bonitasoft

open your processes

Bonita Open Solution

Version 5.6

Simulation Guide

Change Notice

No changes to Simulation have been made between BOS 5.5 and BOS 5.6.

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Simulation Guide

Welcome to Bonita Open Solution (BOS). If you don't already have the software, you can download it from the BonitaSoft web site.

This Simulation Guide describes how to configure and run a Simulation of a completed Process in **Bonita Open Solution** Version 5.6. You can download this document and its updates from the BonitaSoft web site.

Part 1 gives a basic overview and general information.

Part 2 describes how to define Simulation parameters on individual elements in the Process.

Part 3 describes how to install resources and load profiles for Simulation.

Part 4 describes how to run a Simulation and report the results.

Part 5 describes how to export and import Simulation files in Bonita Open Solution.

Part 6 describes how to analyze a problem in Bonita Open Solution.

Part 1.   Bonita Open Solution Simulation Overview

1.1   Description

Use Simulation in Bonita Open Solution to evaluate the way a Process runs under different resource availabilities and different load profiles. When a Simulation is run, a specified number of iterations over a specified period of time are run either with simulated data or with assigned probabilities, and the cumulated result of all iterations is shown in a report.

To use the Simulation function on a Process, first define Simulation parameters on individual elements (Steps), then define Simulation resources and load profiles.

This document briefly describes each of these steps, and shows where to find them in BOS 5.

There is an example Process included in BOS 5.6, *Delivery-Simulation*, which illustrates how to configure a Simulation, using two Processes with the same Steps and Simulation parameters but slightly different flows. You can run both to see and compare the Simulation reports.

Part 2.   How to define Simulation parameters

Simulation parameters are used to determine what conditions are applied in each iteration for a Simulation run. Conditions can be complex or simple, for example, specific data inputs can be assigned; expressions can be applied that are resolved when specific data inputs arrive; a simple probability that a particular branch is taken by the Process can be assigned, and so on.

2.1   Define Simulation parameters for a Process

2.1.1   Define Simulation Data for a Process

At the Process level, you have the option of defining data that can be set to its various possible values throughout the iterations as the Simulation is run. The data defined here reflect the data defined and use in the Process, but are applied only during Simulation.

Defining data here is optional. Iterations can also be defined by assigning probabilities to paths (see Define Resource assignment for a Transition.)

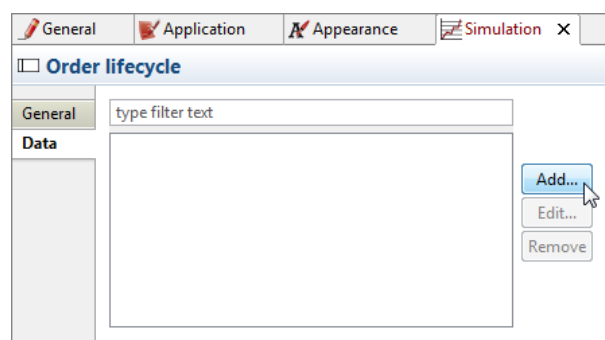Go to the Details Panel for the Pool, **Simulation -> Data**.

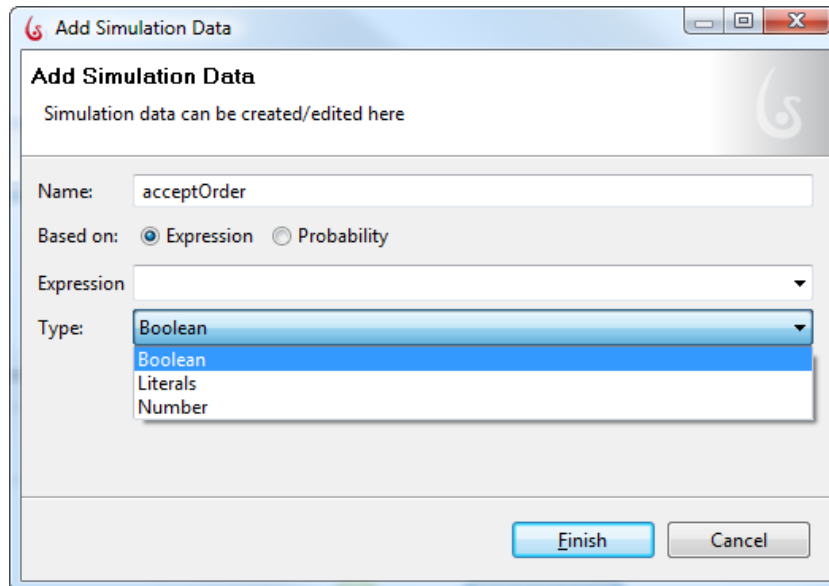Figure 1. Define data for Simulation (optional)

Figure 2. 3 types of data that can be used in expressions in Simulation iterations

There are three types of data that can be used in Simulation iterations:

- Boolean   true or false
- Literal   an exact string (used to reflect a list or options defined in the Process)
- Number   an integer

These data types can be used in expressions, or assigned a probability for each iteration.
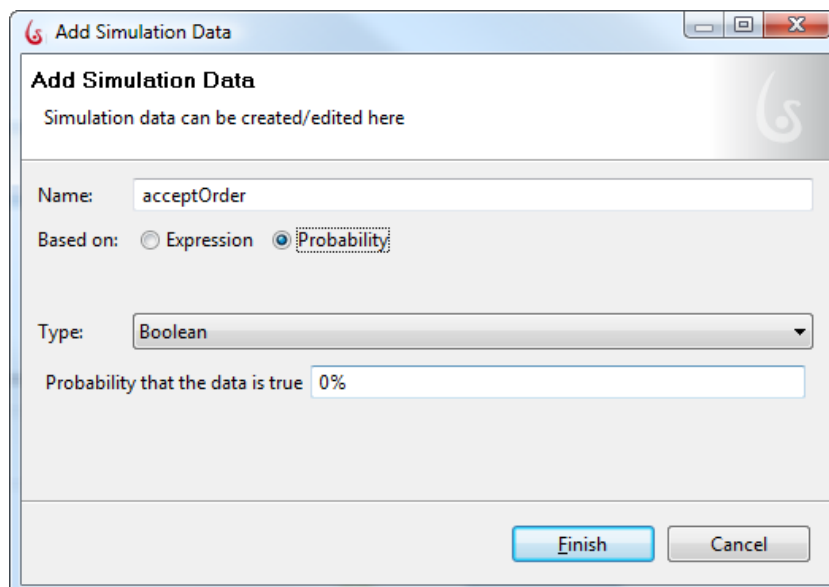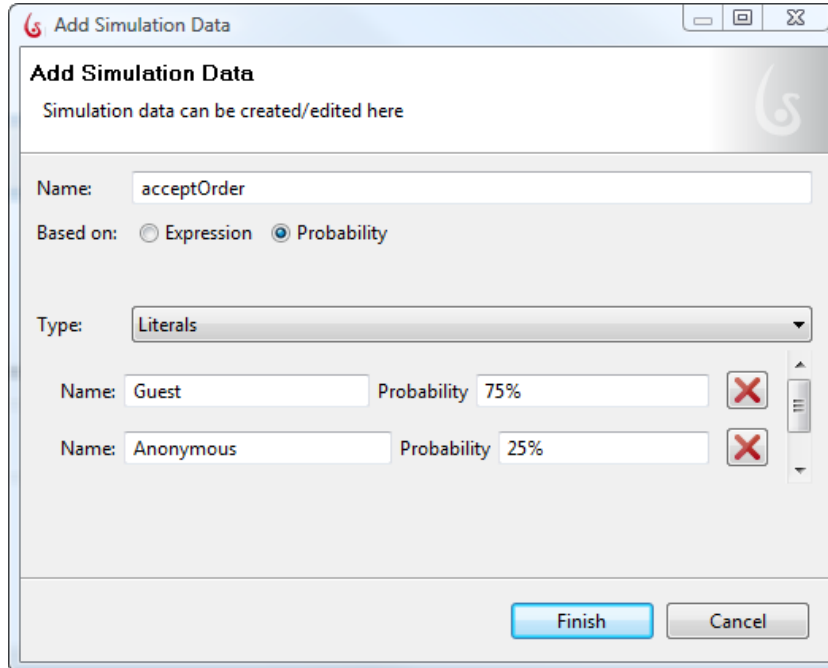
Figure 3. Data can be assigned a probability

Data that can be assigned a probability of input:

- Boolean   what percentage of the iterations will take the input as true
- Literal   what percentage of the iterations will take each input string
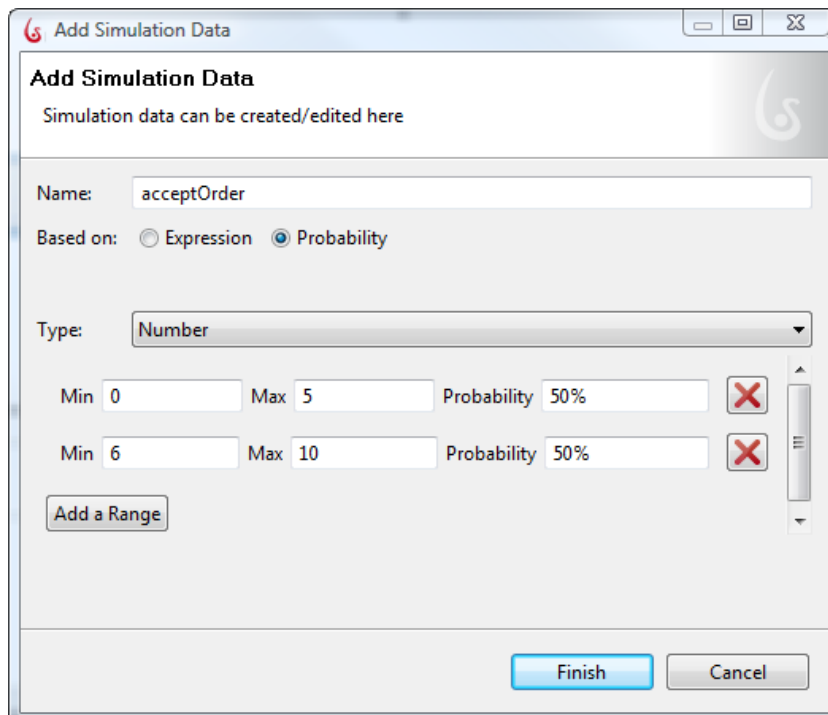- Number   an integer

Figure 4. Define what percentage of the iterations will take each input string

Figure 5. Define what percentage of the iterations will take what integer

2.2   Define Simulation parameters for an Element

You can define Simulation parameters for the following events:

- Tasks
- Gates
- Transitions
- Start, Intermediate, and End events (including Messages, Timers, Signals, and Errors)

Boundary events do not have Simulation parameters.

To define Simulation parameters, go to the Details panel for a Task, **Simulation-> General**. Note that you can also define Simulation parameters for other elements such as Start, End, and Intermediate Events.
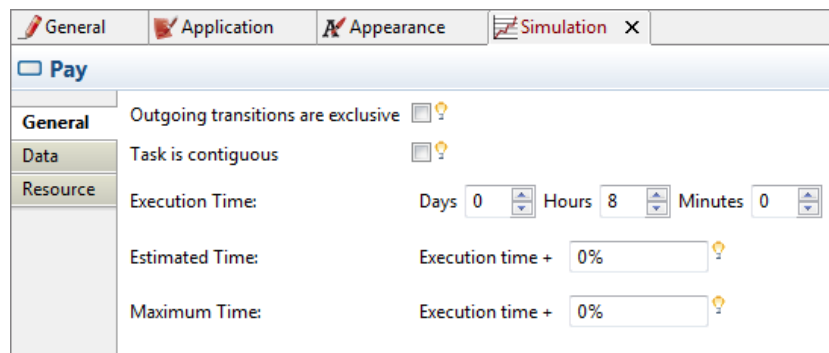

Figure 6. Simulation tab on an element

2.2.1   Define General Simulation conditions for an Element

Add the appropriate information in the General section of the Simulation tab:

- Outgoing transitions are exclusive: check this if there are multiple outgoing transitions from this element, and the Simulation should select only one of them
- Task is contiguous   check this if task must be done all in one go during its execution – if the step itself must be performed with no interruption for the whole of its duration. Leave unchecked if the task is "interruptible" – eg, when a resource is temporarily unavailable to complete it
- Execution time   define how long you anticipate it will take to complete the task
- Estimated Time   you can enter a percentage of the execution time to define an "estimated" line on your reports. If it is 0, the estimated time will be equal to the execution time.
- Maximum Time   you can enter a percentage of the execution time to define a "threshold" line on your reports. If it is 0, the threshold will be equal to the execution time.

2.2.2   Define Simulation Data for an Element

You can add optional information in the **Data** section of the Simulation tab if you choose to set data to a specific value when the process arrives here. Use this only if you have defined data at the Process level. See Define Simulation parameters for a Process.

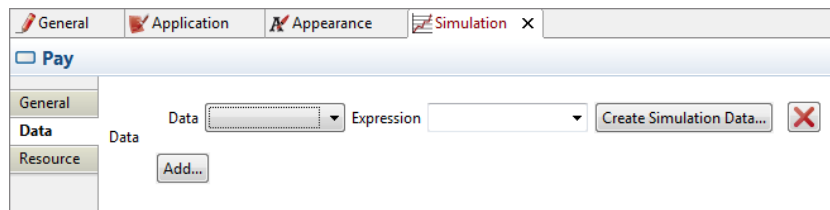- Data set a value for data to be used in the Simulation

Figure 7. Define Simulation data and expression for an element

2.2.3   Define Resource assignments for an Element

Define the resources used for this Step or element in the Resource Assignment tab. Go to **Simulation -> Resource** and *Add*.
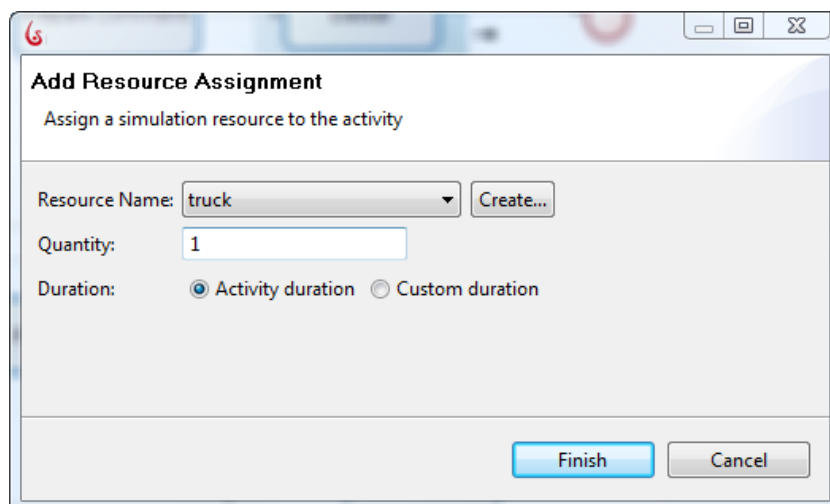

Figure 8. Add a resource to the activity

Define the discrete resources that are needed to complete this Step, how many, and whether they are available for the entire duration of the step or for only a specific amount of time. This is useful to simulate the possibility that a task will be waiting for an available resource to complete.

2.2.3   Define Resource assignments for a Transition

Which transitions an iteration should take can be defined by an expression (for example, for conditional transitions) or by probability.

Go to the Details Panel of a Transition and select **Simulation**. If you choose to use an **Expression** with data defined; you can either use previously defined data or you use *Create Simulation Data* from here.

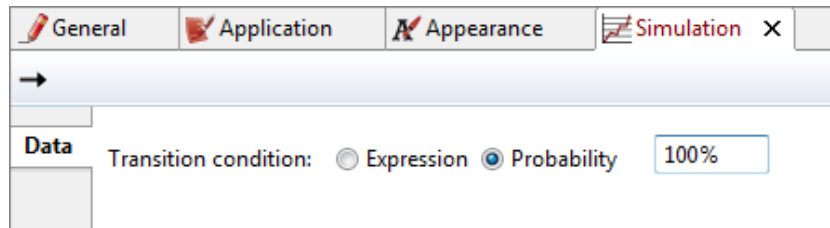Otherwise, enter a probability that the Process will follow this path.

Figure 9. Define Simulation condition for a transition

Part 3.   How to install resources and load profiles for Simulation

Once you have defined Resources in individual elements, you can manage them from the Menu bar. Here you can also define the load profiles for the Simulation.
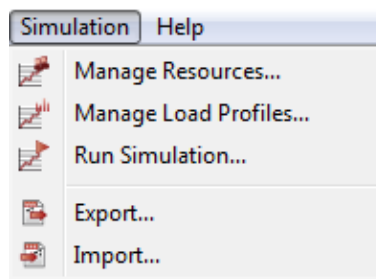

Figure 10. Manage resources

3.1   Define resource characteristics

From the Menu bar, select **Simulation -> Manage resources**.

The **Manage Simulation Resources** dialog appears, and it will contain any resources you have defined in Simulation for the Process elements. From here you can *Add*, *Edit*, or *Remove* a resource. It also shows a summary of a selected resource. The next paragraphs explain how to complete the information shown under "Resource Information."
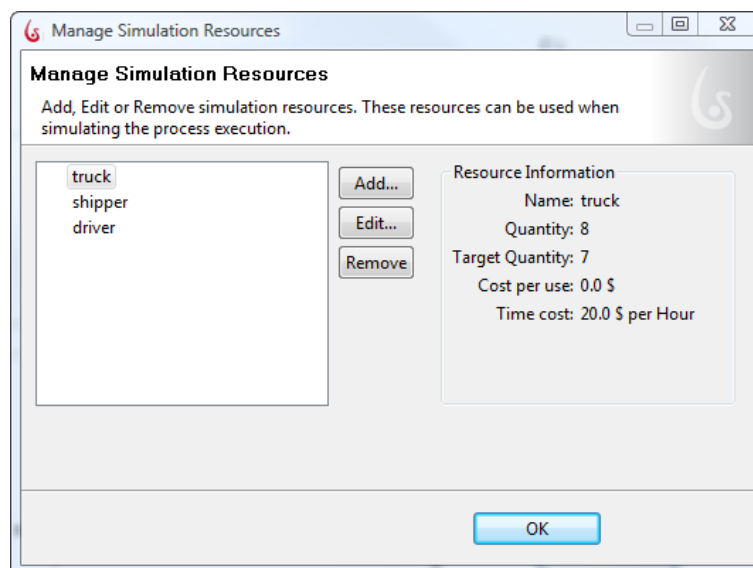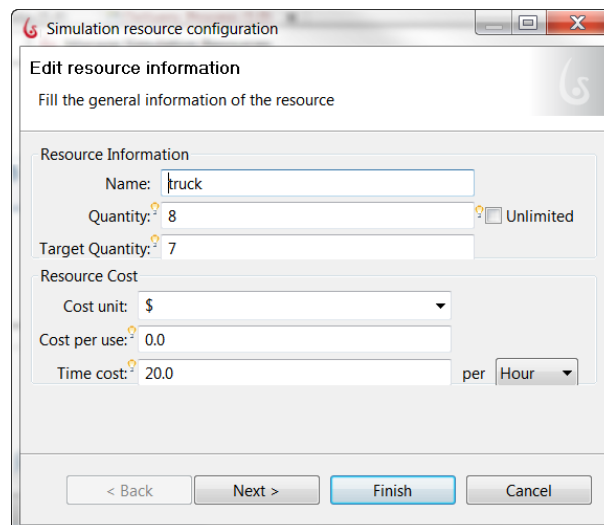

Figure 11. Further define resources for Simulation

3.1.1 Define Resource quantity and cost
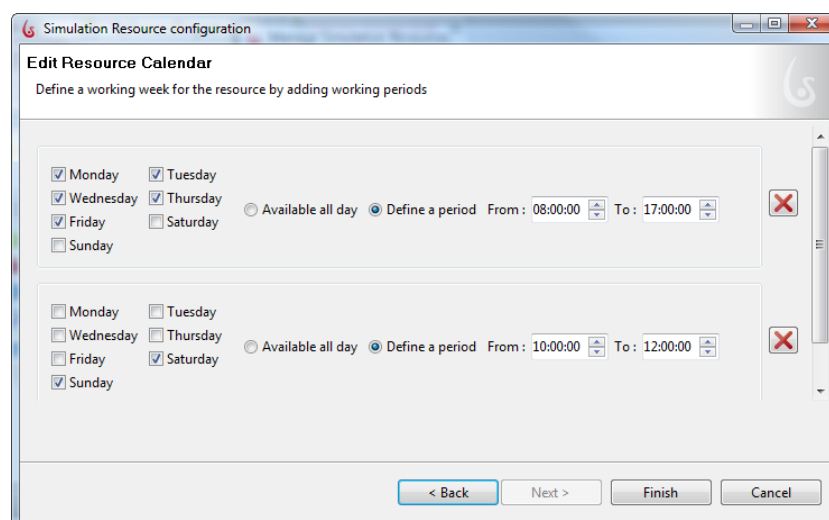
Figure 12. Define quantity and cost of resource available

- **Quantity**: total of this resource available (check if unlimited)
- **Target Quantity**: you can enter a quantity to define a "threshold" line on your reports. If it is empty, the threshold will be equal to the Quantity
- **Cost Unit**: select unit to display on report
- **Cost per use**: this is applied each time a resource is used in an iteration
- **Time cost**: select a cost per unit time

3.1.2 Define Resource schedule

You can also define, optionally, the availability of a Resource by calendar days and times.

Figure 13. Define daily availability of resource

Use **Add a period** to add other profiles, for example, different hours of availability during weekends, holidays, etc.

3.2   Define load characteristics

The load characteristics apply to the number, duration, etc of the iterations of the Process that the Simulation will run.

3.2.1   Define load profile

From the Menu bar, select **Simulation -> Manage load profiles**.

The **Manage Load profiles** dialog appears. From here you can *Add*, *Edit*, or *Remove* a profile to be applied when simulating the process execution.
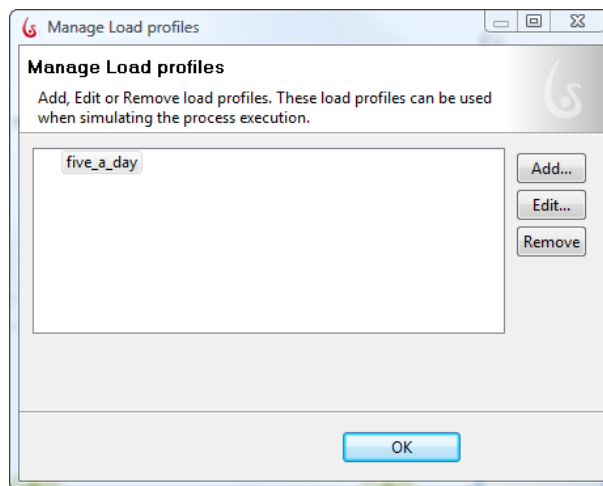

Figure 14. Manage load profiles for Simulation

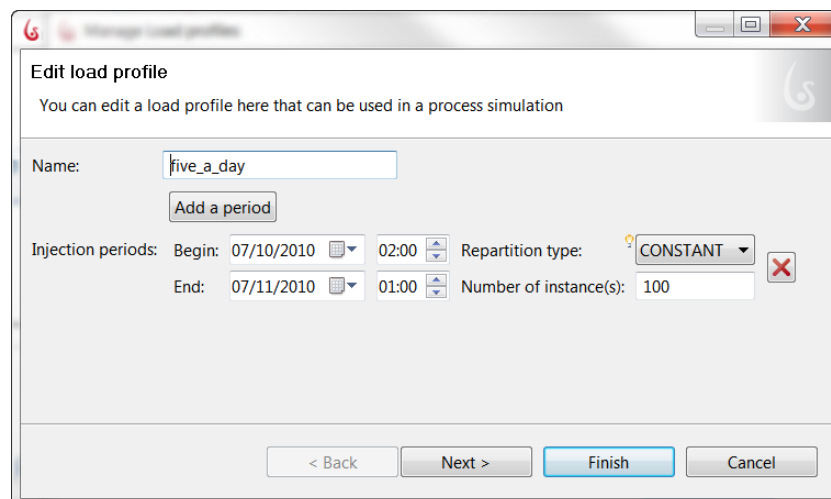Add the characteristics for the iterations you want the Simulation to run.

Figure 15. Define the load profile for a Simulation

- **Name**: give the profile a title
- **Injection periods**: define the beginning and the end date and time of the Simulation
  You can define multiple time spans with ***Add a period*.**
- **Repartition type**: this defines how the iterations will be launched in the Simulation
  Constant will launch iterations at regular intervals along the timeline of the injection period
  Direct will launch all iterations at the same time, at the start of the Simulation
- **Number of instances**: the total number of iterations to run in

Part 4. How to run and report a Simulation

4.1 Run a Simulation

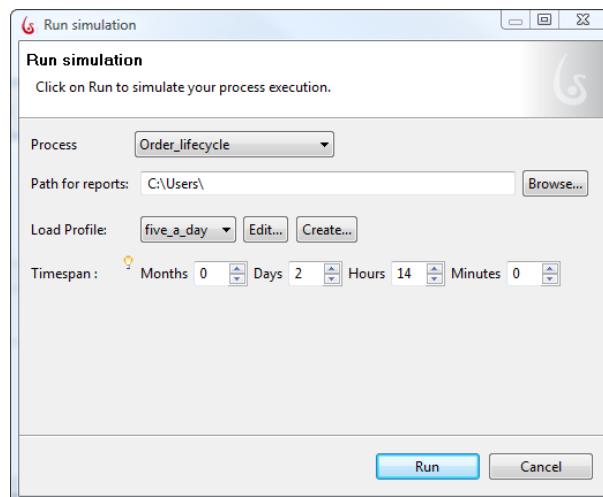To run a Simulation, go to the Menu bar and select ***Run Simulation***.

Figure 16. Run Simulation

Select the Process to Simulate, enter the path for the generated report to be copied to, and the Load Profile you want to run. Note that you can ***Edit*** a previously defined Profile, or ***Create*** a new one, from here.

Define the Sampling rate (**Timespan**) at which you want the Simulation to take data. Then…***Run***.

4.2   Reports

A PDF file of the Simulation will be saved to the destination directory.
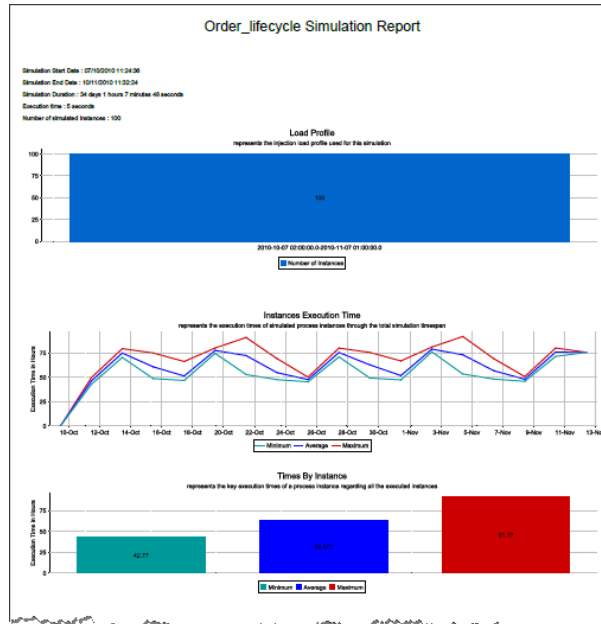

Figure 17. Simulation report

It contains the following graphs, by default:

- Load profile: total number of iterations run
- Instances Execution Time: execution time in hours vs date
- Time by Instance   minimum, average, and maximum execution times calculated over all iterations
- Instances Waiting Time   waiting (inactive) time vs date
- Waiting Times by Instance   minimum, average, and maximum waiting (inactive) times calculated over all iterations
- Instances Cumulated Time   execution time + waiting time calculated over all iterations

Then follows a series of reports calculated for each element in the Process:

- Instances Execution Time
- Execution Time by Instance
- Instances Waiting Time
- Waiting Time by Instance

These are followed by a series of reports for each Resource used in the Process:

- Time Consumption   number/amount of this resource consumed or used vs date
- Consumption by Instance   minimum, average, and maximum resource consumption or usage calculated over all iterations
- Total Resources Consumption total number of this resource consumed or used

- Time Cost   total cost of this resource consumed or used vs date
- Cost by Instance   minimum, average, and maximum resource cost calculated over all iterations
- Total Resources Cost   total cost of this resource
- Time Utilization   utilization of this resource vs date
- Utilization by instance   minimum, average, and maximum resource consumption or usage by percentage, as compared to the total available
- Total Utilization   total amount of this resource consumed or used, by percentage as compared to the total available

Part 5. How to export and import artifacts of a Simulation

Note that in order to export the resources and a profile, **you must have already created the resources** and **loaded a profile**. If these two actions are not carried out previously, there will be nothing to select in the export window and so nothing to export to the directory! See "How to install resource and load a profile for Simulation" in this guide.

5.1 Export Artifacts from a Simulation

To export the artifacts of a Simulation, go to the Menu bar and select *Export.*
Select the artifacts to export.
Click *Finish*.
A message is displayed confirming the export: "All artifacts were successfully exported".
Click *OK*.

5.2 Import Artifacts into a Simulation

Note that in order to import artifacts, a *.**loadprofile** and/ or a *.**simresource** file must exist in a directory from a previous export (see above).

To import the artifacts of a Simulation, go to the Menu bar and select *Import.*
Select the artifacts to import.
Click *Finish*.
A message is displayed confirming the import: "All artifacts were successfully imported".
Click *OK*.

Part 6. How to analyze a problem in Bonita Open Solution

Your Bonita Open Solution log files (for Bonita Studio and Bonita Execution Engine) are available via the Menu Bar: **Help -> *Show log*** and **Help -> *Show engine log.***

When you encounter a problem, please post a description of the problem and a copy of your log file on the Bonita Community Forum at www.bonitasoft.org/forum/.

BonitaSoft developers, among others, actively contribute to the Bonita Community and will post a response.