



Next Generation Domain-Services
in PL-Grid Infrastructure for Polish Science

Interactive Scientific Research with the Data Farming Methodology and the Scalarm Platform

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Agenda



- A common research case - assumptions
- Data farming methodology
- Interactive data farming process with Scalarm
 - Example of Immunological Evolutionary Multi-Agent System optimization
- Summary and future works



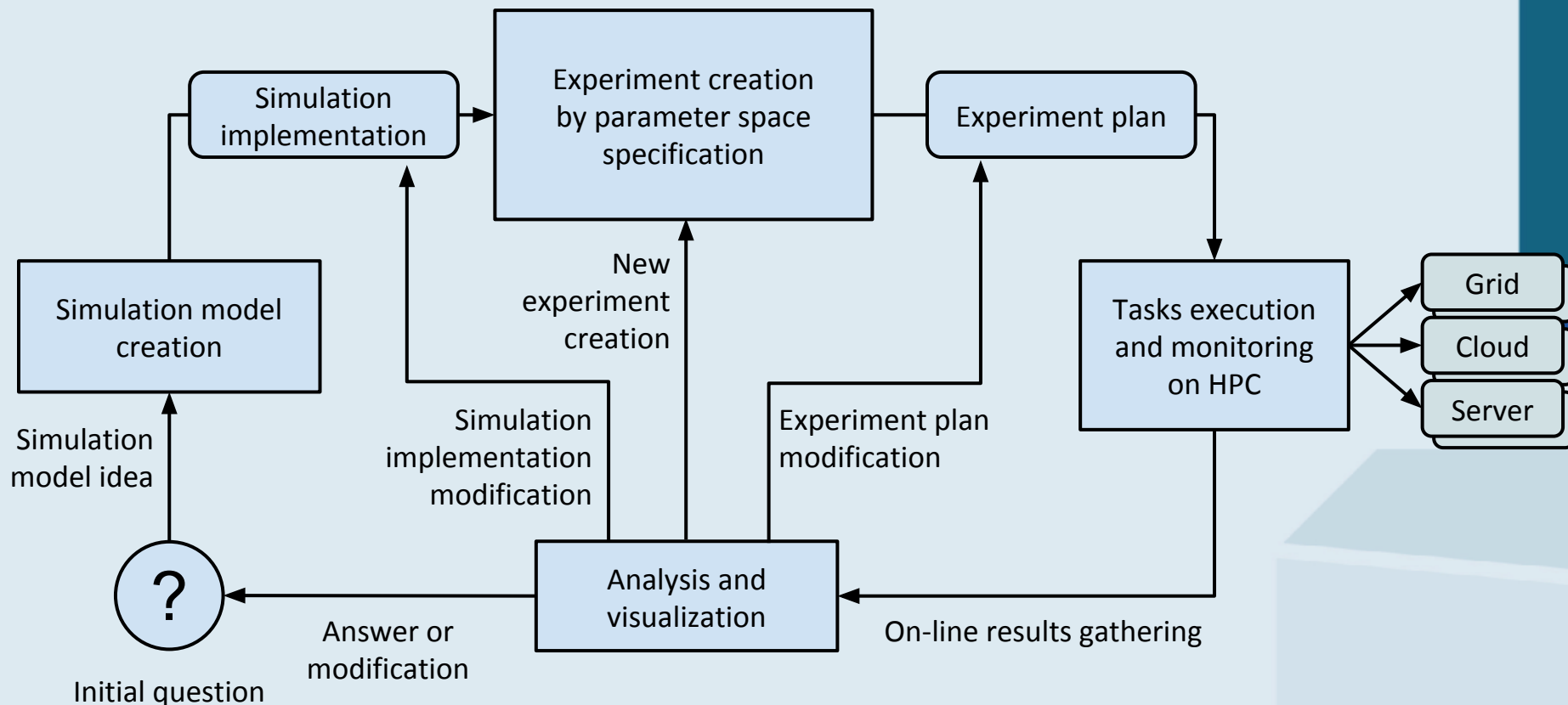
Research assumptions



- Simulations
 - Simulation as a “black box”
 - Behavior study in various configurations
- Goals
 - Interesting results discovery
 - Optimal simulation configuration discovery
 - Simulation model and implementation optimization
- An example
 - Validation and search for optimal configuration of developed algorithm



Data Farming Process with The Scalarm Platform



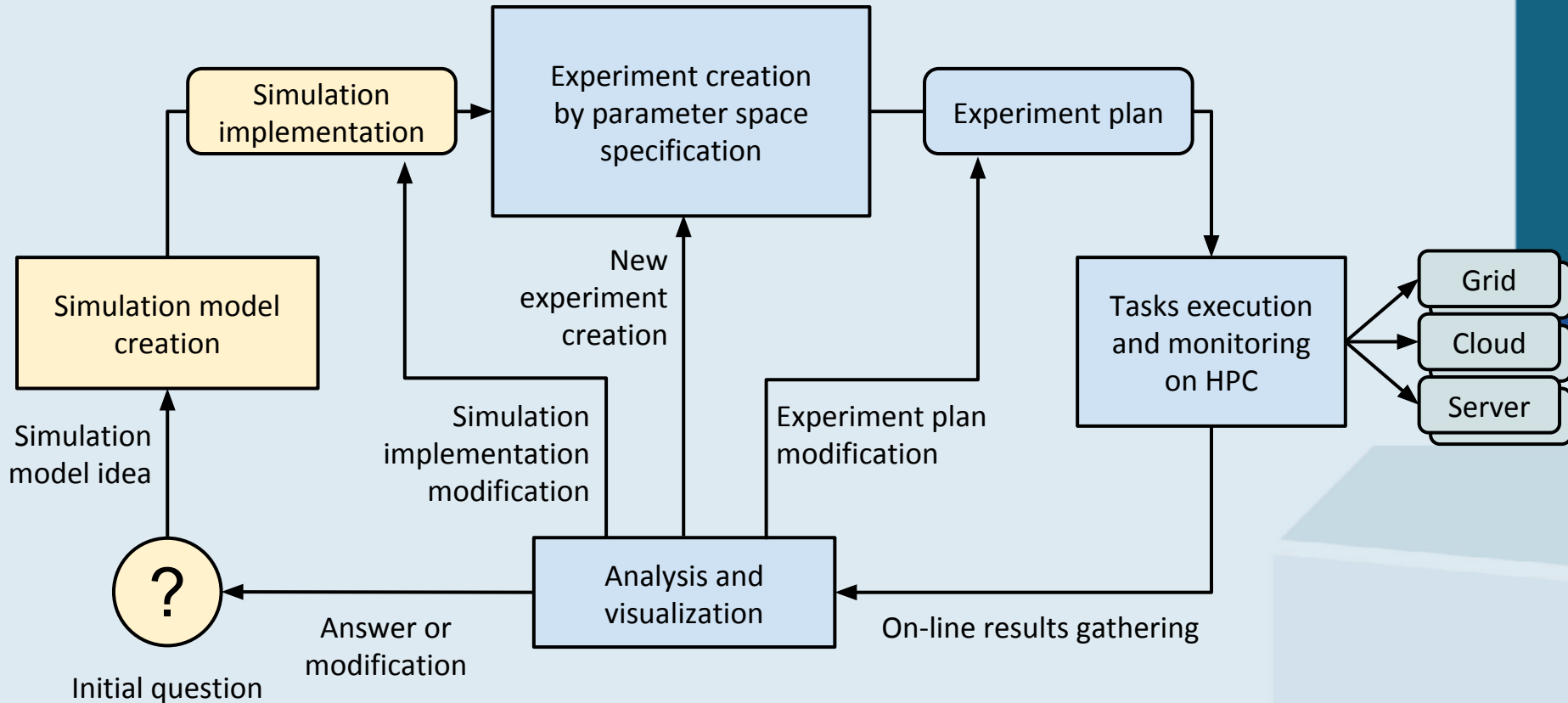
Experiment Example: Optimization and Testing of IEMAS



- Evolutionary Multi-Agent System (EMAS)
 - **Intelligent Information Systems Group AGH**
 - Multi-agent metaheuristics without global control
 - An agent represents a solution of optimization problem
- Immunological Evolutionary Multi-Agent System (IEMAS)
 - **dr hab. inż. M. Kisiel-Dorohinicki, D. Kluba, D. Wojciechowski**
 - Extension of EMAS with immunological mechanisms
- Data Farming experiment goals
 - Validation and efficiency check of IEMAS in various configurations
 - Evaluation of IEMAS implementation extensions



Data Farming in Scalarm Platform: Simulation creation



Data Farming in Scalarm Platform: Simulation creation



Definition
of input

Input definition Design Upload JSON

Parameters

- Reproduction ... (reproducti...)**
- Newborn energ... (newborn_en...)**
- Transferred e... (transferre...)**
- Amount of ite... (amount_of_...)**
- Immunological... (immunologi...)**
- Bite transfer (bite_trans...)**
- Mahalanobis s... (mahalanobi...)**
- Immunological... (immunologi...)**
- Good agent en... (good_agent...)**
- Evaluation me... (evaluation...)**

Parameter specification

Parameter ID:

Label:

Type:

Min: Max:

Your simulation
binaries

Files

Simulation binaries

Current file: simulation_binaries.zip

Upload new file: Nie wybrano pliku

Executor

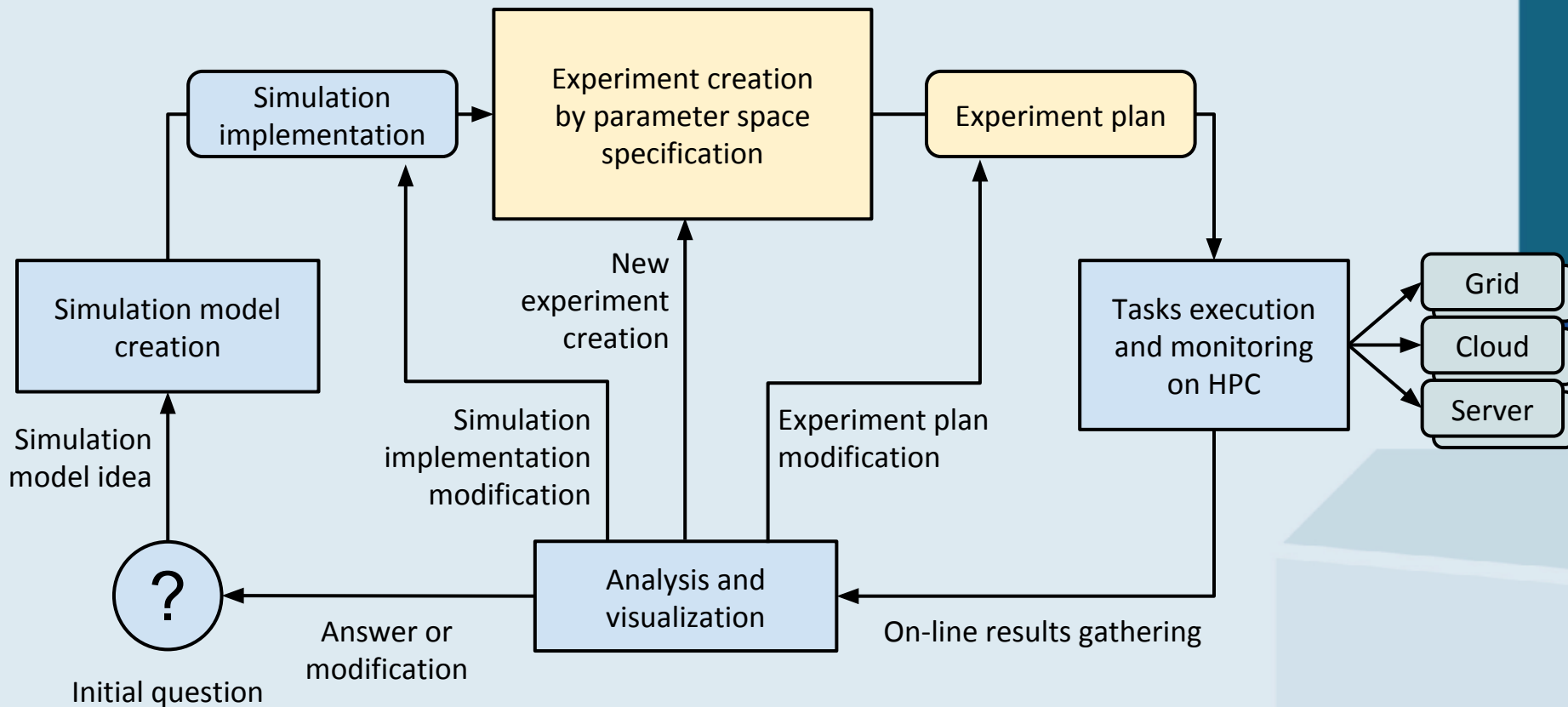
Select a registered name:

or insert file: Nie wybrano pliku

Script to run
simulation



Data Farming in Scalarm Platform: Experiment Creation



Data Farming in Scalarm Platform: Experiment Creation



Input space - manual specification

On Off

1. Parametrization

2. Design of Experiment

3. Parameter constraints

Specify parametrization for each input parameter below

Group: Default group

Entity: Default entity

Parameter 'Reproduction minimum' - Value constraints: [0, 1000]

Set parametrization type: Single value

Specify values based on the selected parametrization type

Set value: 3

Parameter 'Newborn energy' - Value constraints: [0, 1000]

Set parametrization type: Range

Specify values based on the selected parametrization type

Set minimum: 1

Set maximum: 1000

Set step: 200

- 3 tabs:
- basic
 - DoE
 - constraints

Single value parameter

Range parameter



Data Farming in Scalarm Platform: Experiment Creation



Input space - import from a CSV file

On Off

Select a CSV file with the parameter space:

Wybierz plik configur...s_1.csv

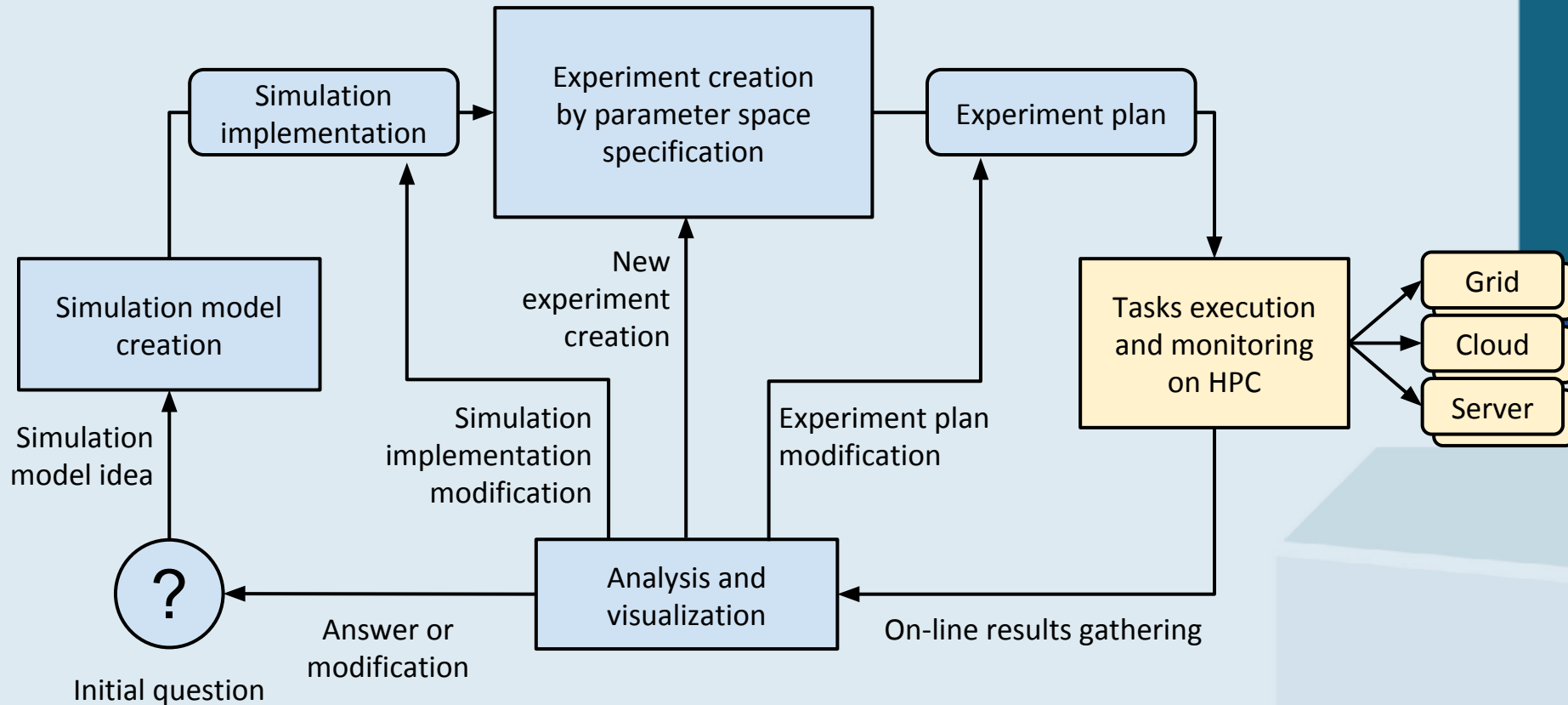
Import

Select parameters which should be included in the parameter space

	Parameter full id	Values in each row
<input checked="" type="checkbox"/>	reproduction_minimum (Reproduction minimum)	Single value
<input checked="" type="checkbox"/>	newborn_energy (Newborn energy)	Single value
<input checked="" type="checkbox"/>	transferred_energy (Transferred energy)	Single value
<input checked="" type="checkbox"/>	amount_of_iterations (Amount of iterations (replication))	Single value
<input checked="" type="checkbox"/>	immunological_time_span (Immunological time span)	Single value



Data Farming in Scalarm Platform: Simulations execution



Data Farming in Scalarm Platform: Simulations execution



Experiment: IEMAS 0.6 (54f9ce4b8fca0a5ae0001b78) ▾

Infrastructure: Private resources ▾

Instance counter: Dummy

Private resource: PL-Grid

Job time constraint [min]:

Start at ("hh:mm:ss" format):

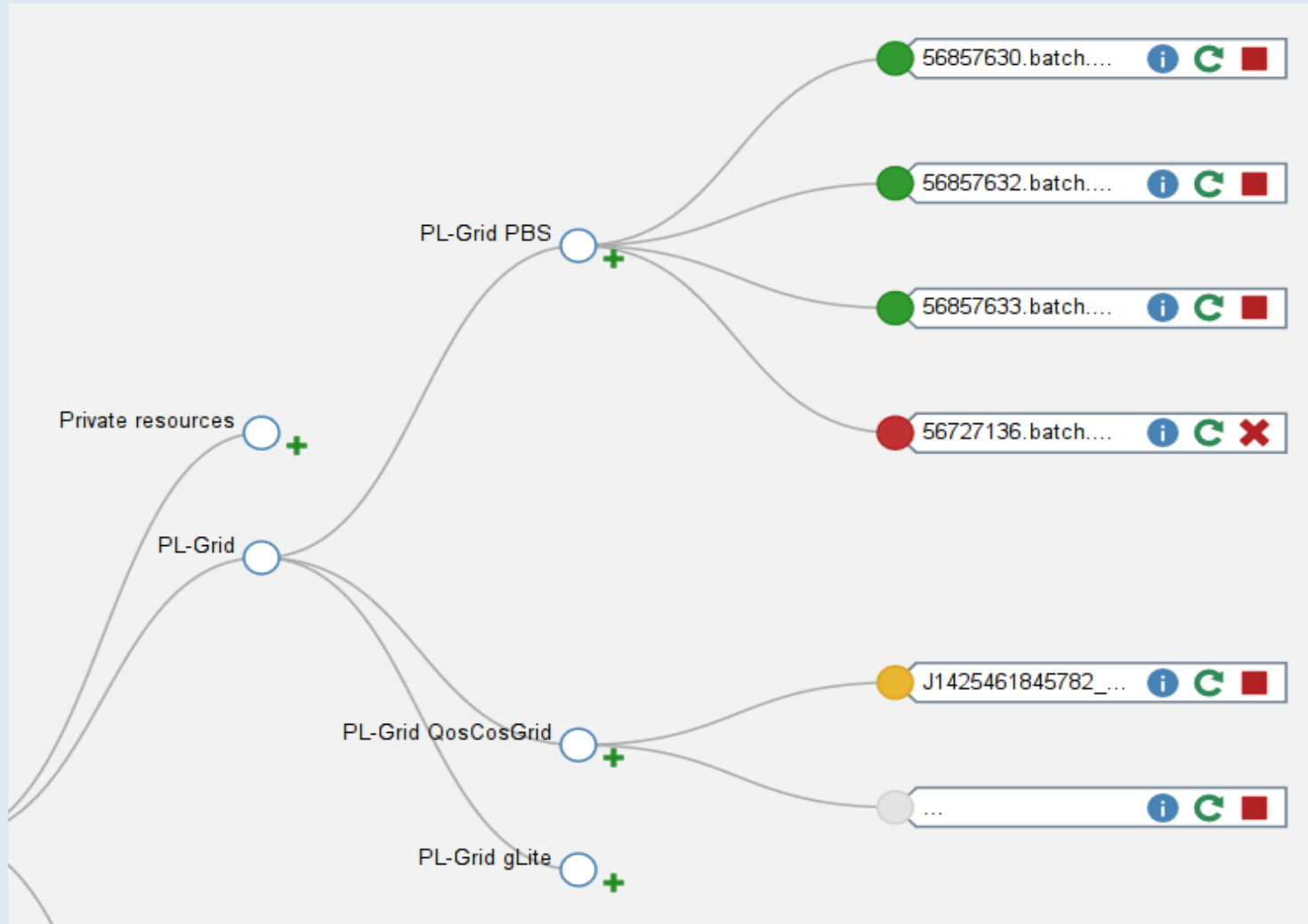
Submit

- Private resources
- Dummy
- PL-Grid**
- PL-Grid PBS
- PL-Grid QosCosGrid
- PL-Grid gLite
- Clouds
- Google Compute Engine
- PLGrid Cloud
- Amazon Elastic Compute Cloud

ALARM



Data Farming in Scalarm Platform: Simulations execution



ALARM



Data Farming in Scalarm Platform: Experiment Progress



Experiment progress

ALL:	78
RUNNING:	0
DONE:	58 ('74.36' % COMPLETED)
Average simulation execution time:	5 [m] 58 [s]

Experiment Speedometer



Highcharts.com

Execution progress bar



Data Farming in Scalarm Platform: Progress Information



Progress information

Show/Hide completed

Show/Hide running

Complete simulation runs

#	Execution time	Final results	Transferred energy	Amount of iterations (replication)
1	98.112 [s]	{"fitness_calls"=>72, "iemas_fitness"=>692.112086227, "time_elapsed"=>50}	0	1
2	136.69 [s]	{"fitness_calls"=>57, "iemas_fitness"=>740.62615994, "time_elapsed"=>100}	0	2
3	191.722 [s]	{"fitness_calls"=>66, "iemas_fitness"=>724.829450338, "time_elapsed"=>140}	0	3



Data Farming in Scalarm Platform: Simulation Details



Simulation 2

Status: completed

Started at: 2015-02-25 17:25:22 UTC

Completed at: 2015-02-25 17:27:38 UTC

Input:

- **Reproduction minimum:** 0
- **Newborn energy:** 0
- **Transferred energy:** 0
- **Amount of iterations (replication):** 2
- **Immunological time span:** 1
- **Bite transfer:** 1
- **Mahalanobis similarity:** 0.8
- **Immunological maturity time:** 1
- **Good agent energy:** 1
- **Evaluation method:** rastrigin

Output:

- **fitness_calls:** 57
- **iemas_fitness:** 740.62615994
- **time_elapsed:** 100

Binary output:

[click to download](#)
File size: 685 [kB]

Simulation STDOUT:

[click to download](#)
File size: 365 [B]

Input
parameters

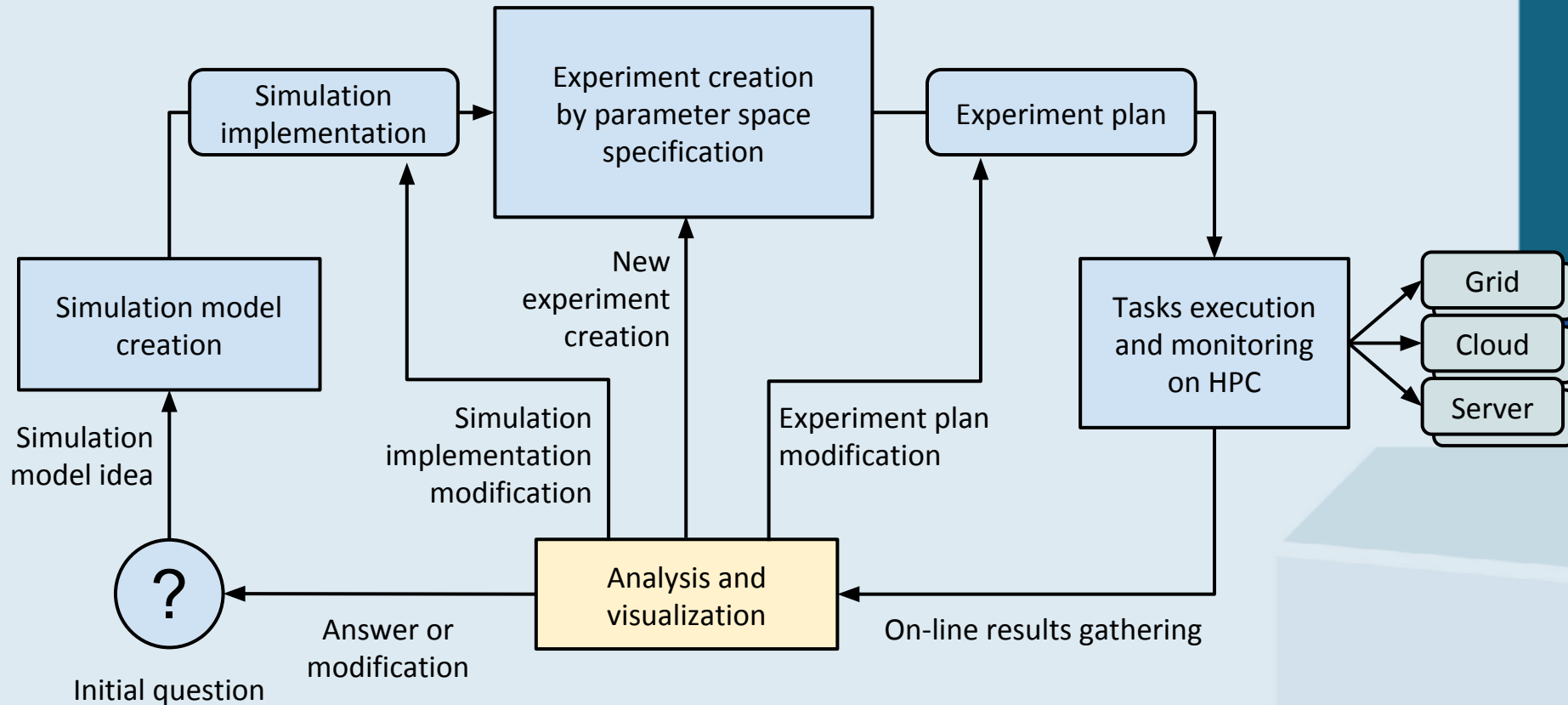
Standard
output

Measures of
Effectiveness

Binary output



Data Farming in Scalarm Platform: Analysis and Visualization



Data Farming in Scalarm Platform: Analysis and Visualization



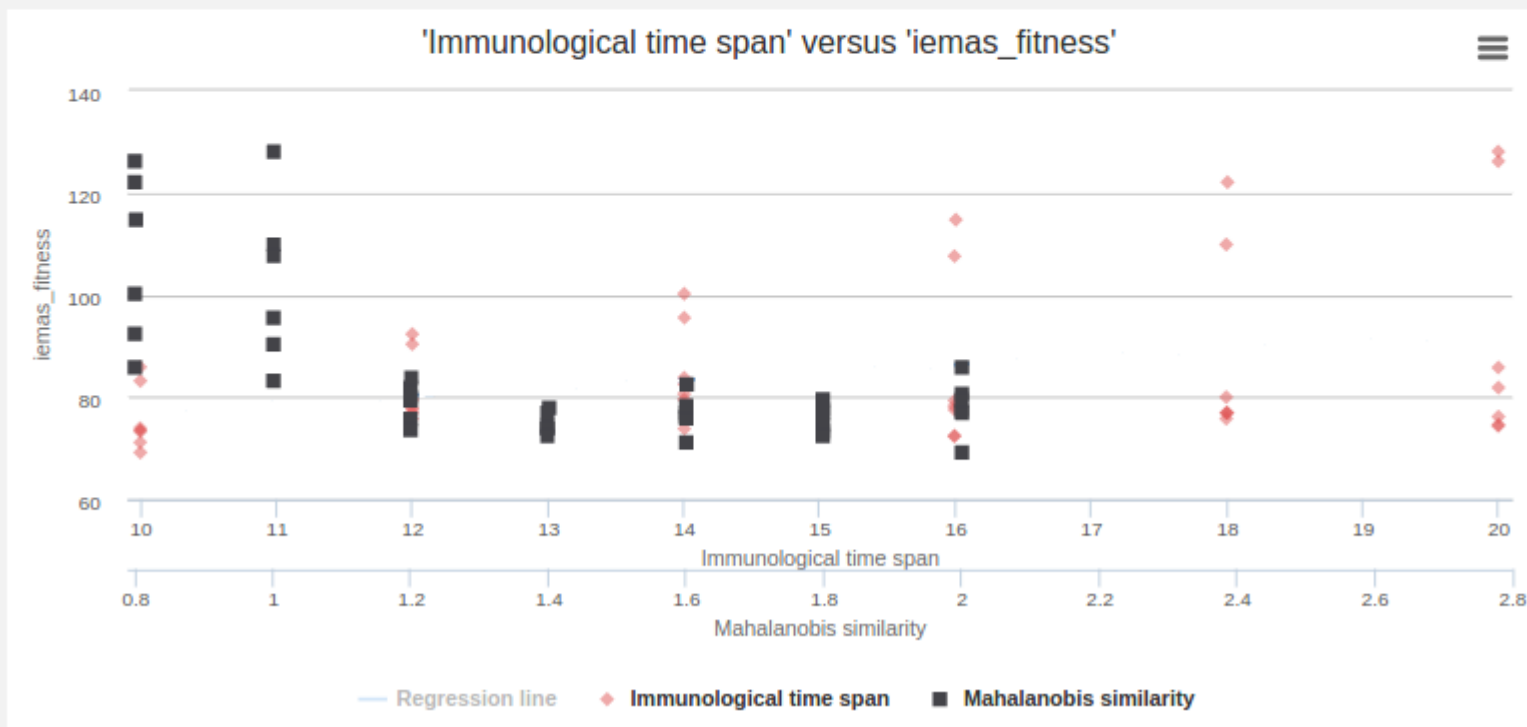
Select axis to add series:

Axis X

Add new series:

Mahalanobis similarity

Add series



ARM



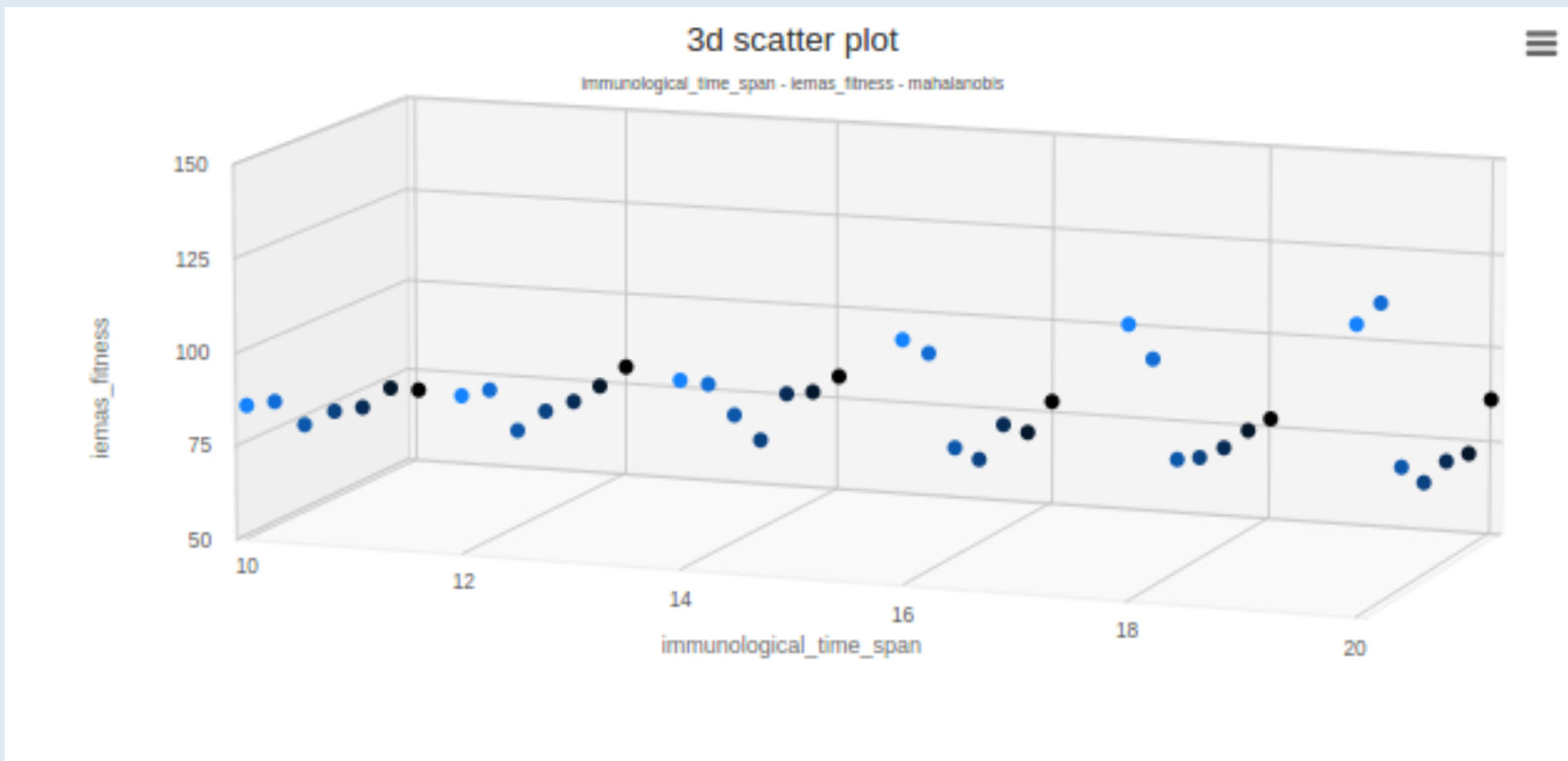
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NATIONAL COHESION STRATEGY



EUROPEAN UNION
EUROPEAN REGIONAL
DEVELOPMENT FUND



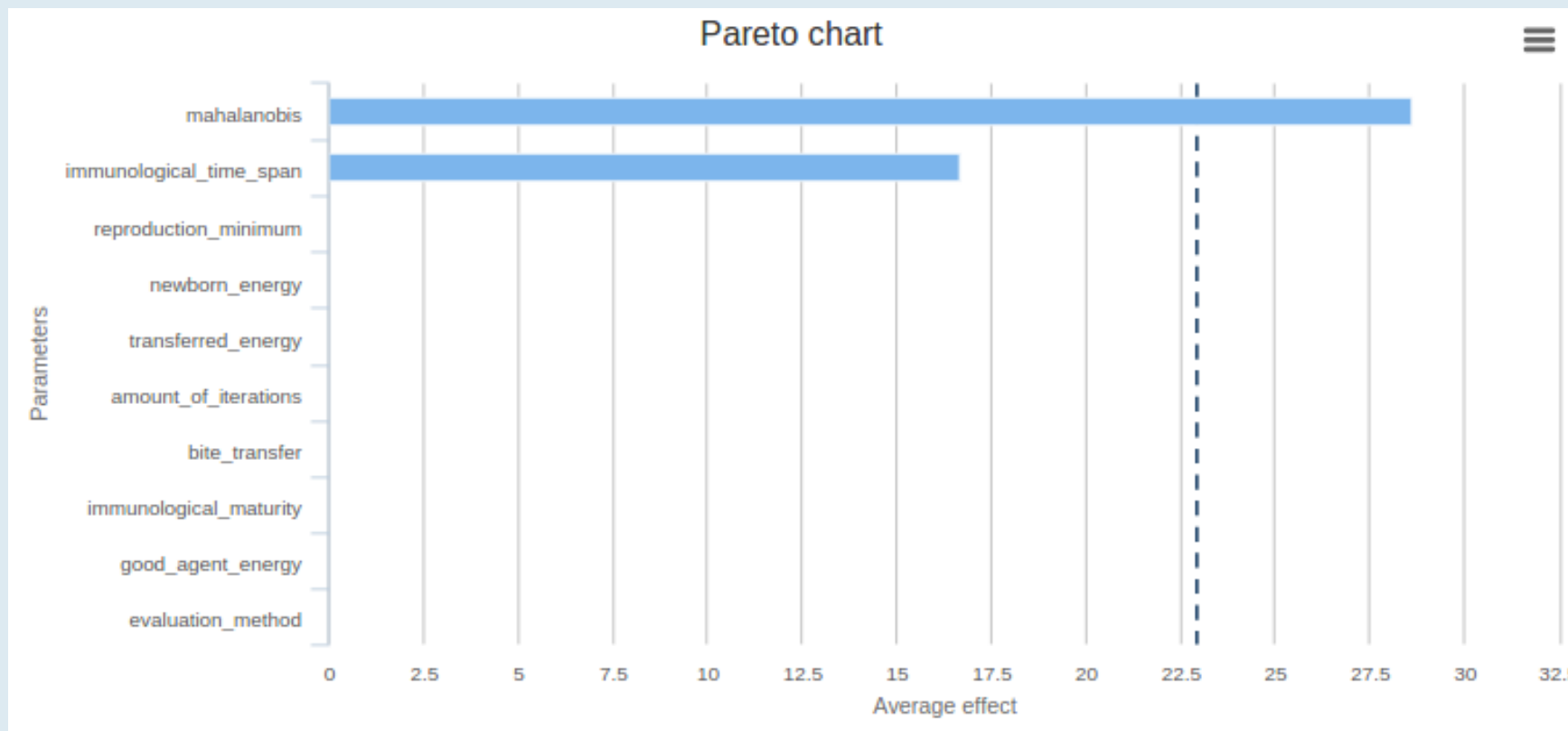
Data Farming in Scalarm Platform: Analysis and Visualization



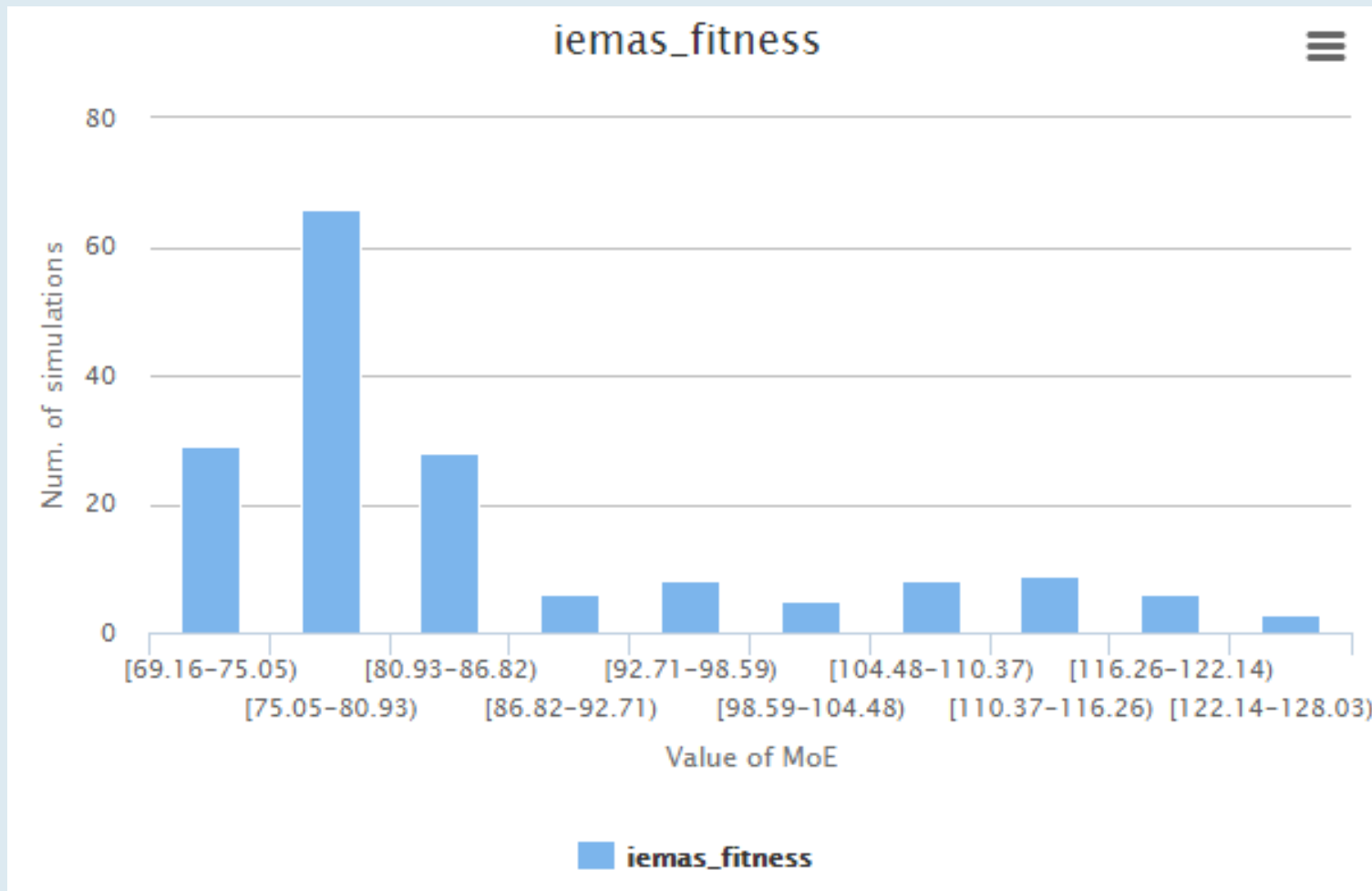
Data Farming in Scalarm Platform: Analysis and Visualization



Data Farming in Scalarm Platform: Analysis and Visualization



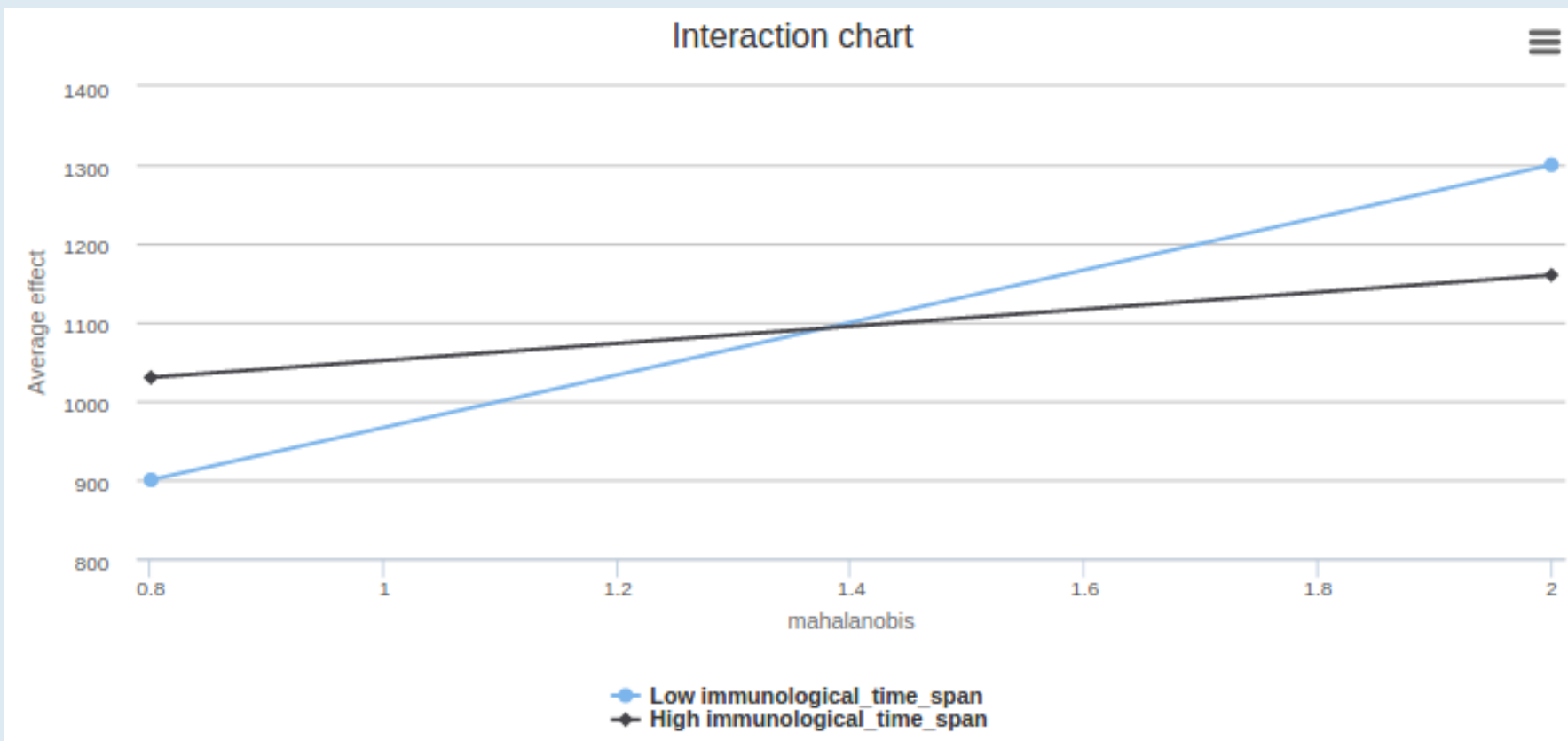
Data Farming in Scalarm Platform: Analysis and Visualization



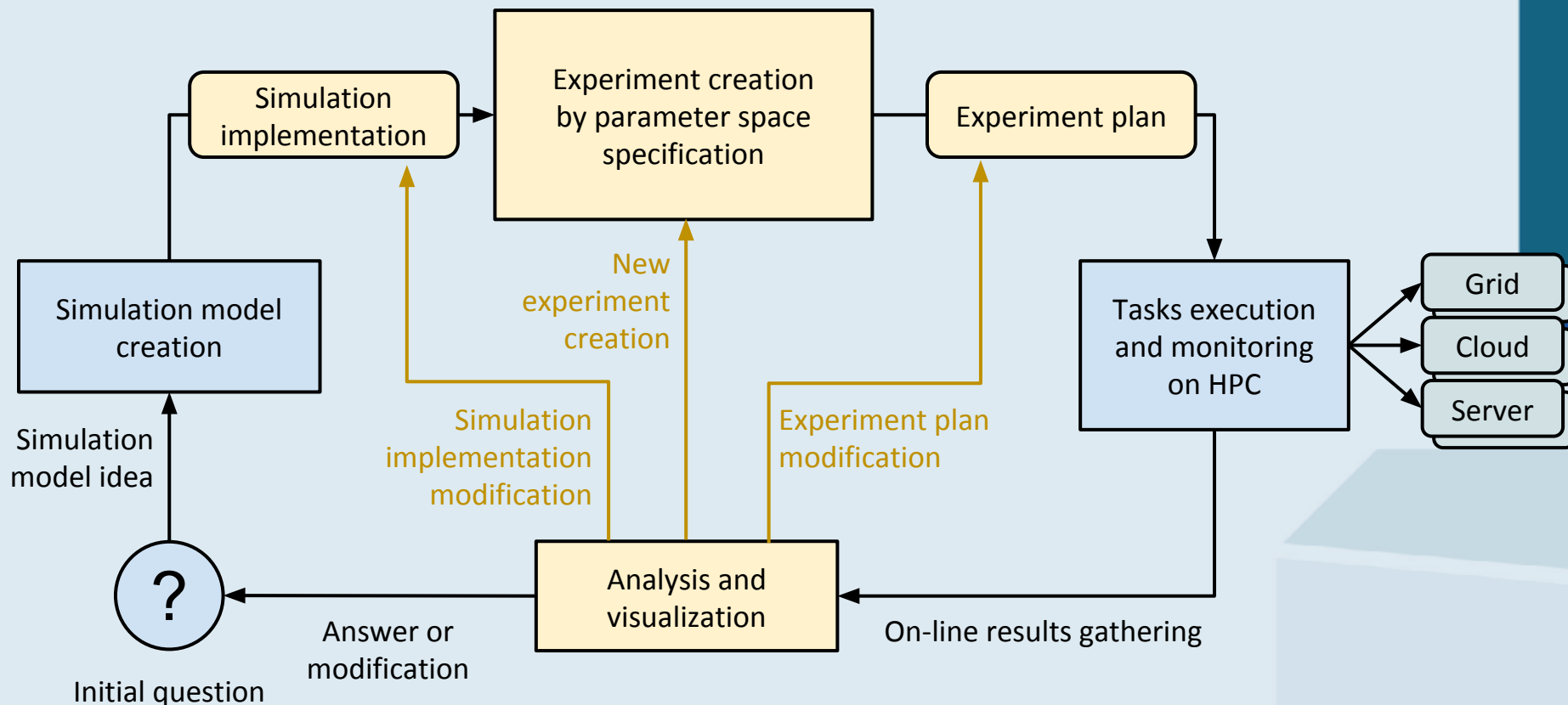
SCALARM



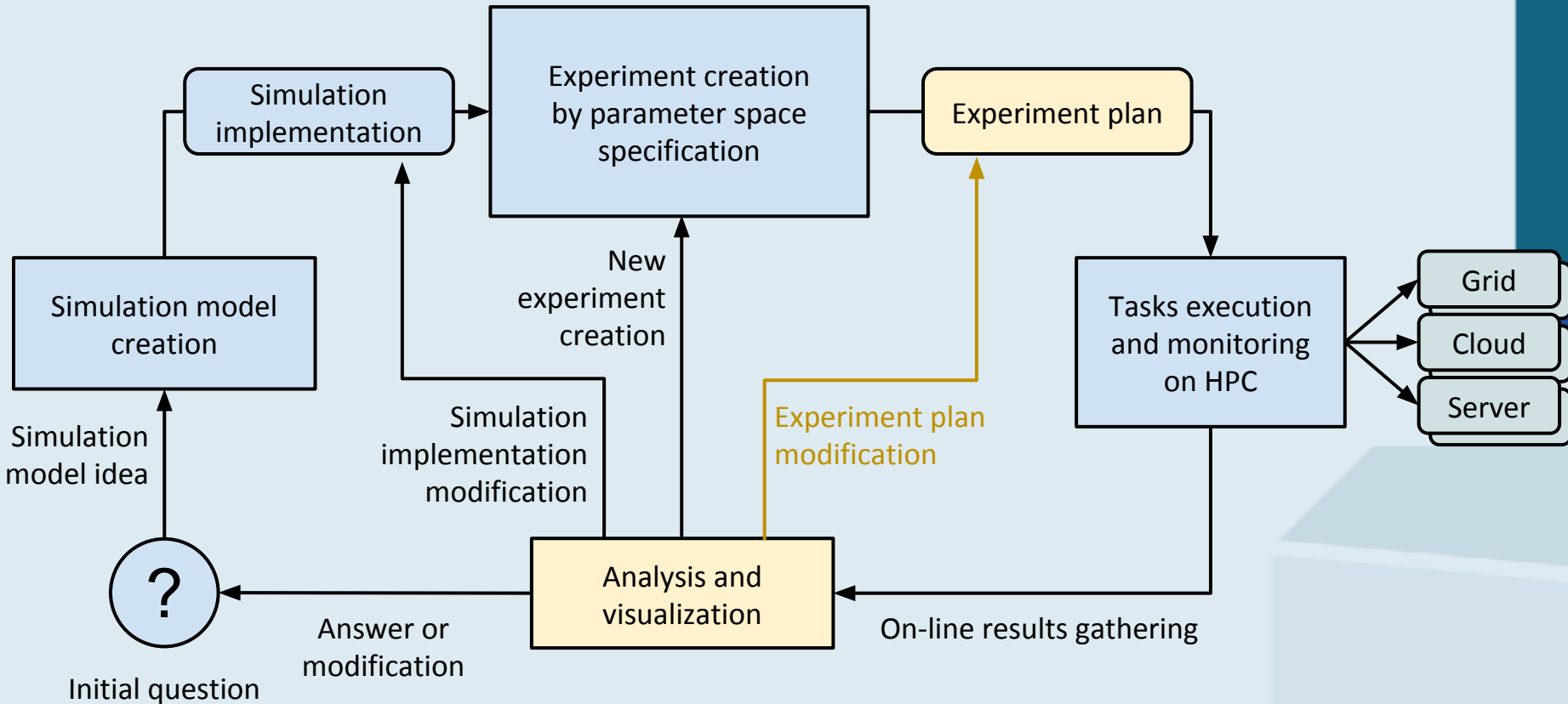
Data Farming in Scalarm Platform: Analysis and Visualization



Data Farming in Scalarm Platform: Analysis and Visualization



Data Farming in Scalarm Platform: Experiment Plan Modification



Data Farming in Scalarm Platform: Experiment Plan Modification



Experiment extension dialog ✕

Parameter:

Parametrization: range

Included in DoE: false

Values

- 0.8
- 1.0
- 1.2
- 1.4
- 1.6
- 1.8
- 2.0

Expand the input parameter space

Minimum:

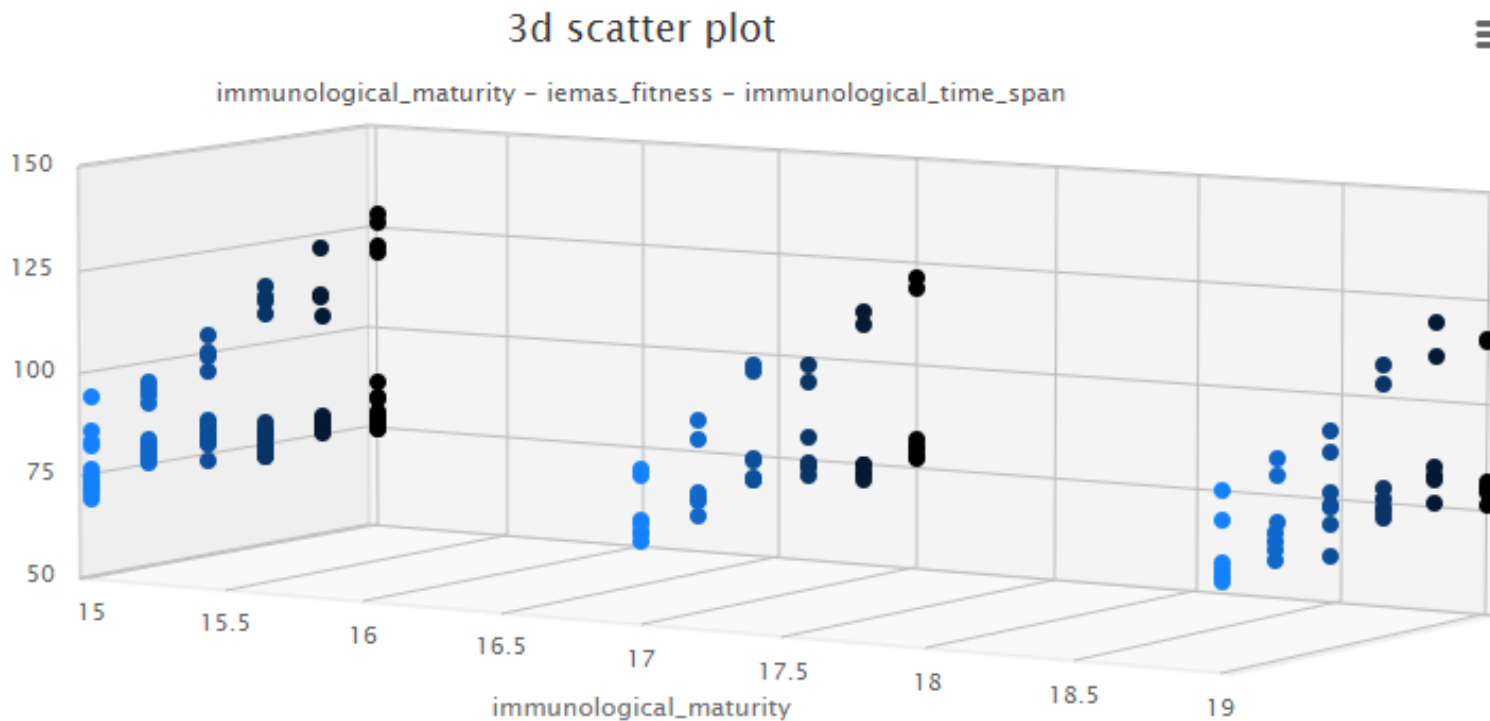
Maximum:

Step:

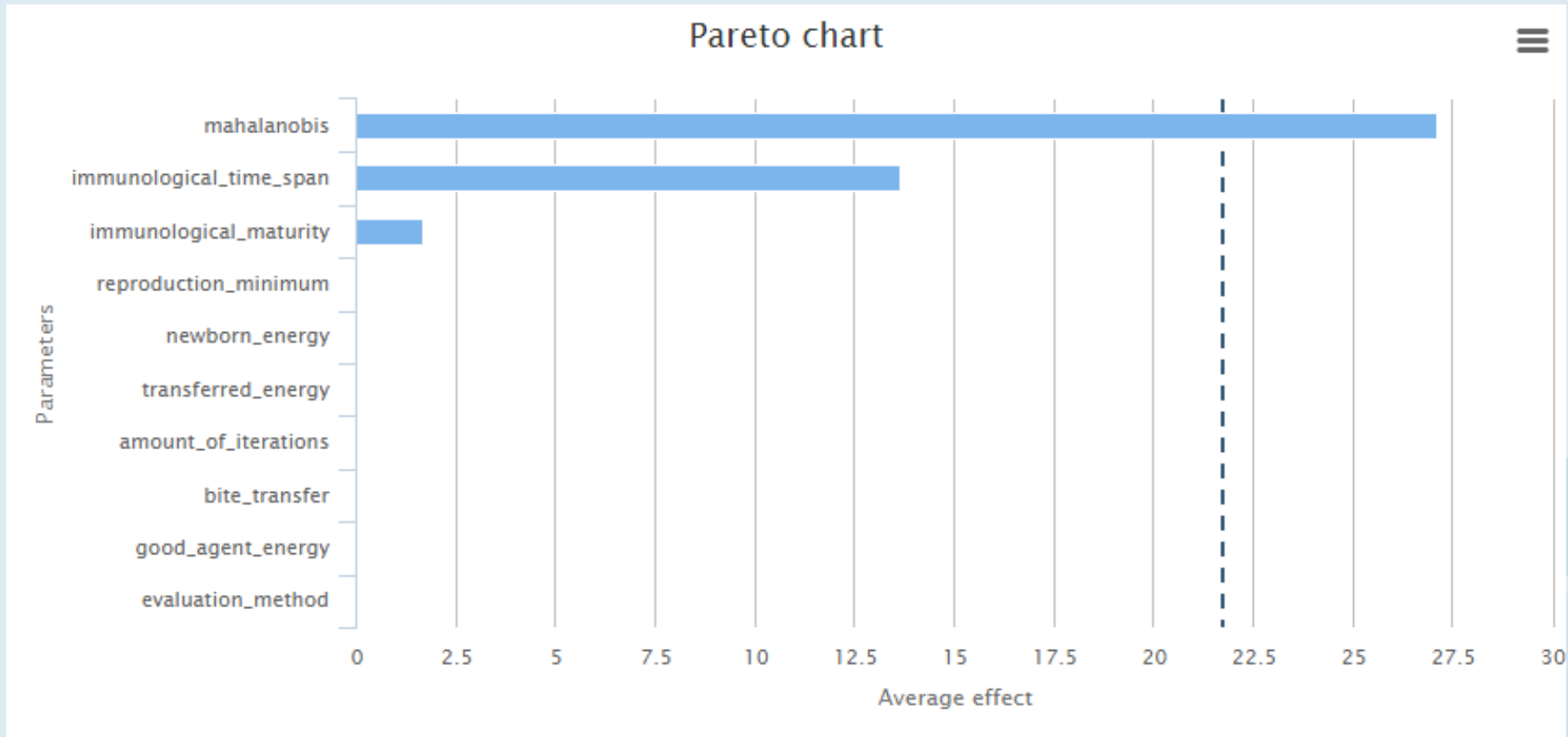
SCALARM



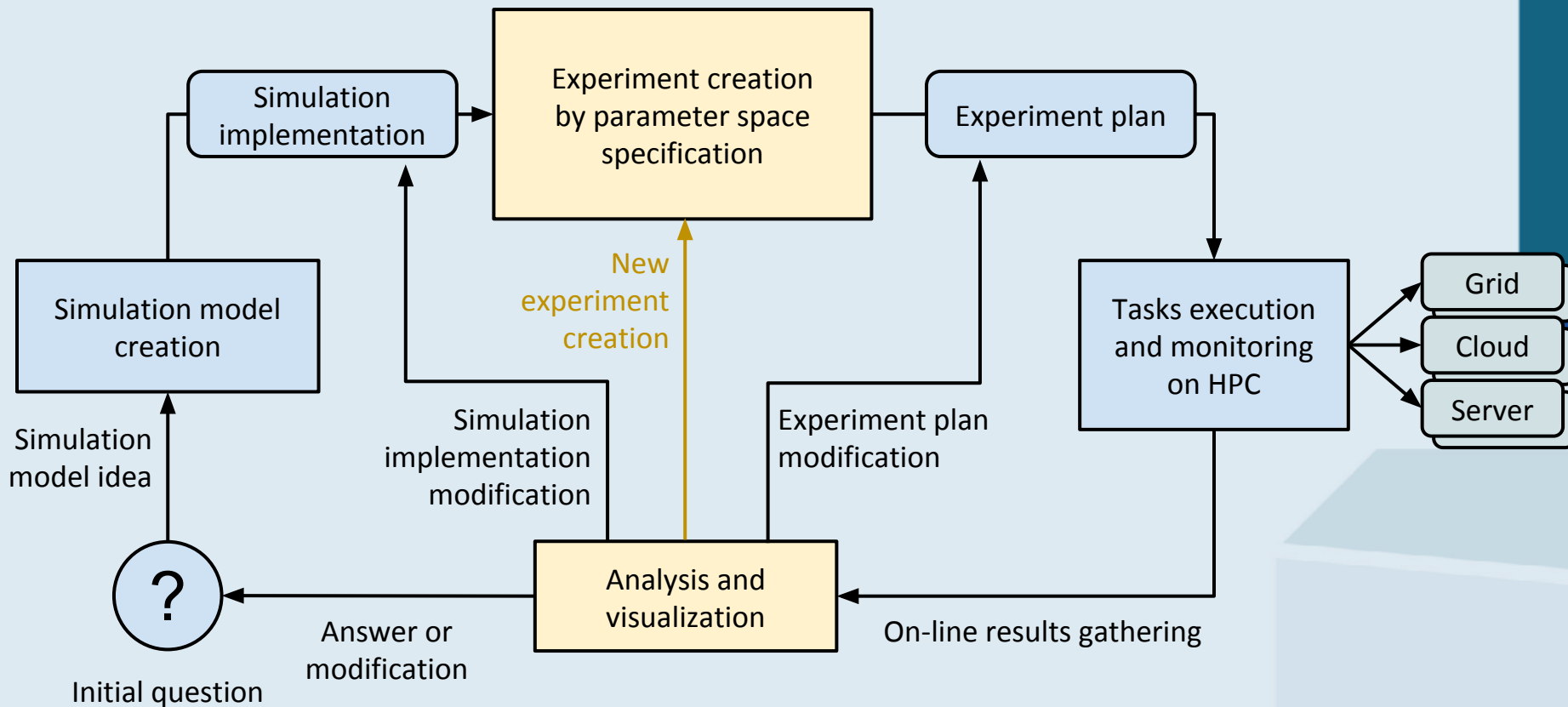
Data Farming w platformie Scalarm: Experiment Plan Modification



Data Farming w platformie Scalarm: Experiment Plan Modification



Data Farming in Scalarm Platform: New Experiment Creation



Data Farming in Scalarm Platform: Experiment Creation



Input space - manual specification On Off

1. Parametrization 2. Design of Experiment 3. Parameter constraints

This is an optional step
You can use only range-based parameters in DoE methods.

Create new parameter group with a DoE method: Create

2^(k-1)

Add parameter

Reproduction minimum
Remove parameter

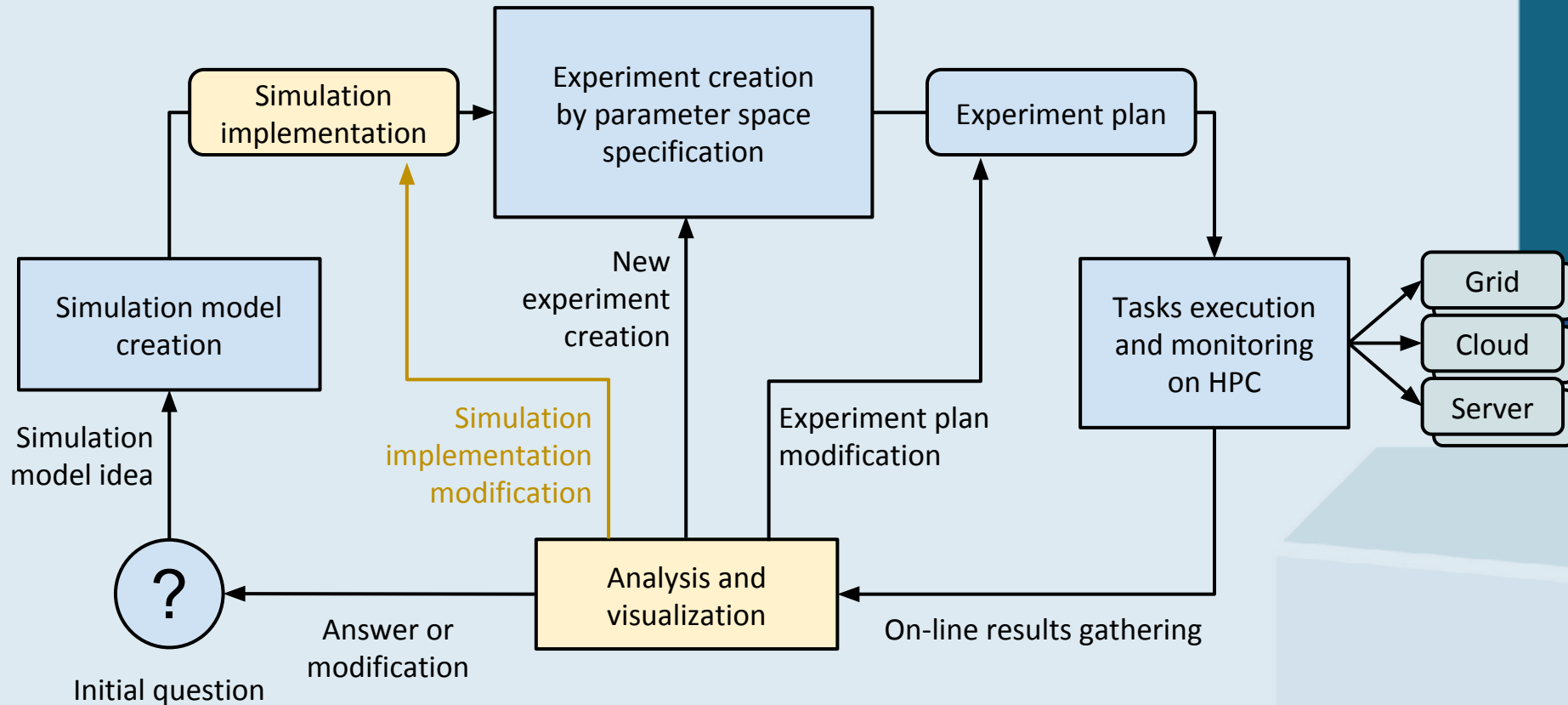
Delete group

Choose DoE method

Choose parameters



Data Farming in Scalarm Platform: Simulation modification



Summary



- The Scalarm Platform introduces considerable ease in parameter study and Data Farming experiments conduction
- Interactivity allows faster response for emerging results
- Scalarm can act as a middleware

<https://scalarm.plgrid.pl>



Future Works



- Extension with more basic analysis and visualisation methods
- Integration with sensitivity analysis methods
 - Faculty of Metal Engineering and Industrial Computer Science,
D. Bachniak
- Support for semi-automatic experiment plan modification





Next Generation Domain-Services
in PL-Grid Infrastructure for Polish Science

Thank you!

<https://scalarm.plgrid.pl>

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