

Framework for Interactive Parameter Sweep Applications

*Adianto Wibisono, Zhiming Zhao,
Adam Belloum, Marian Bubak*



Outline

- Background
- Existing Frameworks
- Requirements
- Design
- Implementation
- Experiments
- Interoperability
- Future work



Background

- Parameter sweep applications (PSA) :
 - simple computational model, occurs in broad range of discipline
- Exploratory nature of parameter search, possible benefit of involving human in the loop (interactivity)
- Most of available frameworks for PSA do not support interactivity.

Background

- Goals
 - Conduct a study on performing interactive parameter search experiments
 - Investigate type of interactivity that will increase the efficiency in conducting parameter search exploration.



Existing Frameworks

Framework	Emphasizes
NIMROD-G/O	Computational Economy
APPLES/APST	Scheduling Heuristics
P-GRADE	Workflow of Parameter Sweep
SEGL	Management of Complex and Dynamic Parameter Studies
Virtual Instrument	Interactive Computational Steering
Sim-X	Interactive Engineering Optimization Problem

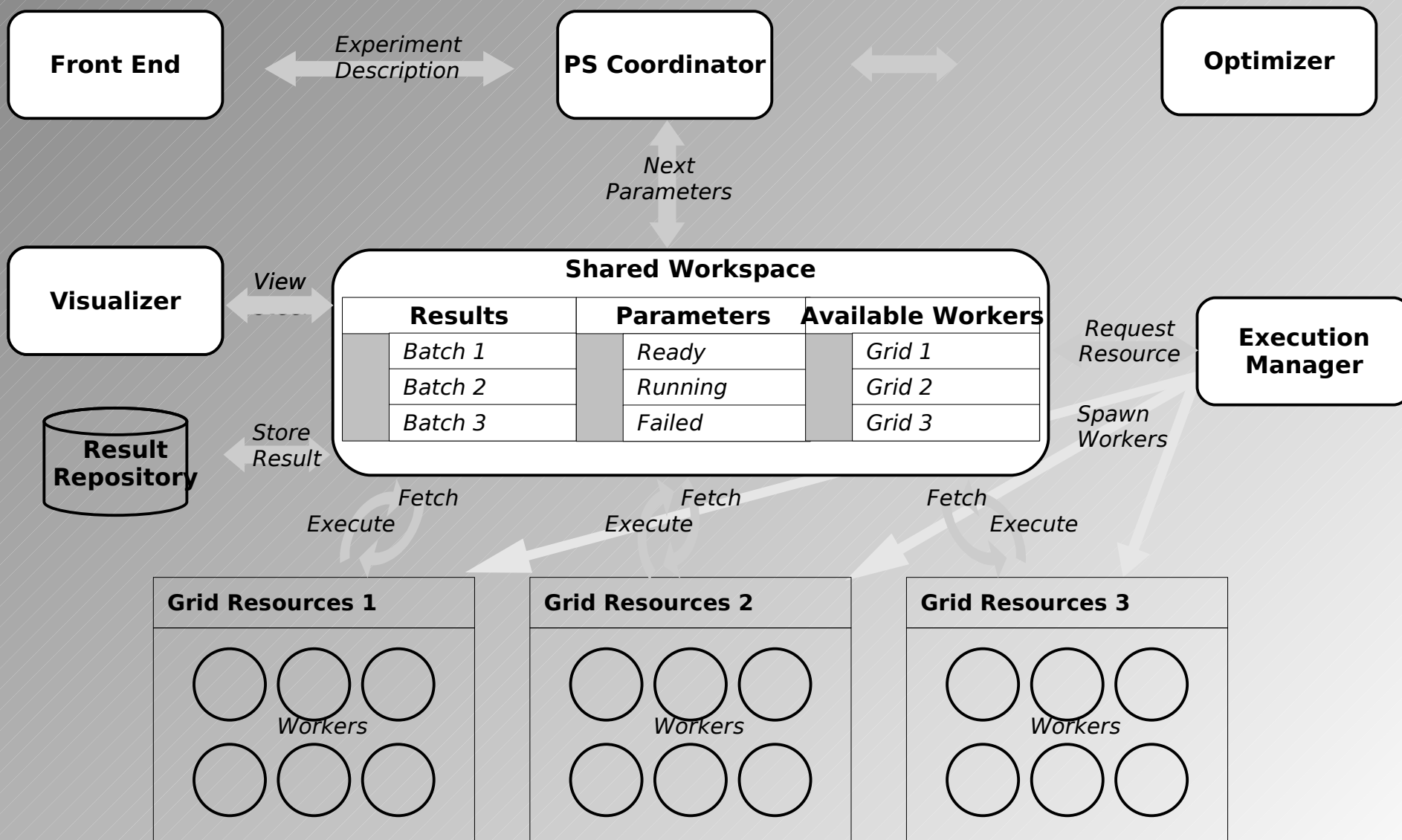
Requirements

- Domain scientist
 - Hidden from the complexity of underlying grid environment
 - Monitor job execution, visualize intermediate results, interact and give feed back for the execution
 - Reproduce experiments
- Application Developer
 - Ease of porting legacy application
 - Support for different optimization method and visualization techniques to be plugged into the framework

Interactivity Requirements

- Perform refinement of search from initial rough search to more detailed
- Focus on certain area of interest
- Stop exploration of non promising regions
- Add additional worker during runtime experiments
- Possibly change optimizers during execution of experiments

Design



Implementation

- NetworkSpace library for shared workspace, python implementation of Linda space
- Ganga for submission to heterogeneous resource manager.
- PyLab for visualization and use of existing optimization library.



Implementation

- Trajectory optimizers have been implemented based on simplex/Nedel Mead optimizer
- Optimisers used generators from Python to communicate with workspace
- Implemented a visualizer capable of displaying progress of objective function
- Current prototype provides limited interactivity, only to cancel and restart an optimizer with different set of parameters

Experiments

- Applications : ADDA, Red Blood Cell
- Inverse light scattering problem, minimize error between simulation and real data
- An MPI application, executed using Lam/Mpi to allow workers to execute it multiple times on the resource
- Each workers managed to perform ~ 100 MPI runs of the experiments with only single submissions.

Experiments

```
rips/test$ history | grep sudo
hd
e
181
lib/python2.5/site-packages/nwss/web.py
hd
sudo
rips/test$ !494
hon2.5/site-packages/nwss/web.py
bisono:
rips/test$ ps -ef | grep twist
4 11:54 ?        00:00:58 /usr/bin/python /usr/bin/
0 12:14 pts/2    00:00:00 grep twist
rips/test$ kill -9 29962
rips/test$ twistd -y /etc/nws.tac
rips/test$ sudo pybabelfishd
rips/test$ ll

wibisono 1442 2008-05-16 12:00 adda-coord.py
wibisono 13 2008-04-21 12:51 adda-runexp.sh
wibisono 477 2008-04-21 12:54 adda-worker.py
wibisono 1201 2008-04-21 12:57 adda_wrapper.py
wibisono 1468 2008-04-21 12:57 adda_wrapper.pyc
wibisono 364
```

Variables in Test-NedelMeadOptimizer
FRIPS: Framework For Interactive Parameter Sweep Refresh

Variable	# Parameters	# Fetchers	# Finders	Mode	Delete?
AVAILABLE_WORKERS	5	0	0	fifo	<input type="checkbox"/>
CURRENT_RESULTS	3	0	0	fifo	<input type="checkbox"/>
FINAL_RESULTS	0	0	0	fifo	<input type="checkbox"/>
OPTIMIZER_VIEWS	4	0	0	fifo	<input type="checkbox"/>
READY_PARAMETERS	0	0	0	fifo	<input type="checkbox"/>
VIEW143986284	183	0	0	fifo	<input type="checkbox"/>
VIEW143986412	186	0	0	fifo	<input type="checkbox"/>
VIEW143986604	178	0	0	fifo	<input type="checkbox"/>
VIEW143986668	178	0	0	fifo	<input type="checkbox"/>
WORKER_STOP_LIST	0	0	0	fifo	<input type="checkbox"/>
5]-0	160	0	0	fifo	<input type="checkbox"/>
5]-1	111	0	0	fifo	<input type="checkbox"/>
5]-2	215	0	0	fifo	<input type="checkbox"/>
5]-3	135	0	0	fifo	<input type="checkbox"/>
5]-4	285	0	0	fifo	<input type="checkbox"/>

Previous Highlight all Match case

Figure 1

```
rips/test$ p
erator obje
d successfu
ion value: (
84
uations: 66
d successfu
ion value: :
43
uations: 78
r of functi
ng optimum p
99999997023059, 0.999999995444122, 0.9999999990012989, 0.9999999983513244) optimum value 1.617509737e-19
```



Interoperability

- Possible to interoperate with other existing workflow as long as they have access to the workspace
- A pre processing workflow with other framework can supply initial random guess for parameter search
- Post processing workflow obtain results from workspace and further processed it.

Future Works

- Study and implement further types of interactivity.
- Perform further experiment with different types applications.
- Experiments with different optimizers for each of the applications.
- Study the interoperability of the framework with existing workflow engine.