OpenMOLE: a grid enabled workflow platform

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Introduction

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=> It is possible to develop a **generic software framework** for distributing naturally parallel application.

Outline

From a sequential approach...

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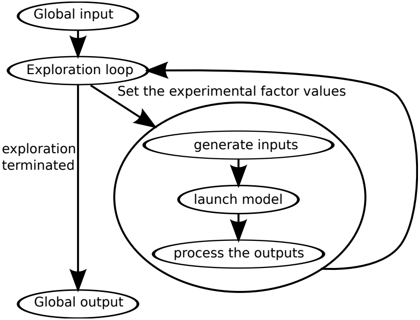

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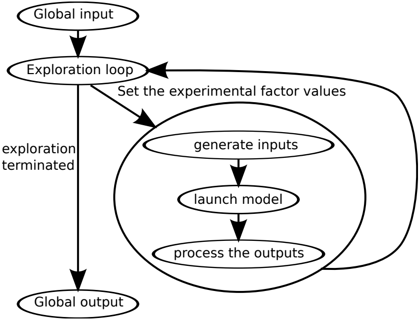

These concepts were inherently **sequential !**

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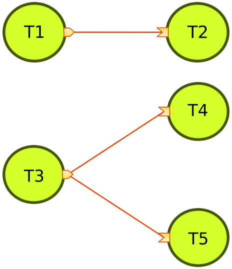

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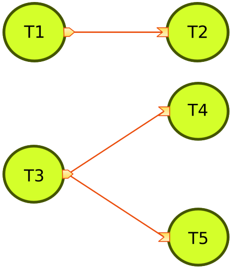

Untie distributed algorithms and execution environments = environment agnostic distributed algorithms.

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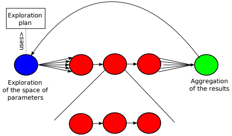
OpenMOLE:

- allows **the definition of complex workflows** for model exploration,



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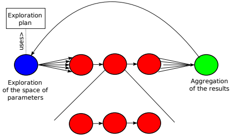

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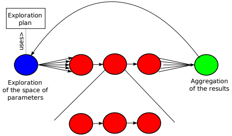
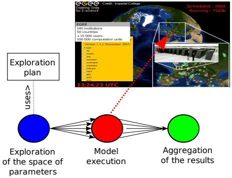


- **manages the execution** of these workflows on the user desktop PC,

- provides **transparent delegation mechanisms** of part of these workflow's execution **to distributed environments** (grids, clusters, ssh servers).



Tasks

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A task decribes a portable computation which can be executed on any execution environment. Task is polymorphic and extensible.

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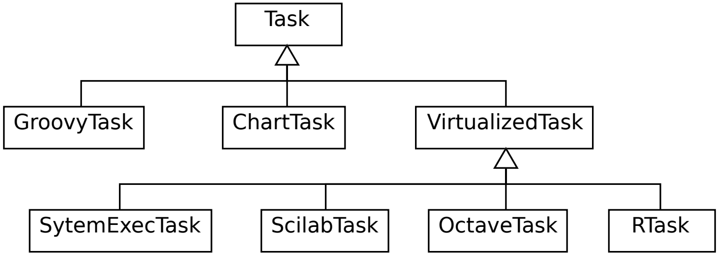
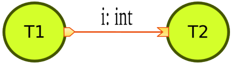


Simple Transitions



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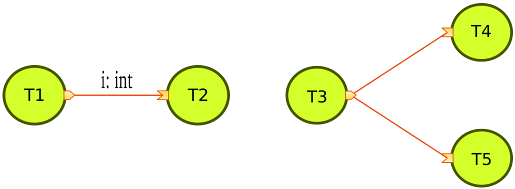

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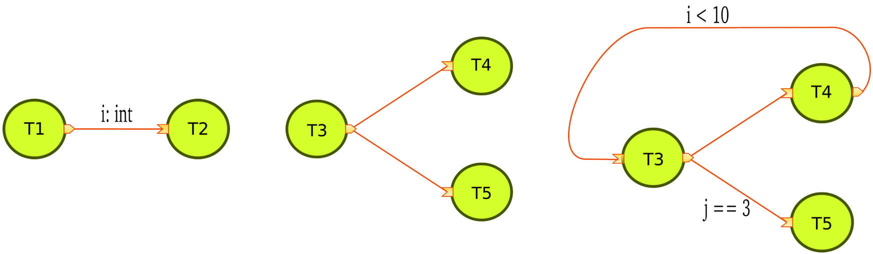
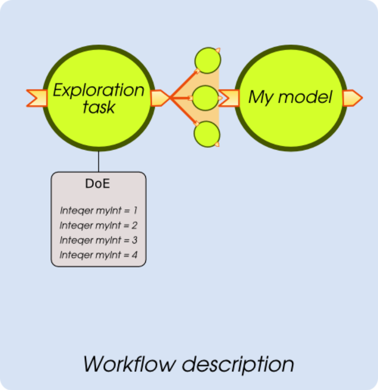
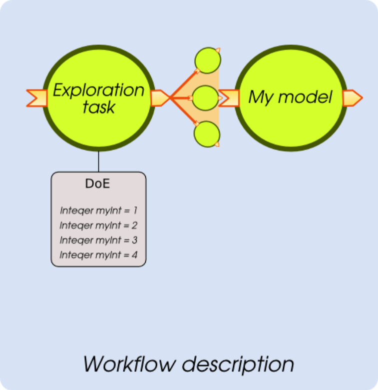
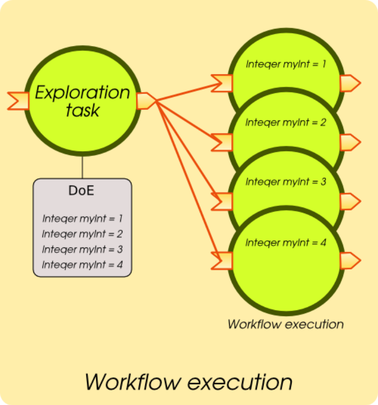


Exploration transition

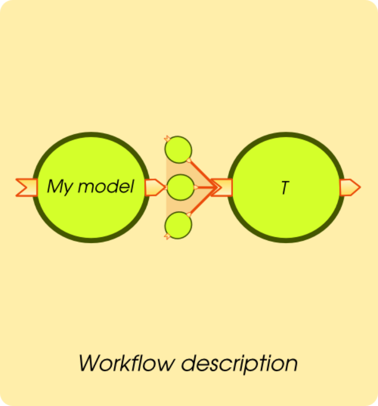


Exploration transition

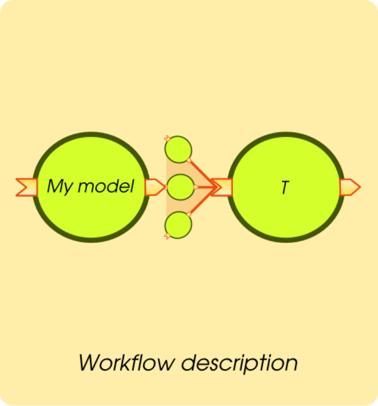


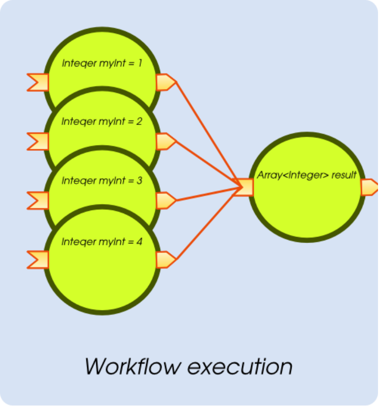


Aggregation transition



Aggregation transition

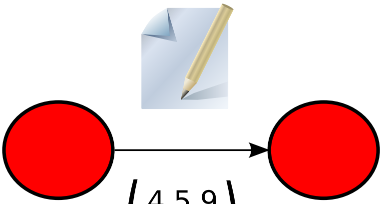




Outline

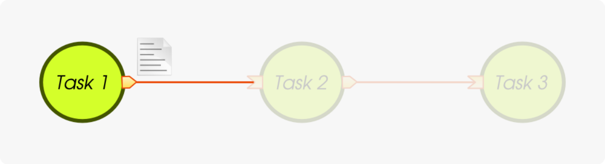
OpenMOLE allows declarative delegation of tasks on distributed execution environments.

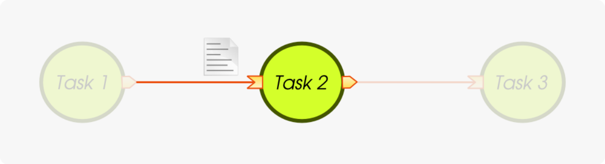
OpenMOLE **manages data and file transfers** between the workflow tasks (executed locally, or remotely on an execution node of a cluster or a grid)



$$\begin{pmatrix} 4 & 5 & 9 \\ 6 & 3 & 1 \\ 4 & 4 & 5 \end{pmatrix}$$

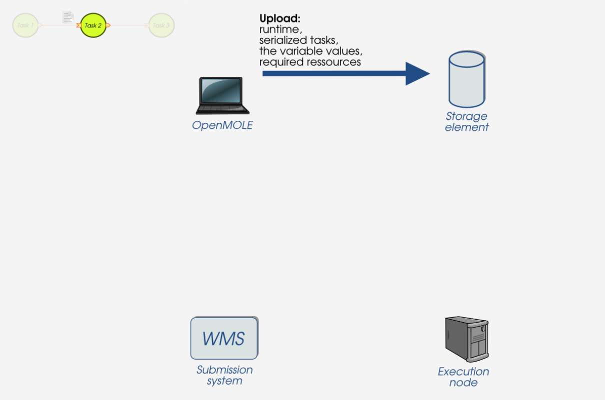
Delegation of a task onEGEE


Task 1
Task 2
Task 3


Task 1
Task 2
Task 3


Task 2


OpenMOLE
Storage element
WMS
Submission system
Execution node


Task 1
Task 2
Task 3
Upload:
runtime,
serialized tasks,
the variable values,
required ressources
OpenMOLE
Storage element
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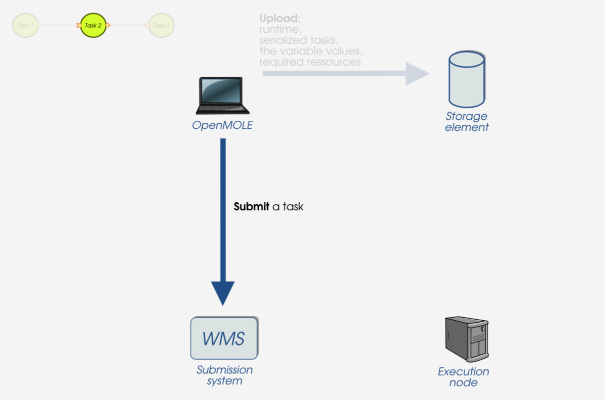
Submission system
Execution node


Task 1
Task 2
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Upload:
runtime,
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OpenMOLE
Storage element
Submit a task
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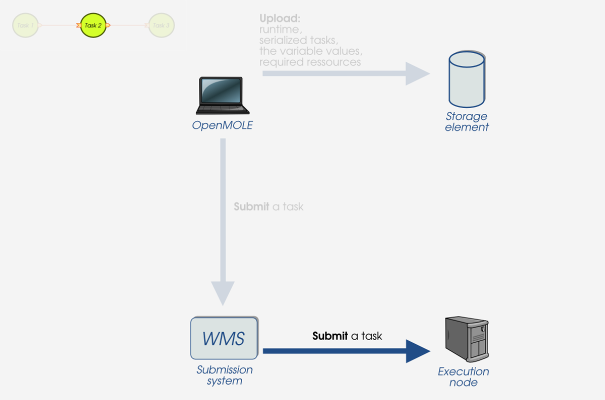
Execution node


Task 1
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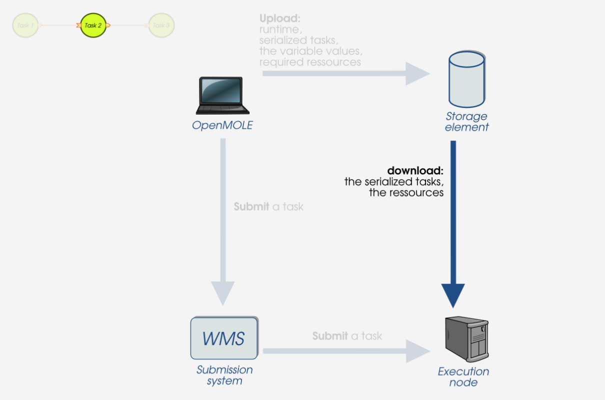
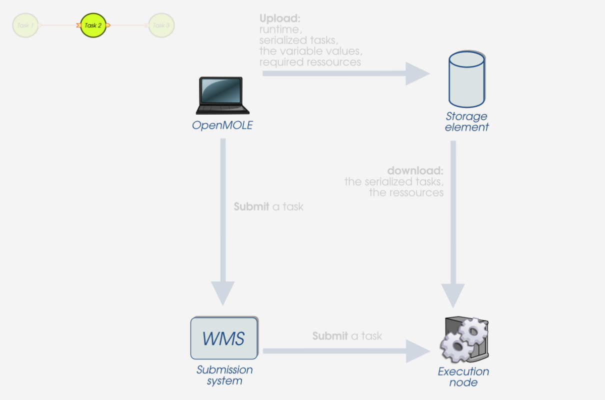
OpenMOLE
Storage element
Submit a task
WMS
Submission system
Submit a task
Execution node


Task 1
Task 2
Task 3
Upload:
runtime,
serialized tasks,
the variable values,
required ressources
OpenMOLE
Storage element
download:
the serialized tasks,
the ressources
Submit a task
WMS
Submission system
Submit a task
Execution node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Submit a task
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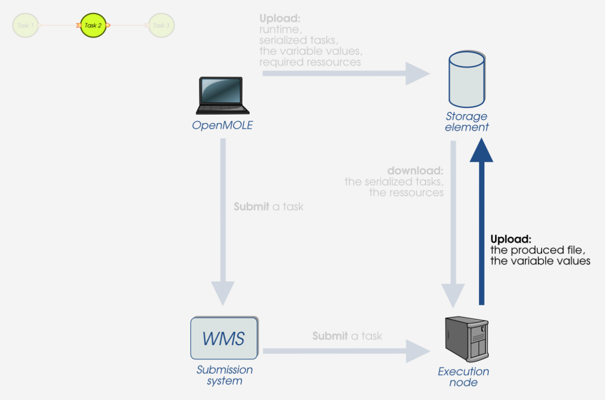
Task 2
Upload:
runtime,
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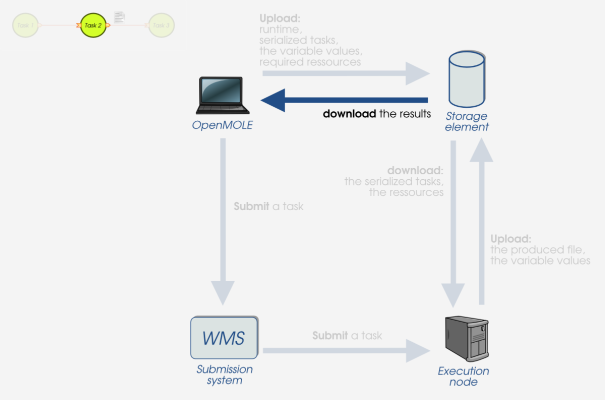
OpenMOLE
Storage
element
download:
the serialized tasks,
the ressources
Submit a task
Upload:
the produced file,
the variable values
WMS
Submission
system
Submit a task
Execution
node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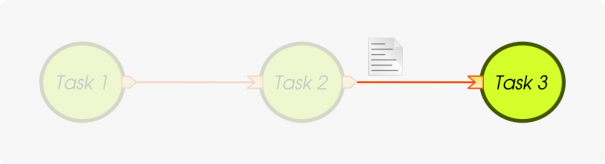
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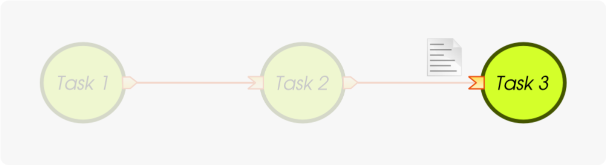
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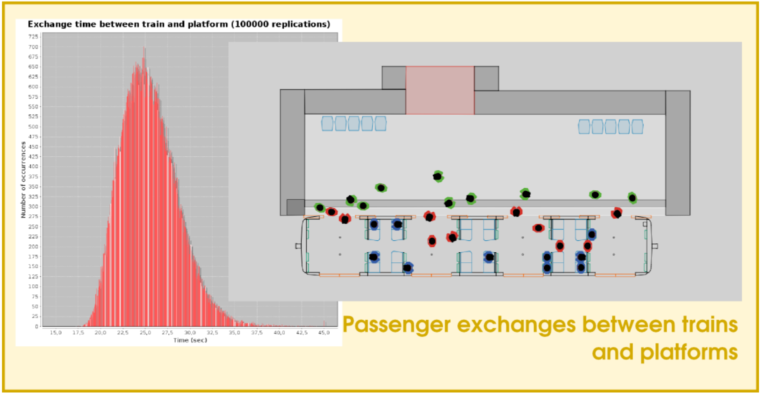
Outline

Drawing distribution of random variables

Agent based model



Projects:

Computer science	multi-scale percolation in collaboration	**IRD institute**
Modeling theory	predator-prey model of savanna	**PATRES European project and CEMAGREF**
Viability	viability aplied to complex food process	**INCALIN French research project and INRA**
Optimization	multi-objective optimization using distributed evolutionary algorithms	**DREAM European research project**
Physics	self-propelled particles	**Complex System Institute**

Coming soon:

Image processing	cell tracking on embryos	**Bioemergences European research project**
Image processing	functional analysis of brain images	**INSERM**

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- Virtualization for portability of legacy software.

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- Meta-data management.

Acknowledgement & Question

We would like to thanks the JSAGA project and in particular Sylvain Reynaud (IN2P3) for his help.

```
textVariable = new Prototype("text", String)

assignTask = new GroovyTask("Assign task")
assignTask.setCode("text = 'Hello world!'")
assignTask.addOutput(textVariable)

helloTask = new GroovyTask("Sample groovy task")
helloTask.setCode("println text")
helloTask.addInput(textVariable)

assignTaskCapsule = new TaskCapsule(assignTask)
helloTaskCapsule = new TaskCapsule(helloTask)
ex = new Mole(assignTaskCapsule, helloTaskCapsule).createExecution()
ex.start()
```