

Project CASSIA

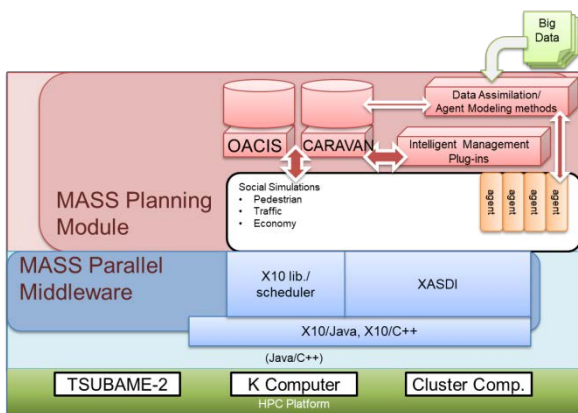
Framework for Administration of Social Simulations on Massively Parallel Computers

Overview

Project CASSIA (Comprehensive Architecture of Social Simulation for Inclusive Analysis) aims to develop a framework to administer to execute large-scale multiagent simulations exhaustively to analyze socially interactive systems. The framework will realize engineering environment to design and synthesize social systems like traffics, economy and politics.

The framework consists of:

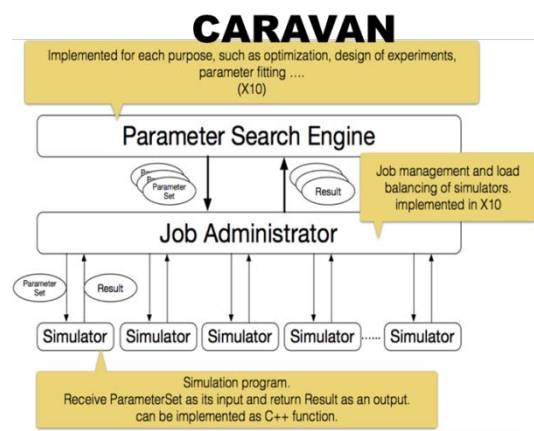
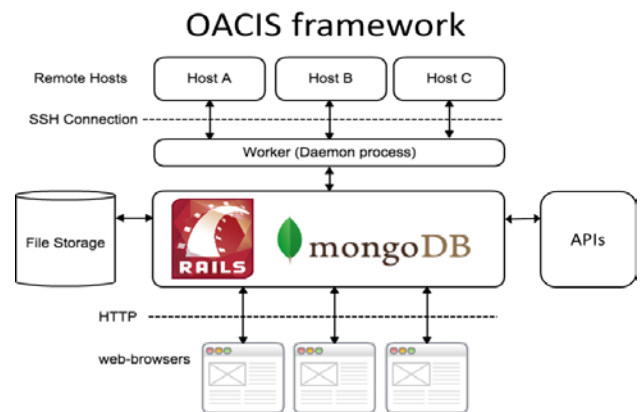
- **MASS Planning Module:** a manager module conducts effective execution plans of simulations among massive possible conditions according to available computer resources.
- **MASS Parallel Middleware:** an execution middleware provides functionality to realize distributed multi-agent simulation on many-core computers.



OACIS & CARAVAN

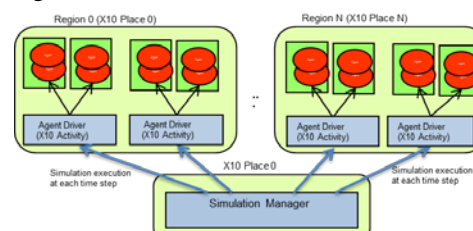
OACIS (Organizing Assistant for Comprehensive and Interactive Simulations) is a job management software for large-scale simulations. It controls a large number of simulation jobs executed in various remote servers, keeps these results in an organized way, and manages the analyses on these results.

CARAVAN provides more powerful scalability for exhaustive simulation. These functionalities are especially beneficial for the complex simulation models having many parameters for which a lot of parameter searches are required.



XASDI

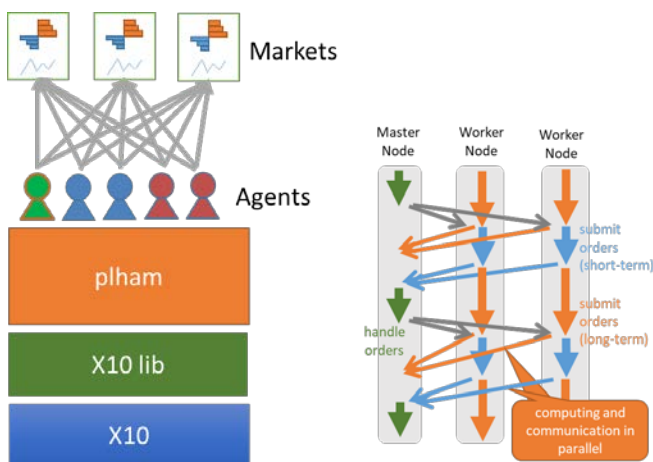
XASDI is the Large-scale agent-based social simulation framework with billions of distributed agents that provides easy-to-use API bridge with Java and X10-based runtime for high scalability. XASDI environment executes various social simulations written in Java with distributed agents and managers written in X10.



- **OACIS:** <https://github.com/crest-cassia/oacis> (<http://www.aics.riken.jp/k/aics-software/>)
- **CARAVAN:** <https://github.com/crest-cassia/caravan>
- **X10 lib.:** <http://x10-lang.org/>
- **XASDI:** <http://x10-lang.org/xasdi/>
- **Plham:** https://hub.docker.com/r/oacis/oacis_jupyter_plham/
- **CrowdWalk:** <https://github.com/crest-cassia/CrowdWalk>
- **ADVENTURE Mates:** <http://adventure.sys.t.u-tokyo.ac.jp/jp/download/Mates.html>

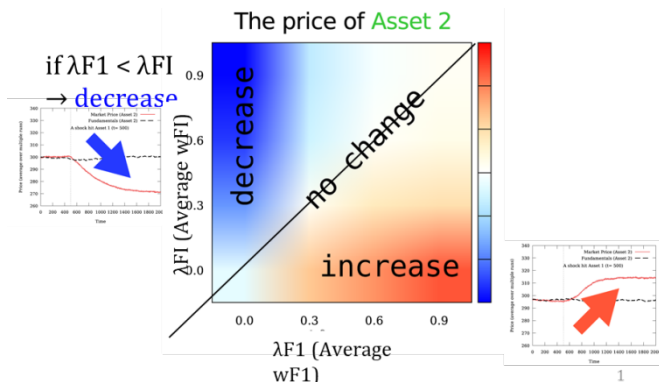
Plham and X10 extention

Plham is a platform for large-scale and high-frequency artificial market simulation. It consists of models of markets for each stocks and three types of agents (high-freq. traders, short-term and long-term traders).



In order to enhance parallelism of computation, we introduce asynchronous computation in agents and communication between agents/markets, and provide high-level library to program them.

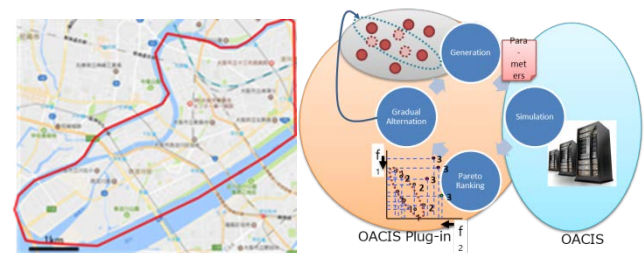
We succeeded to re-generate several market phenomena like flash-crash and effects of risk management with Value at Risks, which are useful to analyze soundness of markets.



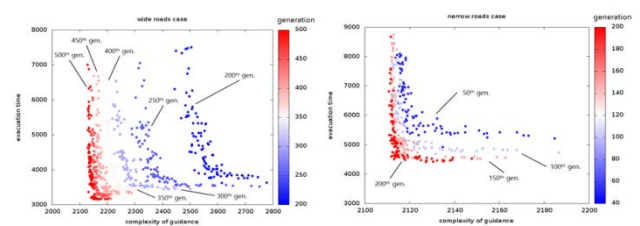
Evacuation Simulation

CASSIA Framework can illustrate a trade-off structure in planning of evacuations from disasters. Optimization in disaster responses is serious requirements for local governments. But, such optimization includes multiple objective functions. So, the important issue is how to understand trade-off structures of such multi-objective functions over large number of policy options.

We apply our framework to evaluate evacuation plans, which have over 300 control parameters, to find out such trade-off. We implement NSGA-II algorithm to search optimal structures over large parameter spaces, and utilize the performance of K-computers to speed-up the process.



As a result, we can see the trade-off structures of efficiency of evacuation plan and complexity of the plan.



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