



# INTRODUCTION TO JAS

## LECTURE 3

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EC910 – L3

# Lecture 3 outline

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- JAS library
  - Introduction
  - Architecture
  - Third party libraries
  
- The JAS application
  - HeatBugs project
  - Highlights
  - Structure

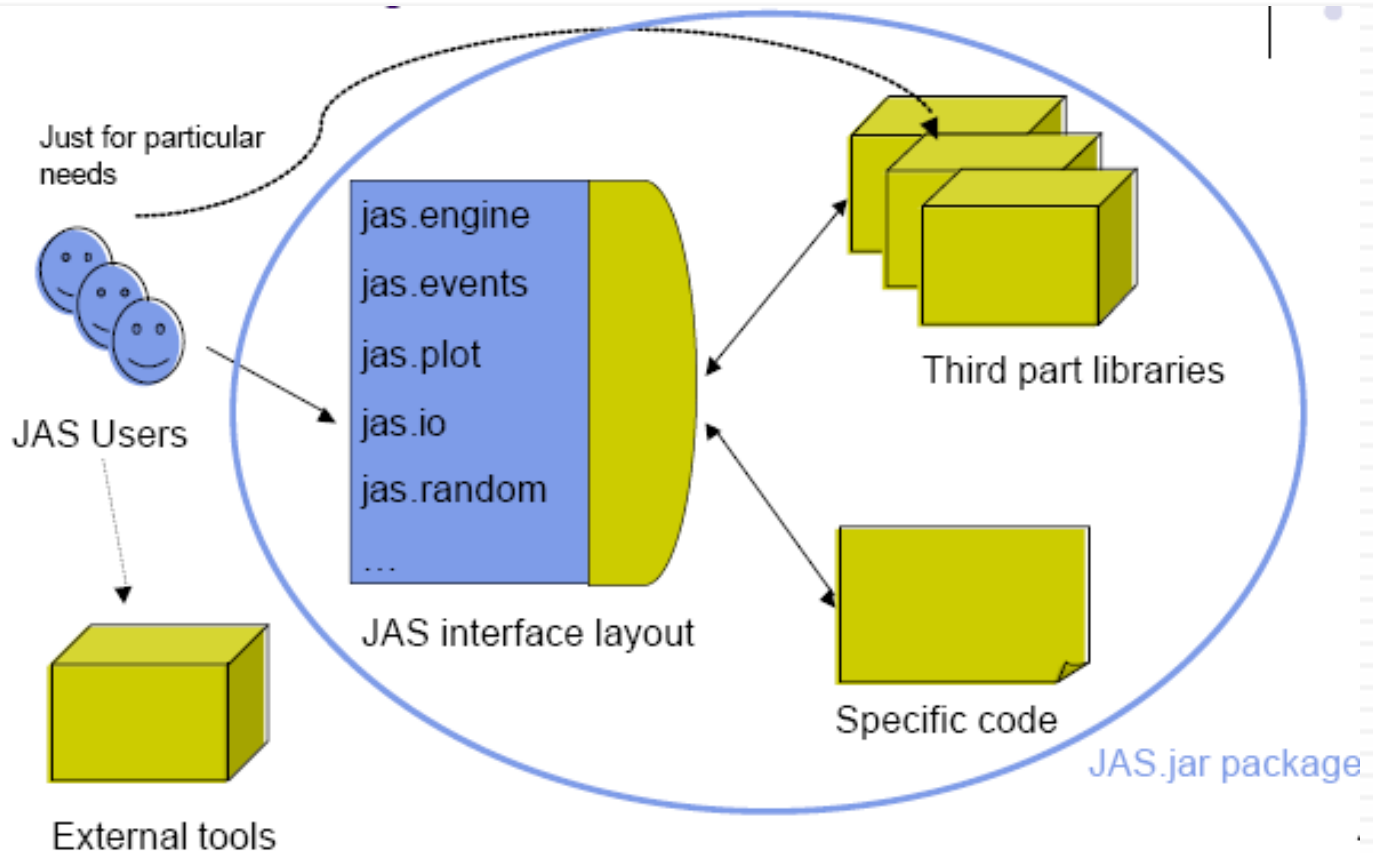
# What is JAS

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- An open source collection of tools (**JAVA library**) to build ABMs
  - Based on the Swarm paradigm
  - Written using Java and XML
  - Founded on 3rd party well-tested open-source libraries
- An **application** that loads, executes and controls simulation experiments
  - XML project files contain information like list of models to run, classpaths, seed number, windows layout, etc.

# The JAS.jar architecture

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# Third part libraries in JAS

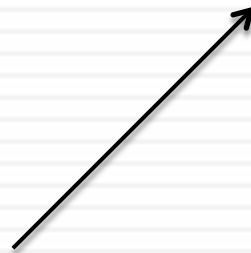
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Library	Author	Description	Link
<b>ptPlot</b>	<i>Berkley University</i>	Plotting	<a href="http://ptolemy.eecs.berkeley.edu/java/ptplot/">http://ptolemy.eecs.berkeley.edu/java/ptplot/</a>
<b>COLT</b>	<i>CERN</i>	Random generation and statistics	<a href="http://acs.lbl.gov/software/colt/">http://acs.lbl.gov/software/colt/</a>
<b>jExcelApi</b>	<i>Andy Khan</i>	Microsoft Excel format I/O	<a href="http://www.andykhan.com/jexcelapi/index.html">http://www.andykhan.com/jexcelapi/index.html</a>
<b>SVG-Batik</b>	<i>Apache</i>	SVG image generation	<a href="http://xmlgraphics.apache.org/batik/index.html">http://xmlgraphics.apache.org/batik/index.html</a>
<b>XML-RPC</b>	<i>Apache</i>	Sim2Web's remote calls	<a href="http://ws.apache.org/xmlrpc/">http://ws.apache.org/xmlrpc/</a>
<b>JGraphT</b>	<i>Barak Naveh</i>	Network analysis	<a href="http://jgrapht.org/">http://jgrapht.org/</a>

# The JAS application

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- JAS models are stand alone applications based on the JAS library but they can be managed as they were documents thanks to the XML project document.
- JAS is able to load models and drop them from memory without shutting down the JVM
- How to create a model:
  - 1) Type code
  - 2) Compile it
  - 3) Generate XML project



Example: HeatBugs XML project file:

```
<?xml version="1.0" encoding="UTF-8" ?>
<JAS projectName="ObsHeabugs">
  <ProjectParameters>
    <TimeUnit>7</TimeUnit>
    <MajorVersion>0</MajorVersion>
    <Seed randomSeed="true">1020968840339</Seed>
    <ProjectDescription>Model with observer
      example.</ProjectDescription>
  </ProjectParameters>
  <Model className="HeatBugsModel">
    <Window title="Heatbugs">5,130,400,400</Window>
  </Model>
  <Model className="HeatBugsObserver">
    <Window title="Unhappiness">
      504,380,500,300</Window>
    <Window title="Space viewer">
      626,23,320,320</Window>
  </Model>
  <ClassPath>
    <Path>.\examples\HeatBugs</Path>
  </ClassPath>
</JAS>
```

# JAS'highlights

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- Real time execution mode
- Sim2Web: a Jas-Zope bridge architecture to publish simulations on the web
- *jas.engine.AgentList* allows asynchronous method execution
- GA, ANN, CS native packages (under construction)
- A multi-run template class for automatic parameter calibration
- Some of the turtles' instructions from Starlogo
- Desktop GUI application mode

# The JAS' structure

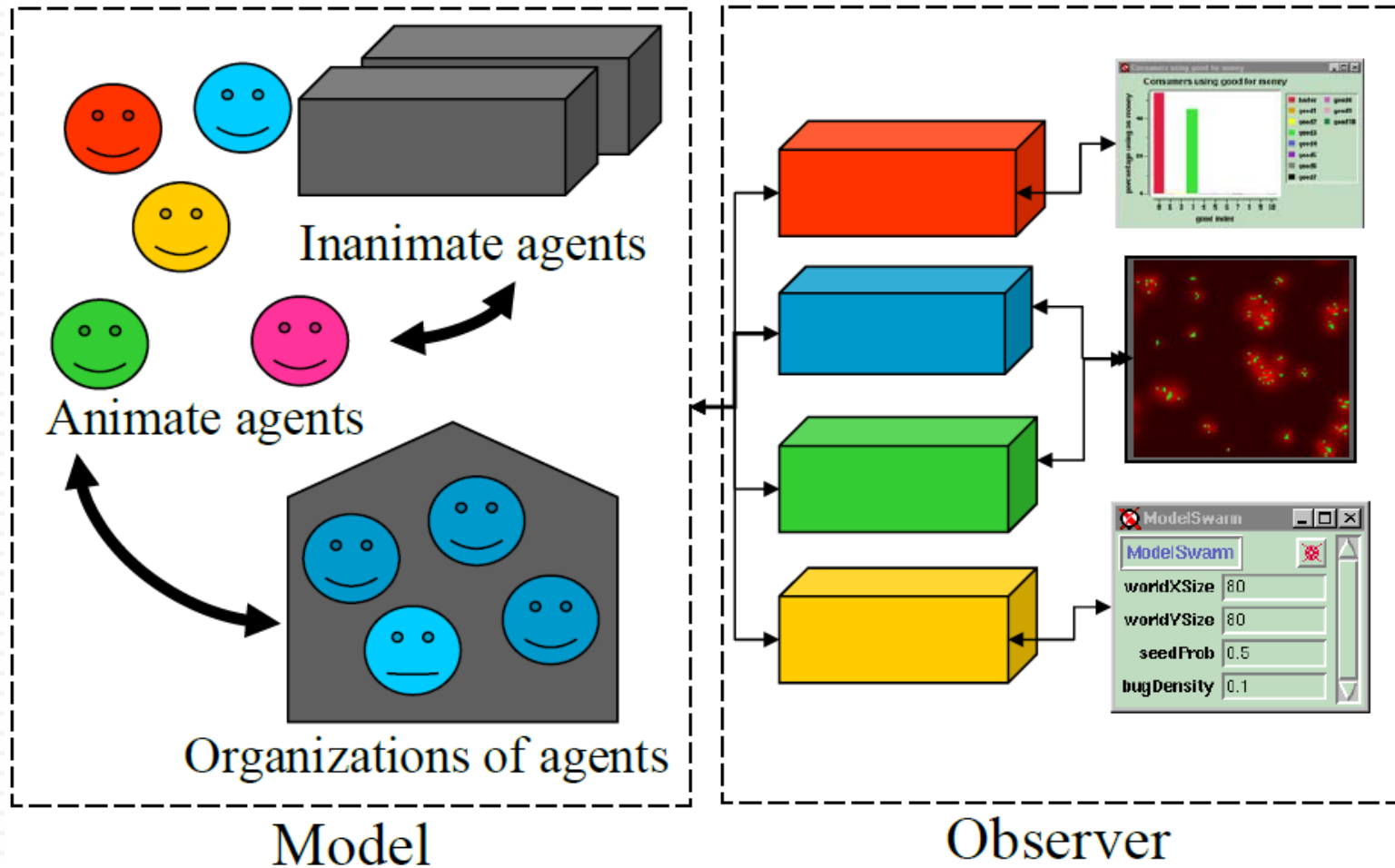
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<i>jas.engine</i>	Simulation engine, time manager, GUI layer.
<i>jas.events</i>	The event architecture
<i>jas.io</i>	General purpose I/O classes supporting CSV, Excel and XML formats
<i>jas.net</i>	Network tools (Sim2Web, remote controlling, ...)
<i>jas.plot</i>	The plotting tools (mostly based on <i>ptPlot</i> library)
<i>jas.probe</i>	The probe library (similar to the Swarm's probes)
<i>jas.random</i>	A rich pseudo-random generation library (mostly based on the COLT library)
<i>jas.space</i>	Bi-dimensional grids, cellular automata, etc.
<i>jas.stats</i>	Statistical probes



# Objects in an Agent-Based Model (2)

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# First steps with JAS

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## ➤ Random Model

- **Description:** Very simple economics model in which some agents extract a random economic choice and communicate it to the world.
- **Keywords:** random walk, artificial life.
- **Readings:** First steps with JAS, course material