



**An open-source job management
framework for parameter-space exploration**

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Typical research workflow

essential in research activities

```
consider a model()  
write a source code()  
write a script for analysis()
```

```
while ( necessary ) {  
  select a suitable parameter set()  
  execute simulation run()  
  take a note to remember what we are doing()  
  wait for completion of the simulation run()  
  transfer the simulation results to suitable folders()  
  keep a note to remember what is done()  
  analyze results()  
  create a graph()  
}
```

```
write a paper()  
present in a meeting()
```



tend to be a bottleneck

- comparison of many models, parameters, jobs...
- prone to human-errors
- iteration can be longer as the amount of computation grows

[illegible]

vast amount of directories

SSH login is required many times to submit jobs



we must repeat what we have done when we find a bug in the simulation code

After a few months, the simulation results are no longer traceable



Organizing Assistant for Comprehensive and Interactive Simulations

OACIS Simulators Runs Analyses Hosts Logs

Document

Simulators

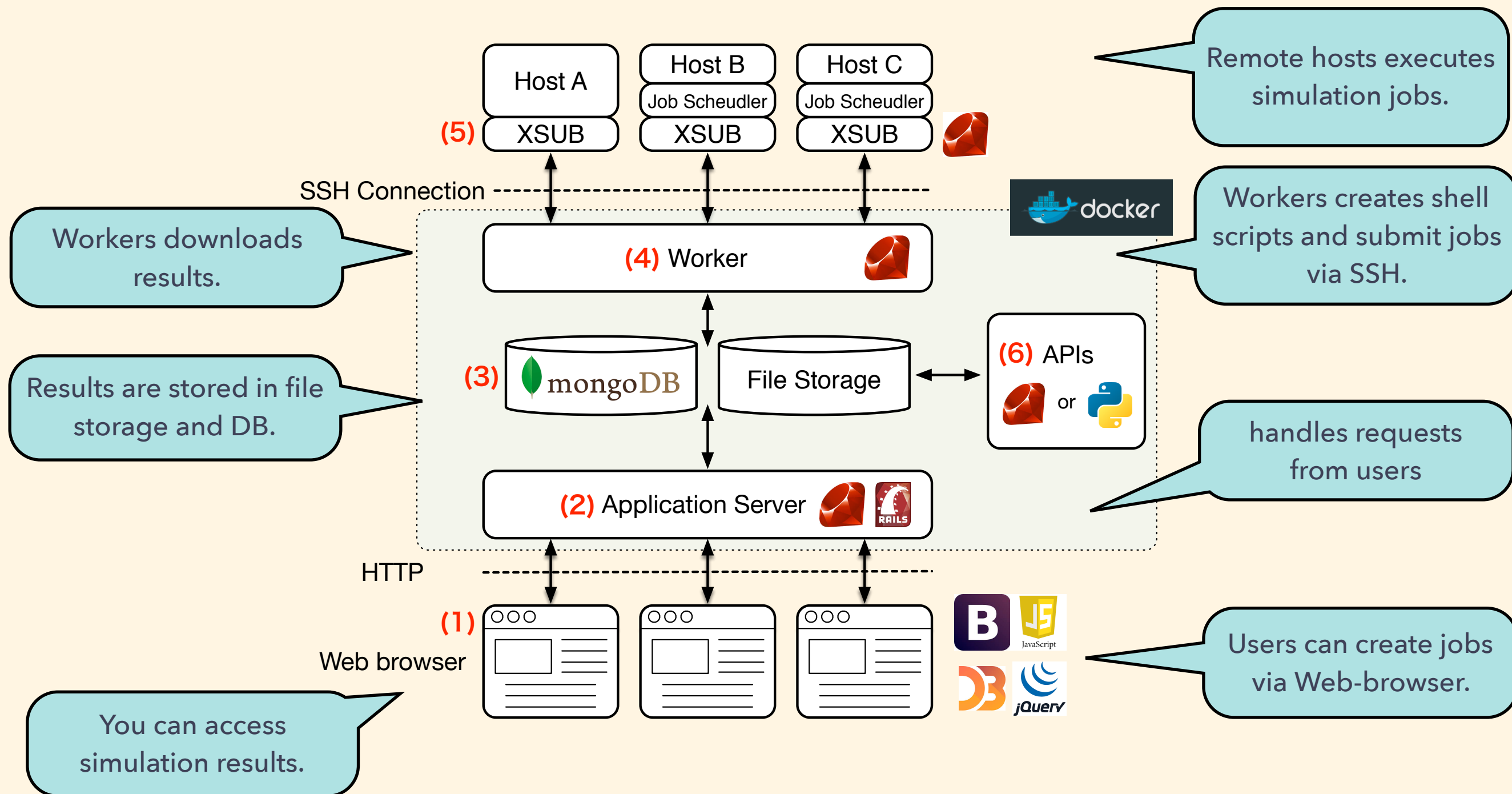
Name	Updated_at	Progress
ising2d	almost 2 years ago	100%
ising2d_2	almost 2 years ago	100%
ising_square	6 months ago	100%
1d_graph_model	almost 2 years ago	100%
niche_dynamical_graph_model	almost 2 years ago	100%
niche_dg_model		%
predator_prey		%
kumpula_model		%
kumpula_model		%
kumpula_parallel		%
kumpula_copy_and_shuffle_max		%
kumpula_2d_multi_layer		100%
kumpula_2d_mobile		100%

Available as an Open-Source software under the MIT license

<https://github.com/crest-cassia/oacis>

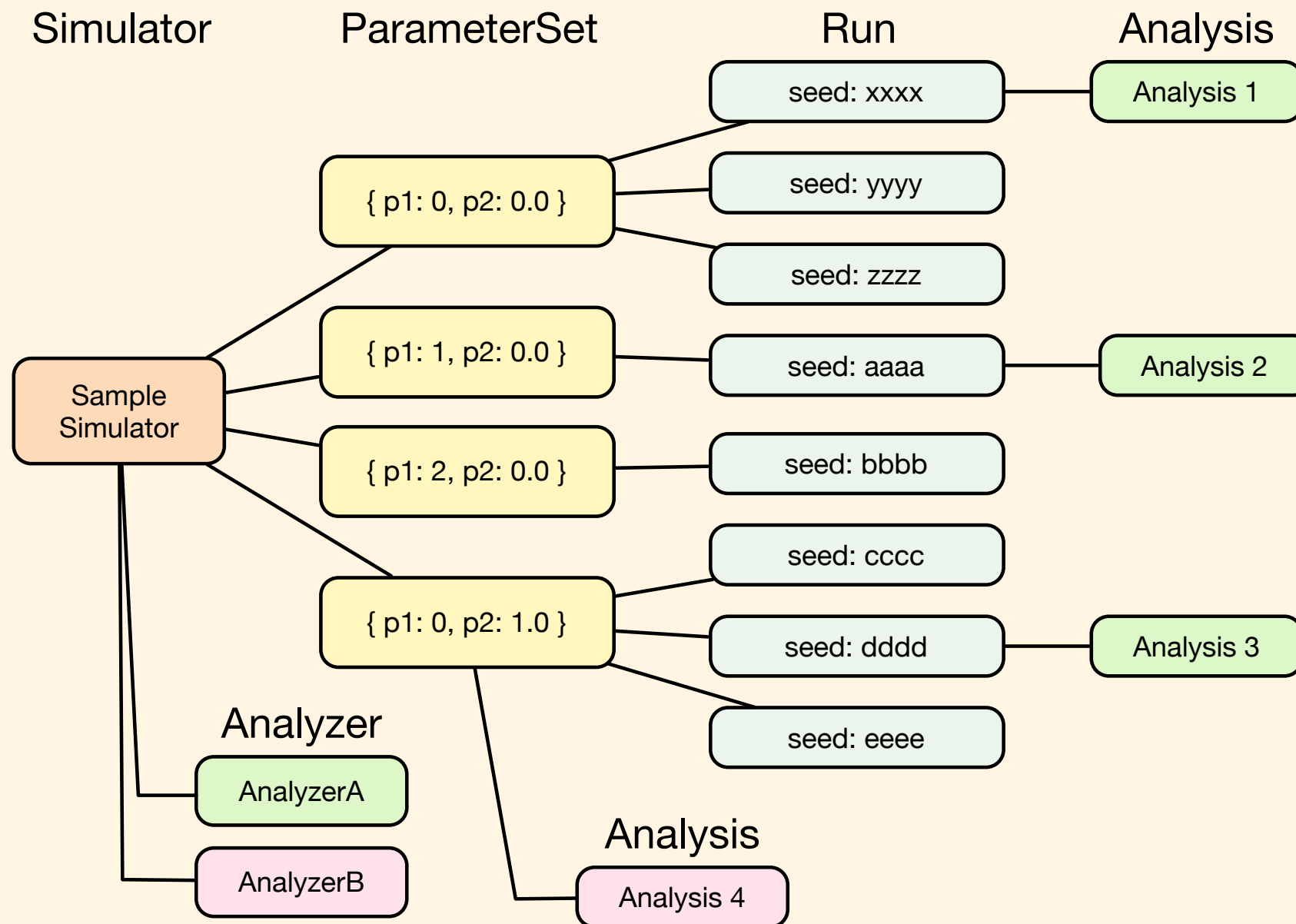
developed by Discrete-Event Simulation Research Team, R-CCS

System Overview



Ruby on Rails + MongoDB, Unix-based OS

Data-structure overview



DEMO

Simulators / ising2d

ising2d

AboutParameter SetsProgress

List of Parameter Sets

[Go to Explorer\(beta\)](#)

Show 100 entries

	Progress	ParamSetID	Updated_at	Lx	Ly	beta	h	t_init	t_measure	
Q	100%	8bac00	1 month ago	299	50	0.6	1.0	10000	10000	
Q	100%	8bac00	over 1 year ago	199	50	0.6	1.0	10000	10000	
Q	100%	8bac00	over 1 year ago	149	50	0.6	1.0	10000	10000	
Q	100%	8bac00	over 1 year ago	99	50	0.6	1.0	10000	10000	
Q	100%	8bac00	over 1 year ago	49	50	0.6	1.0	10000	10000	
Q	100%	8bac00	over 1 year ago	299	50	0.6	0.9	10000	10000	
Q	100%	8bac00	over 1 year ago	249	50	0.6	0.9	10000	10000	
Q	100%	8bac00	over 1 year ago	199	50	0.6	0.9	10000	10000	
Q	100%	8bac00	over 1 year ago	149	50	0.6	0.9	10000	10000	
Q	100%	8bac00	over 1 year ago	99	50	0.6	0.9	10000	10000	
Q	100%	8bac00	over 1 year ago	299	50	0.6	0.8	10000	10000	
Q	100%	8bac00	over 1 year ago	249	50	0.6	0.8	10000	10000	
Q	100%	8bac00	over 1 year ago	199	50	0.6	0.8	10000	10000	
Q	100%	8bac00	over 1 year ago	149	50	0.6	0.8	10000	10000	
Q	100%	8bac00	over 1 year ago	99	50	0.6	0.8	10000	10000	
Q	100%	8bac00	over 1 year ago	49	50	0.6	0.8	10000	10000	
Q	100%	8bac00	over 1 year ago	299	50	0.6	0.7	10000	10000	
Q	100%	8bac00	over 1 year ago	249	50	0.6	0.7	10000	10000	
Q	100%	8bac00	over 1 year ago	199	50	0.6	0.7	10000	10000	
Q	100%	8bac00	over 1 year ago	149	50	0.6	0.7	10000	10000	
Q	100%	8bac00	over 1 year ago	99	50	0.6	0.7	10000	10000	
Q	100%	8bac00	over 1 year ago	299	50	0.6	0.6	10000	10000	
Q	100%	8bac00	over 1 year ago	199	50	0.6	0.6	10000	10000	
Q	100%	8bac00	over 1 year ago	149	50	0.6	0.6	10000	10000	
Q	100%	8bac00	over 1 year ago	99	50	0.6	0.6	10000	10000	
Q	100%	8bac00	over 1 year ago	49	50	0.6	0.6	10000	10000	
Q	100%	8bac00	over 1 year ago	299	50	0.6	0.5	10000	10000	
Q	100%	8bac00	over 1 year ago	249	50	0.6	0.5	10000	10000	
Q	100%	8bac00	over 1 year ago	199	50	0.6	0.5	10000	10000	

Simulators / kumpula_copy_and_shuffle / Param:5423e009b93f96b620000023

Parameter Set

/Users/murase/program/oacis/public/Result_development/537180f4b93f9652b90002d5/5423e009b93f96b620000023

About Runs Analyses Plot

Plot on (net_size=10000, p_tri=0.05, p_jump=0.0005, p_death=0.0005, delta=1.0, t_max=25000, shuffle_fraction=0.005)

Plot type figure viewer

X-Axis p_death

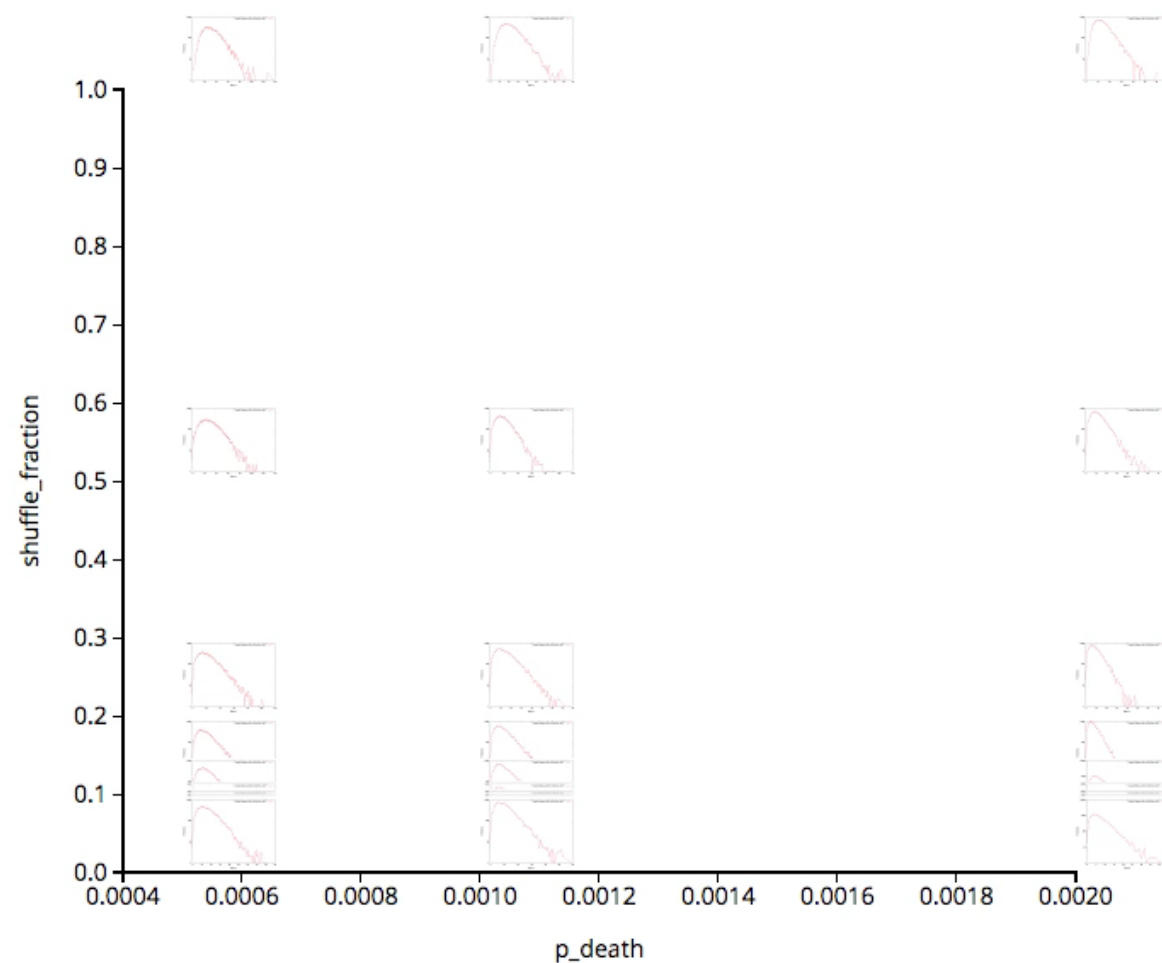
Y-Axis shuffle_fraction

Result plot_all/degree_distribution.png

Add Figure Viewer

Irrelevant parameters:

☐ net_size ☐ p_tri ☐ p_jump ☐ p_death ☐ delta ☐ t_max ☐ shuffle_fraction



X-Axis
p_death

Y-Axis
shuffle_fraction

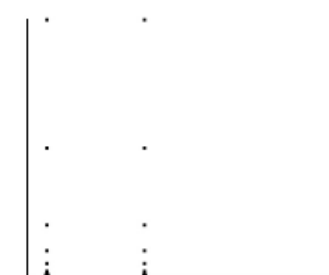
Result
plot_all/degree_distribution.png

URL

http://localhost:3000/parameter_sets/5423e009b93f96b6200

Action

☐ log scale on x axis
☐ log scale on y axis



Command-line based execution

bash script

dynamical_graph

About Parameter Sets Progress

SimulatorDescription

Duplicate Edit Destroy Show in JSON

About

Parameter Input Type

Support MPI

Support OMP

Sequential Seed

Executable On

Defined Parameters

	Type	Default	Description
p	Float	0.2	probability to make a
t_init	Integer	1024	initialization time step
t_measure	Integer	65536	measurement time st

Commands

- Pre-process Script
- Simulation Command

~/work/dynamical_graph_model/run.sh

```
#!/bin/bash
export LANG=C
export LC_ALL=C

# VARIABLE DEFINITIONS -----
export OACIS_JOB_ID=573f38c36b696d07093a0200
export OACIS_IS_MPI_JOB=false
export OACIS_MPI_PROCS=1
export OACIS_OMP_THREADS=1
OACIS_PRINT_VERSION_COMMAND="cd ~/work/dynamical_graph_model; git describe --always"

# PRE-PROCESS -----
if [ `basename $(pwd)` != ${OACIS_JOB_ID} ]; then # for manual submission
  mkdir -p ${OACIS_JOB_ID} && cd ${OACIS_JOB_ID}
  if [ -e ../${OACIS_JOB_ID}_input.json ]; then
    mv ../${OACIS_JOB_ID}_input.json ./_input.json
  fi
fi
echo "{" > ../${OACIS_JOB_ID}_status.json
echo "  \"started_at\": \"`date`\", \">> ../${OACIS_JOB_ID}_status.json
echo "  \"hostname\": \"`hostname`\", \">> ../${OACIS_JOB_ID}_status.json

# PRINT SIMULATOR VERSION -----
if [ -n "$OACIS_PRINT_VERSION_COMMAND" ]; then
  (eval ${OACIS_PRINT_VERSION_COMMAND}) > _version.txt
fi

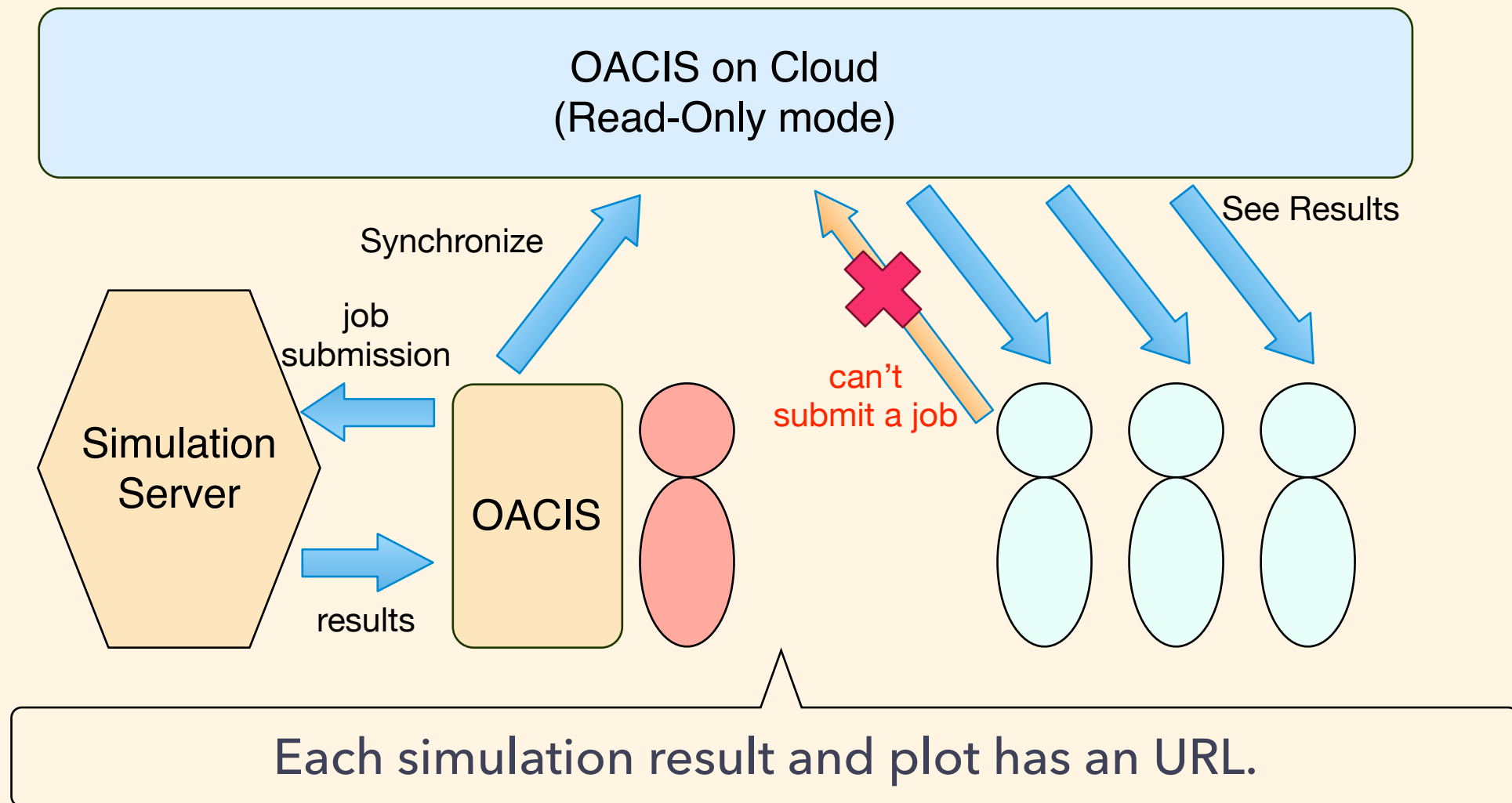
# JOB EXECUTION -----
export OMP_NUM_THREADS=${OACIS_OMP_THREADS}
{ time -p { ~/work/dynamical_graph_model/run.sh 0.002 1048576 33554432 1471364291; }
RC=$?
echo "  \"rc\": $RC,\" >> ../${OACIS_JOB_ID}_status.json
echo "  \"finished_at\": \"`date`\", \">> ../${OACIS_JOB_ID}_status.json
echo "}" >> ../${OACIS_JOB_ID}_status.json

# POST-PROCESS -----
if [ -d _input ] && [ $RC -eq 0 ]; then {
  rm -rf _input
} fi
```

A command is embedded into a shell script.
We can implement simulators in any language.

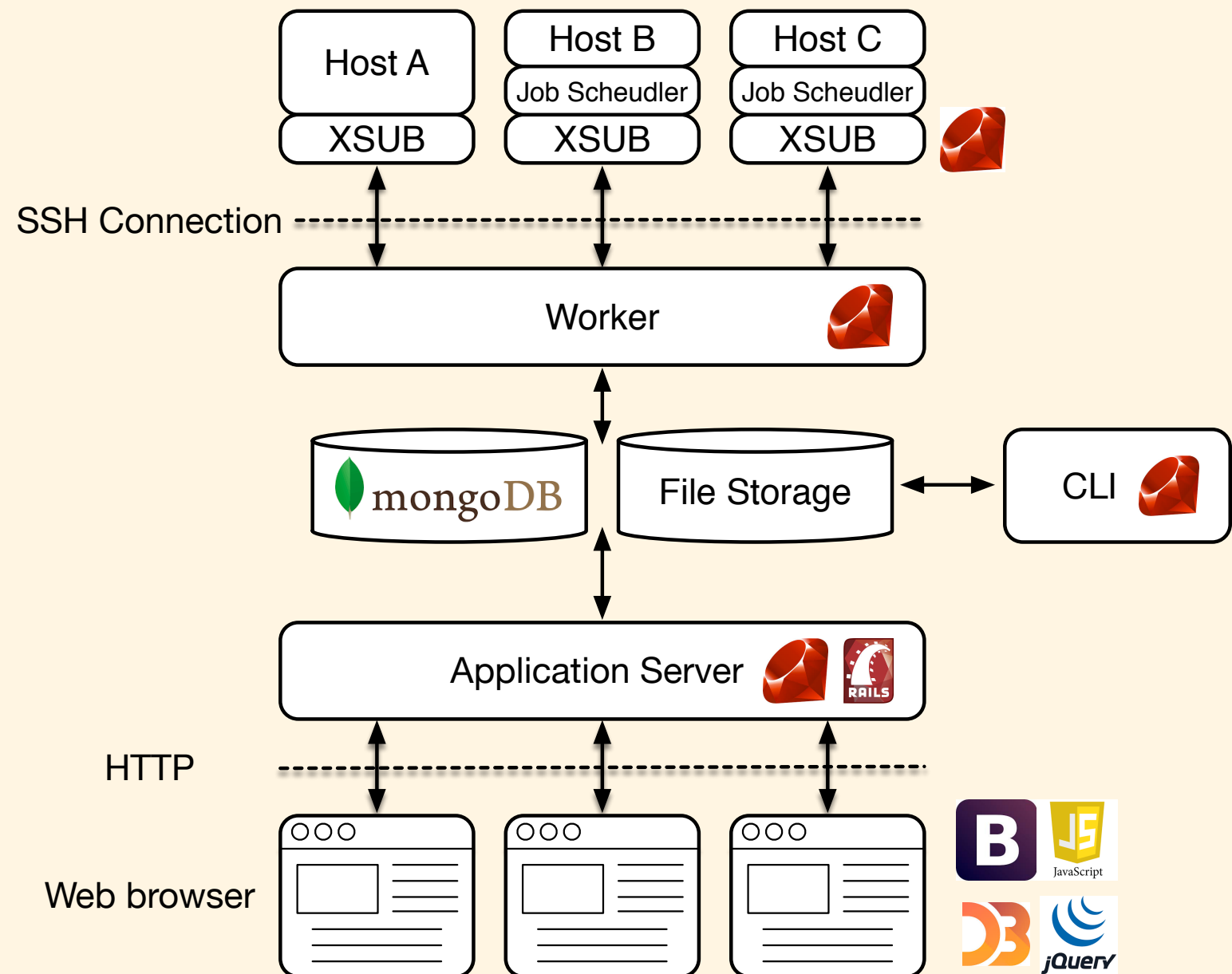
Sharing data

- To share the data, we provide “read-only” mode.
 - To share data, you may prepare another read-only instance.



Software Stack

- server side
 - Ruby
 - Ruby on Rails
 - MongoDB
 - front-end
 - D3.js
 - jQuery
 - twitter-bootstrap
- ~ 12,000 lines for app
~ 12,000 lines for unit tests



APIs

Python and Ruby APIs are available for automate your workflows.

```
sim = Simulator.where(name: "my_simulator").first
host = Host.where(name: "localhost").first

p1_values = [1.0, 2.0, 3.0, 4.0, 5.0]
p2_values = [2.0, 4.0, 6.0, 8.0, 10.0]

p1_values.each do |p1|
  p2_values.each do |p2|
    parameter = {"p1"=>p1, "p2"=>p2}
    ps = sim.find_or_create_parameter_set( parameter )
    ps.find_or_create_runs_upto(5, submitted_to: host)
  end
end
```

loop on parameter "p1"

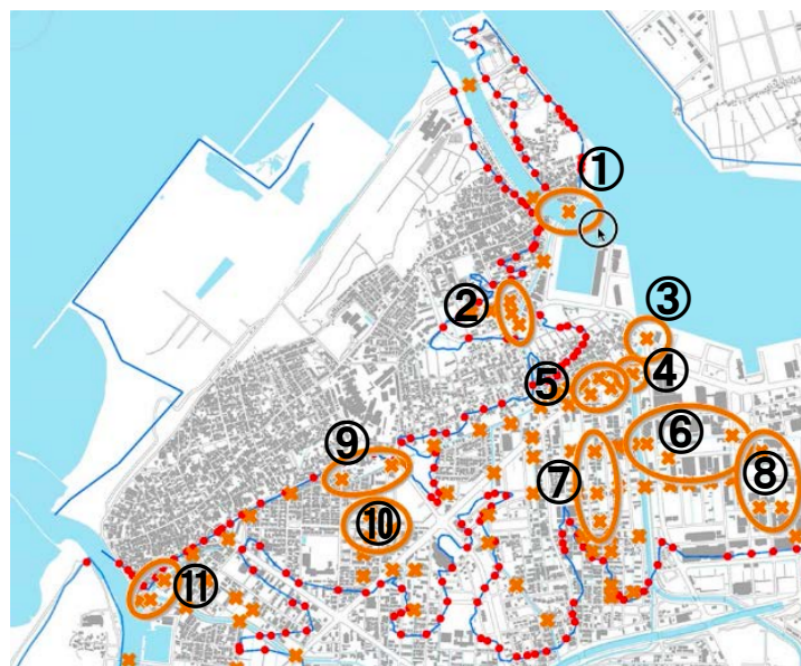
loop on parameter "p2"

creation of PS and Runs

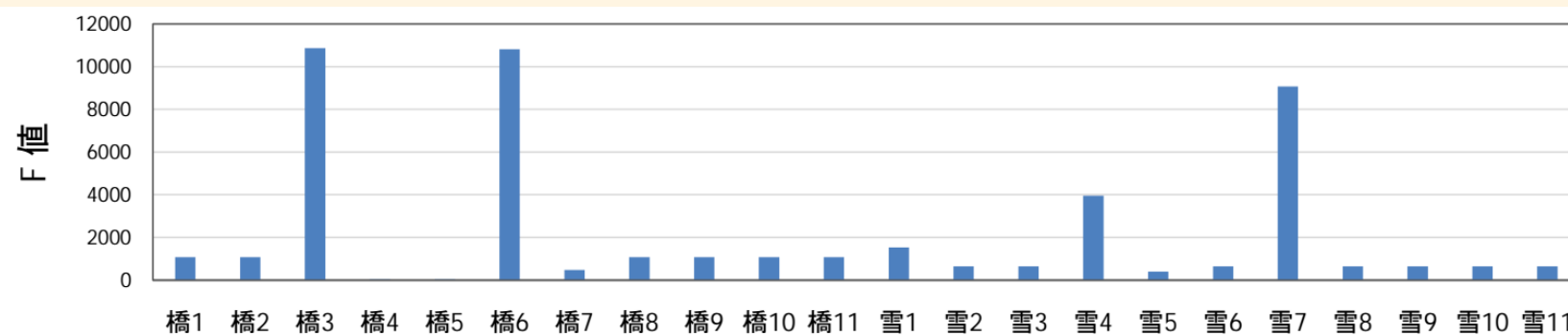
Sensitivity Analysis

Identifying the input factors that affect simulation outputs

Agent simulation of evacuations from Tsunami



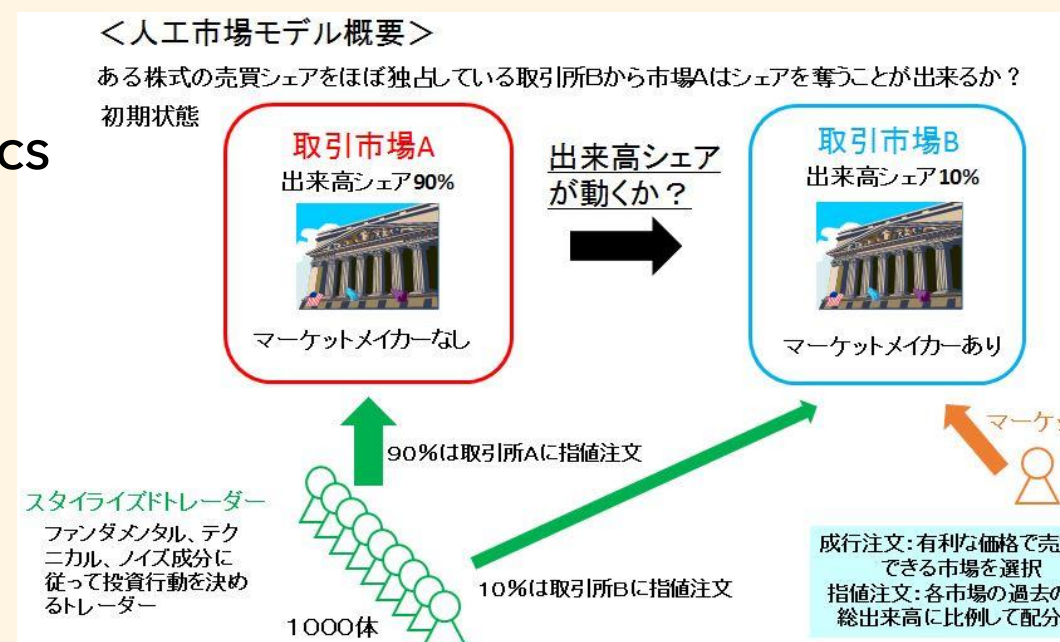
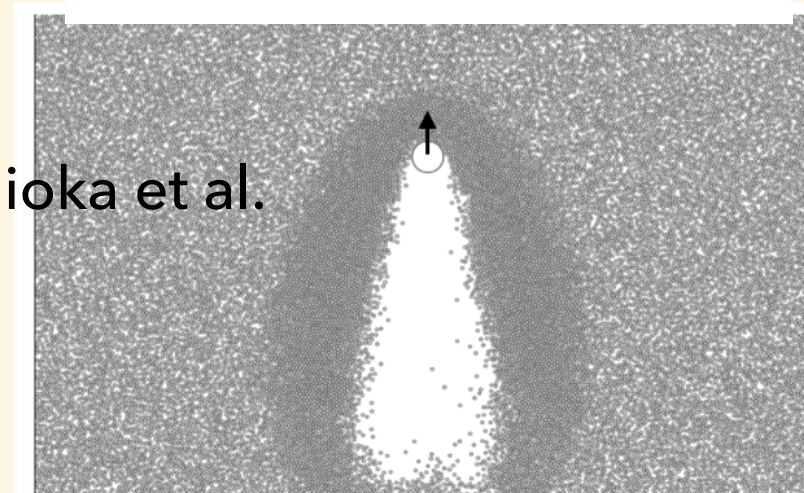
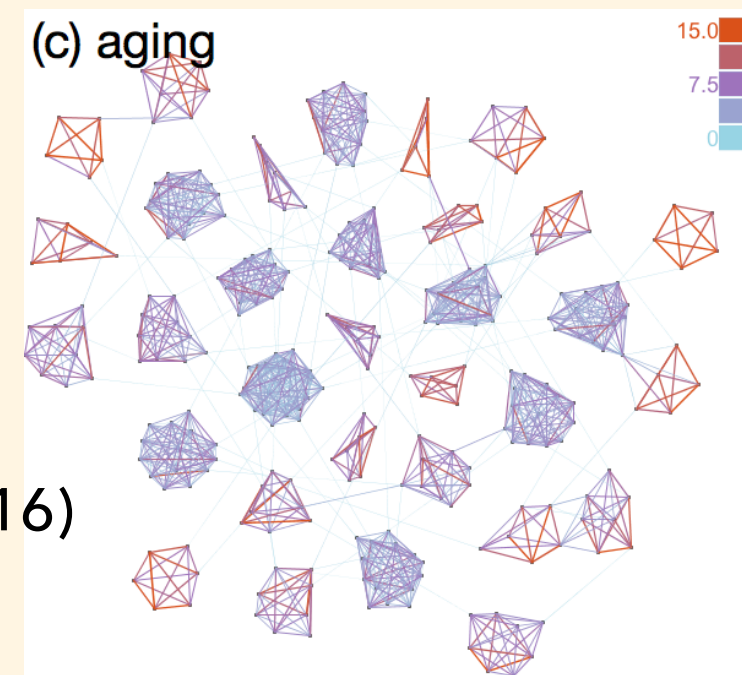
金沢市大野町で実施された「逃げ地図ワークショップ」で決定



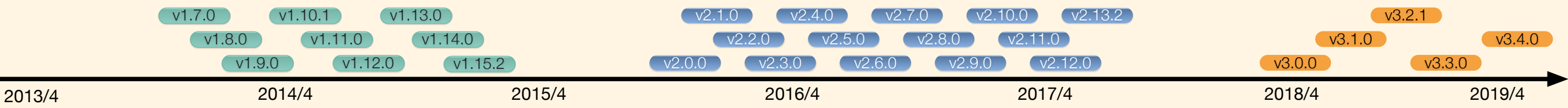
因子（橋 11 箇所，雪道 11 箇所）

Use cases

- modeling social networks
 - Y. Murase et al. (2014,2015), Torok et al.(2016), Jo et al. (2016)
- agent-based simulation of stock markets
 - Kusada et al. (2014), Torii et al. (2015)
- agent-based simulation of traffic and pedestrians
 - Matsushima(2016), Tsuji(2015), Uchitane et al.(2016), Yoshioka et al.
- studies on open evolving systems
 - Shimada et al. (2014,2015), Murase et al.(2015)
- molecular dynamics simulation of granular material
 - Kuwabara et al.
- first-principle calculation of condensed matter physics
 - Pham et al.(2017)
- simulation of rescue robots
 - Takayanagi et al. (2016), Takami et al. (2017)



Development History



CASSIA Manager

SimulatorsJobsQueuesHostsUsers

Simulators / ArtificialMarket_TickSizeDependency

ArtificialMarket_TickSizeDependency

AboutParameter SetsAnalysis

List of Parameter Sets

Show 100 entries

Runs Progress	ID	Updated_at	NumAgents	MaxOrders	TMax	NumMark
▶ 100%	00006a	about 24 hours ago	1000	10	10000000	2
▶ 100%	00006b	about 24 hours ago	1000	10	10000000	2
▶ 100%	00006c	about 24 hours ago	1000	10	10000000	2
▶ 100%	00006d	about 24 hours ago	1000	10	10000000	2
▶ 100%	00006e	about 24 hours ago	1000	10	10000000	2
▶ 100%	00006f	about 24 hours ago	1000	10	10000000	2
▶ 100%	000070	about 24 hours ago	1000	10	10000000	2
▶ 100%	000071	about 24 hours ago	1000	10	10000000	2

OACIS

SimulatorsRunsAnalysesHostsLogs

Simulators / ising2d_2

ising2d_2

AboutParameter SetsProgress

List of Parameter Sets

Show 100 entries

	Progress	ParamSetID	Updated_at	Lx	Ly	beta	h
Q	100%	2d9a00	almost 3 years ago	49	50	0.32	-0.1
Q	100%	f8b600	almost 3 years ago	49	50	0.4	-0.1
Q	100%	2d9a00	almost 3 years ago	49	50	0.3	-0.1
Q	100%	2d9900	almost 3 years ago	49	50	0.28	-0.1
Q	100%	2d9900	almost 3 years ago	49	50	0.28	-0.1
Q	100%	2d9900	almost 3 years ago	49	50	0.28	-0.1
Q	100%	2d9800	almost 3 years ago	49	50	0.25	-0.1
Q	100%	2d9800	almost 3 years ago	49	50	0.25	-0.1
Q	100%	2d9800	almost 3 years ago	49	50	0.23	-0.1
Q	100%	2d9700	almost 3 years ago	49	50	0.23	-0.1
Q	100%	2d9700	almost 3 years ago	49	50	0.23	-0.1
Q	100%	2d9700	almost 3 years ago	49	50	0.2	-0.1
Q	100%	2d9700	almost 3 years ago	49	50	0.3	-0.1
Q	100%	2d9600	almost 3 years ago	49	50	0.28	-0.1
Q	100%	2d9600	almost 3 years ago	49	50	0.28	-0.1
Q	100%	2d9600	almost 3 years ago	49	50	0.28	-0.1

OACIS

SimulatorsJobsHostsLogs

Document

Simulators / homophily_wsn

homophily_wsn

ID : 59e5ab9a85cf85475599c1a7

AboutParameter SetsProgress

List of Parameter Sets

Q not filtering

Show 100 entries auto reload 5 sec

Export CSV New Parameter Set

show/hide columns

	Progress	ParamSetID	Updated_at	N	p_tri	p_r	p_Id	F	q	t_max	delta
Q	100%	ae5a19	11 months ago	50000	0.2	0.001	0.005	4	8	800000	1.0
Q	100%	8ba9fb	11 months ago	50000	0.2	0.001	0.005	4	7	400000	1.0
Q	100%	8ba9fd	11 months ago	50000	0.2	0.001	0.005	4	9	400000	1.0
Q	100%	8ba9fe	11 months ago	50000	0.2	0.001	0.005	4	10	400000	1.0
Q	100%	8ba9f9	11 months ago	50000	0.2	0.001	0.005	4	5	400000	1.0
Q	100%	8ba9fc	11 months ago	50000	0.2	0.001	0.005	4	8	400000	1.0
Q	100%	8ba9fa	11 months ago	50000	0.2	0.001	0.005	4	6	400000	1.0
Q	100%	19c8f4	11 months ago	50000	0.2	0.001	0.005	3	10	400000	1.0
Q	100%	19c8f5	11 months ago	50000	0.2	0.001	0.005	3	11	400000	1.0
Q	100%	1a1582	11 months ago	50000	0.2	0.001	0.005	3	20	400000	1.0
Q	100%	dc2fc6	11 months ago	50000	0.2	0.001	0.005	4	5	50000	0.0
Q	100%	19c8f6	11 months ago	50000	0.2	0.001	0.005	3	12	400000	1.0
Q	100%	19c8fd	11 months ago	50000	0.2	0.001	0.005	3	19	400000	1.0
Q	100%	dc5235	11 months ago	50000	0.2	0.001	0.005	12	5	50000	0.0

Conclusion

<https://github.com/crest-cassia/oacis>

The screenshot shows the GitHub repository page for `crest-cassia / oacis`. The repository has 13 pull requests, 15 stars, and 1 fork. The main navigation bar includes links for Code, Issues (11), Pull requests (0), Projects (0), Pulse, Graphs, and Settings. The repository statistics bar shows 2,718 commits, 2 branches, 30 releases, and 3 contributors. The commit history table lists recent commits with their descriptions and timestamps.

Commit	Description	Time
takeshi-uchitane	committed on GitHub Merge pull request #512 from crest-cassia/debug_print_ssh	Latest commit 372b34f a day ago
app	print debug log if OACIS_SSH_DEBUG=1	2 days ago
bin	support Ruby 2.2.0 or later	10 months ago
config	initial import of HostGroupsController	22 days ago
docs	Merge pull request #509 from crest-cassia/cli_support_host_group	8 days ago
lib	Merge pull request #509 from crest-cassia/cli_support_host_group	8 days ago
public	removed obsolete document	2 months ago
script	remove redundant files	3 years ago
spec	set host_group for auto_run analyses	8 days ago
test	fixed the command to run the performance test	7 months ago