on multiple nodes
- Compare the simulation times for one node and multiple nodes to determine that the simulation runs correctly
- Implement the Time Warp algorithm and test the simulation to determine if times were decreased

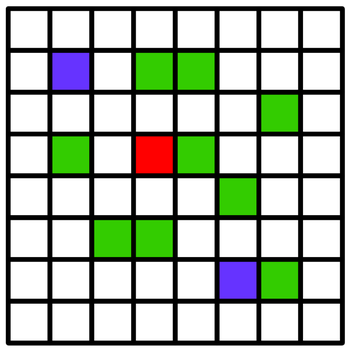
Tests







RescueSim



Command Control Center

preliminary results

expected results

- Simulation times on one node are significantly less than on multiple nodes
- The more nodes used the lower the simulation time
- The more nodes used, the higher the number of rollbacks
- Implementing the Time Warp algorithm will mitigate rollbacks and decrease simulation time

alternative pathways

- The simulations could experience negligible decrease in time as nodes increase due to volume of rollbacks
- The simulation could be too memory intensive which would inhibit collecting proper simulation times.
- The simulation could have too few rollbacks which would cause a negligible decrease in time when implementing the Time Warp algorithm

broader impact

The Time Warp Algorithm could allow larger scale agent based simulations on smaller hardware. Types of agent based simulations include:

- Natural disaster scenarios
- Pedestrian/traffic flow
- Warfare situations
- Biowarfare/epidemic spread

acknowledgements

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