

University of Pisa

MSc in Computer Engineering

# Systems for Strategic Management and Support

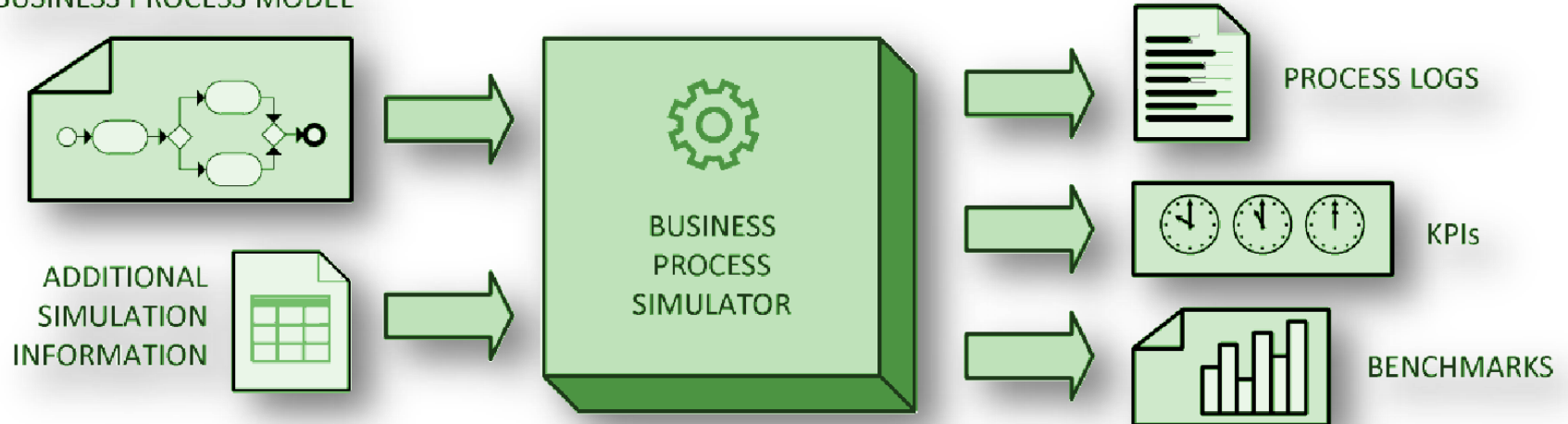
LECTURES 3 AND 4

<http://www.iet.unipi.it/m.cimino/pdis/>

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Department of Information Engineering

## BUSINESS PROCESS MODEL



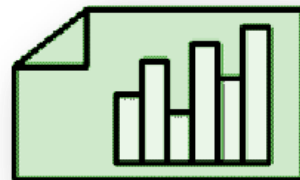
## Basic simulation parameters

Parameter	Description
task duration	the time taken by the task to complete
branching proportion	the percentage of process instances for each outgoing flow of an XOR/OR gateway
resource allocation	the resources needed by each task
task cost	a monetary value of the task execution instance
available resources	the number of pools, lanes, actors or role available for tasks
number of instances	the number of running process instances for the scenario
arrival rate	the time interval between the arrivals of two process instances



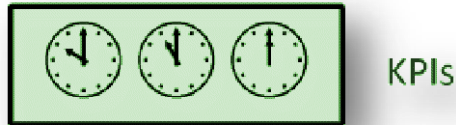
## PROCESS LOGS

A detailed process log of each process instance, which can be analyzed with a process mining framework . Logs are finite sets of transactions involving some process items, such as customers and products. For example: (1) Jane Doe buys pdt1 and pdt2; (2) John Doe buys pdt1; (3) Foo buys pdt2, pdt3 and pdt4. Logs are usually represented in a format used by the majority of process-mining tools, known as MXML (Mining XML)



## BENCHMARKS

A set of benchmarks with some diagrams. Benchmarking is a popular technique that a company can use to compare its performance with other best-in-class performing companies in similar industries . For example, a comparative plot of the compliance to international warranty requirements in a specific industrial sector.



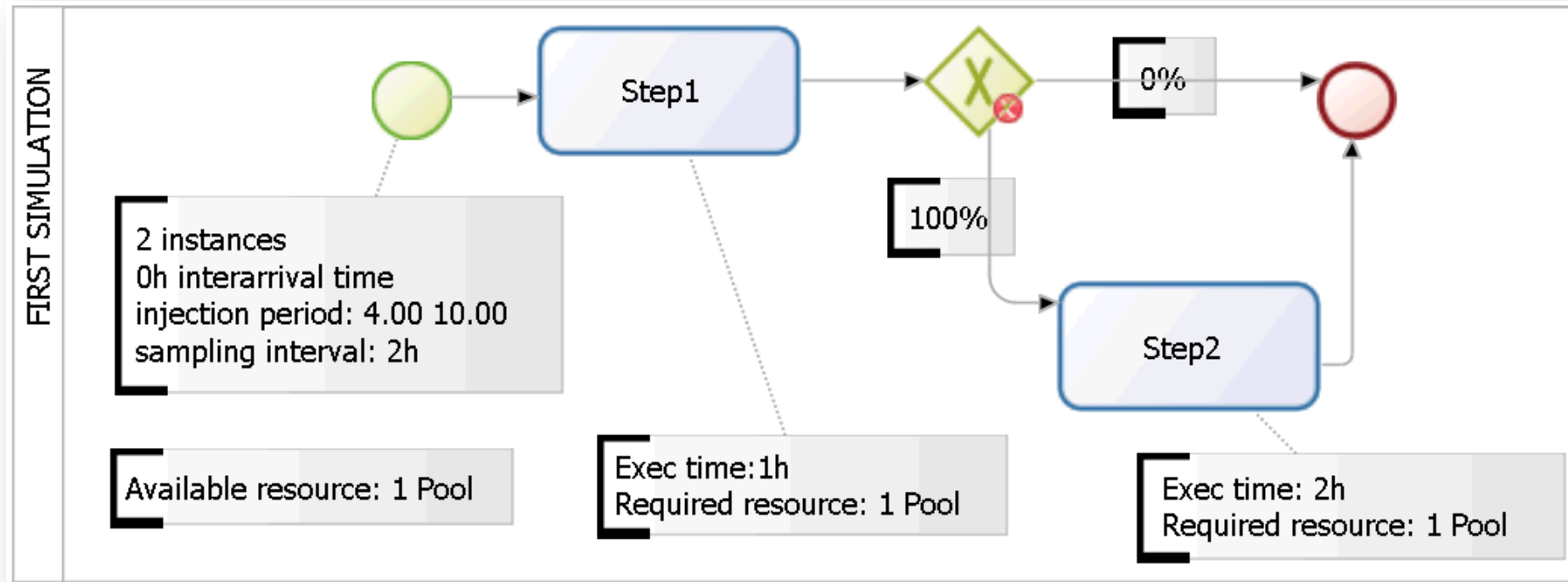
Some general purpose key performance indicators, KPI

KPI	Description
waiting time	time measured from enabling a task to the time when task was actually started
processing time	time measured from the beginning to the end of a single process path
cycle time	sum of time spent on all possible process paths considering the frequencies of the path to be taken in a scenario; cycle time corresponds to the sum of processing and waiting times
process cost	sum of all costs in a process instance
resource utilization	rate of allocated resources during the period that was inspected

## Some commercial BPM/BPS suite supporting BPMN

- ✓ Abacus
- ✓ AccuProcess Modeler
- ✓ Adonis
- ✓ ARIS Business Simulator
- ✓ **BIMP Simulator**
- ✓ Bizagi BPM Suite
- ✓ **Bonita BPM Suite**
- ✓ Enterprise Architect
- ✓ Sparx Systems Enterprise Architect
- ...
- ...
- ✓ IBM Business Process Manager
- ✓ iGrafx Process
- ✓ Inubit BPM Suite
- ✓ Iyopro
- ✓ Oracle BPM Suite
- ✓ Visual Paradigm Logizian
- ✓ MEGA Simulation
- ✓ Savvion Business Manager
- ✓ Signavio Process Editor
- ✓ TIBCO Business Studio

## ✓ A basic example on Bonita Simulator



Simulation Start Date : 09/10/2014 04:00:00

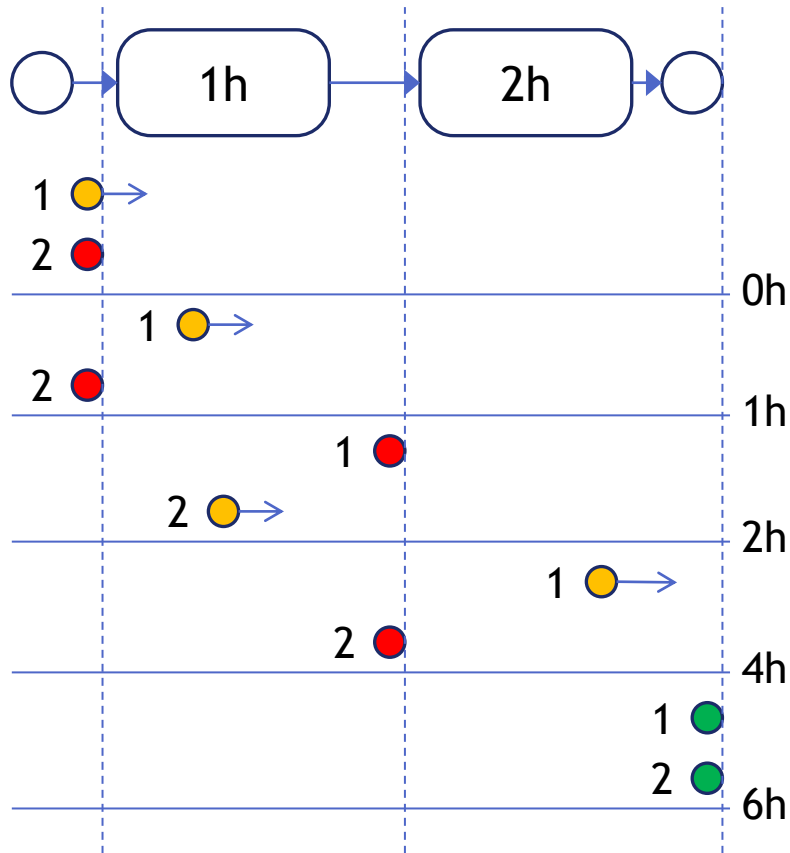
Simulation End Date : 09/10/2014 10:00:00

Simulation Duration : 6 hours

Execution time : 8 seconds

Number of simulated Instances : 2

## PROCESS STATUS



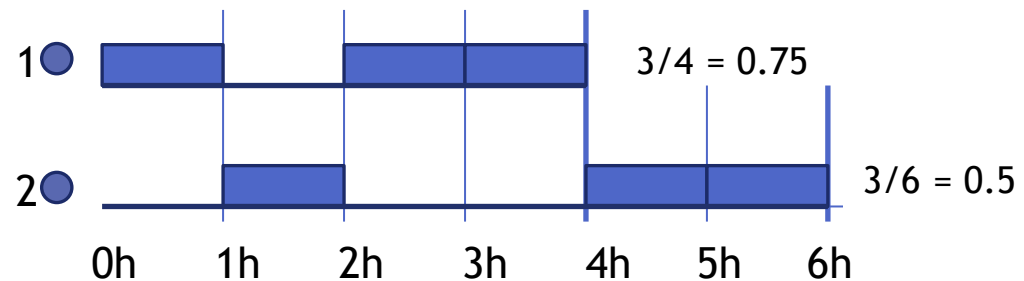
## LEGEND

- processing
- waiting
- completed

## LEGEND

- 100% utilization
- 0% utilization
- completed

## RESOURCE UTILIZATION

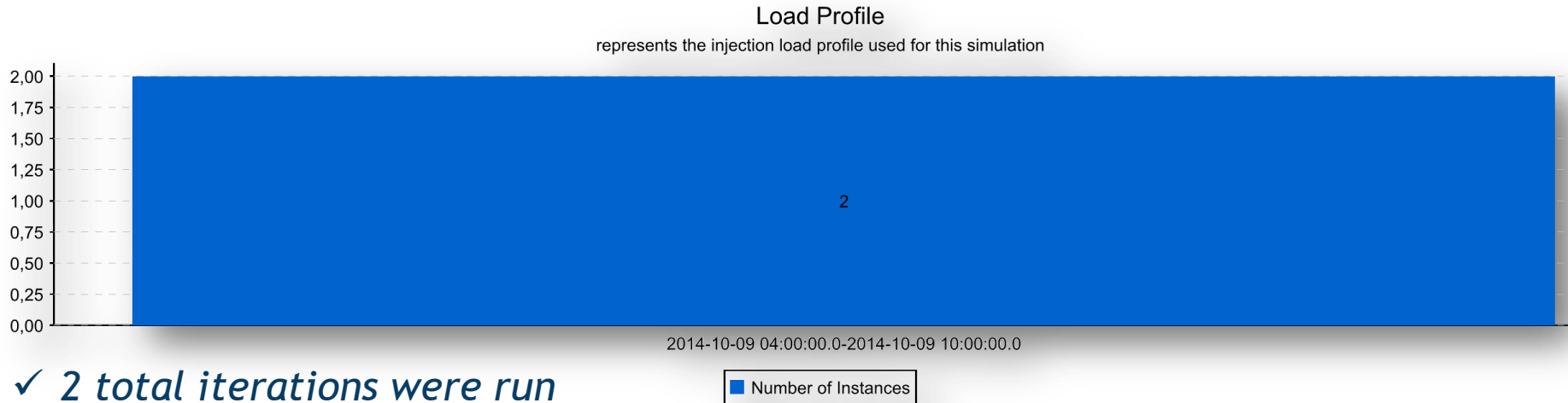


✓ Process Simulation (Official Documentation)

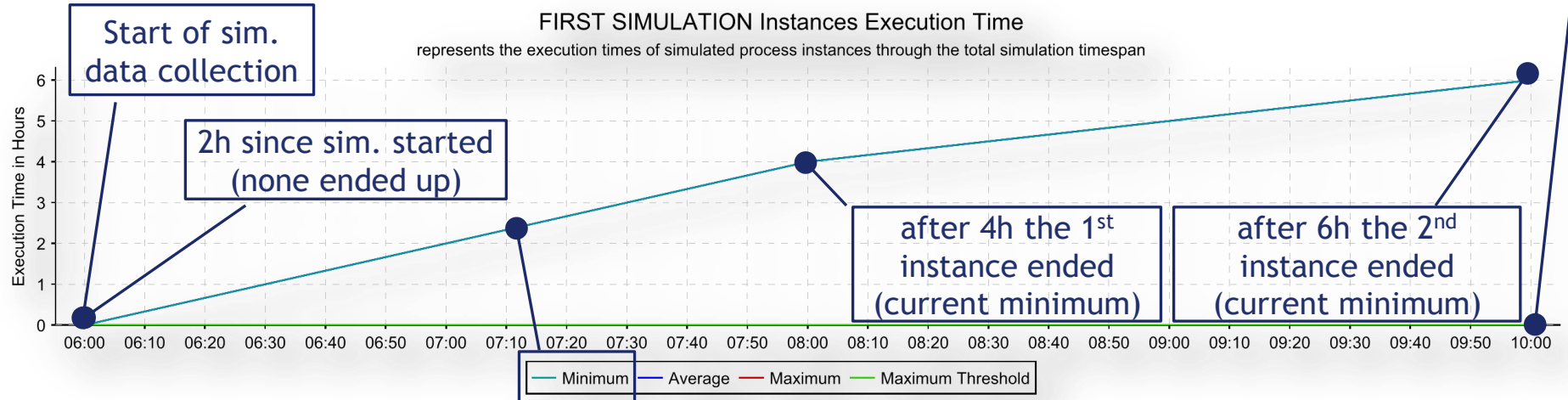
<http://documentation.bonitasoft.com/5x/bos-59/process-simulation>



## Load profile: total number of iterations run



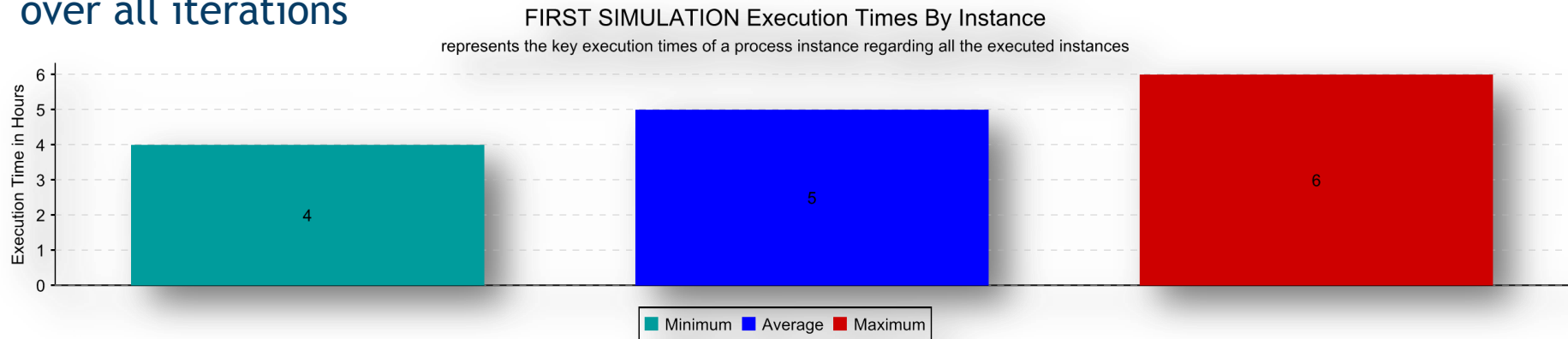
## Instances Execution Time: execution time in hours vs date



- ✓ The minimum execution time of simulated process instances was 4h after 4h and 6h after 6h.



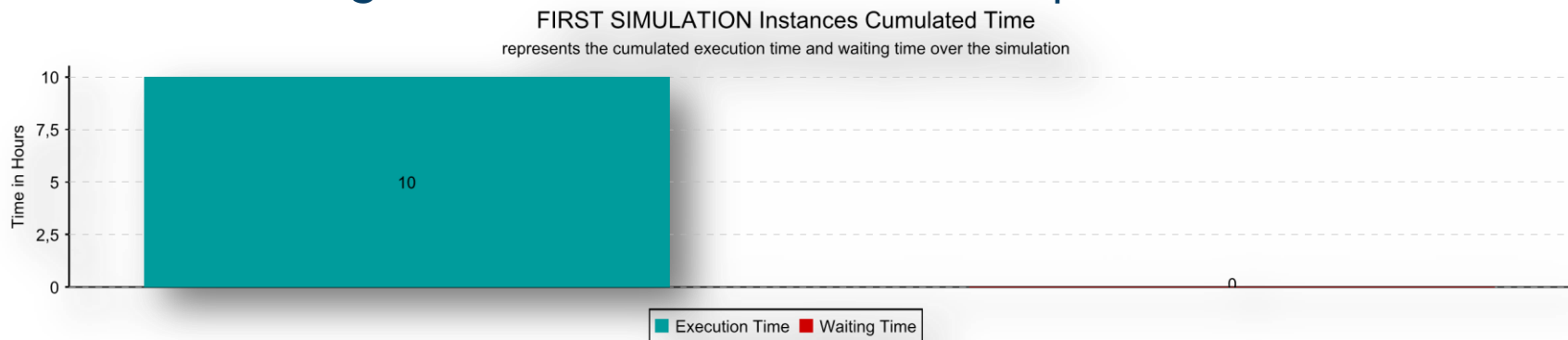
## Time by Instance: minimum, average, and maximum execution times calculated over all iterations



- ✓ *The process instance with minimum execution time lasted 4h, the one with maximum execution time lasted 6h, the mean over two instances is  $(4+6)/2=5$*

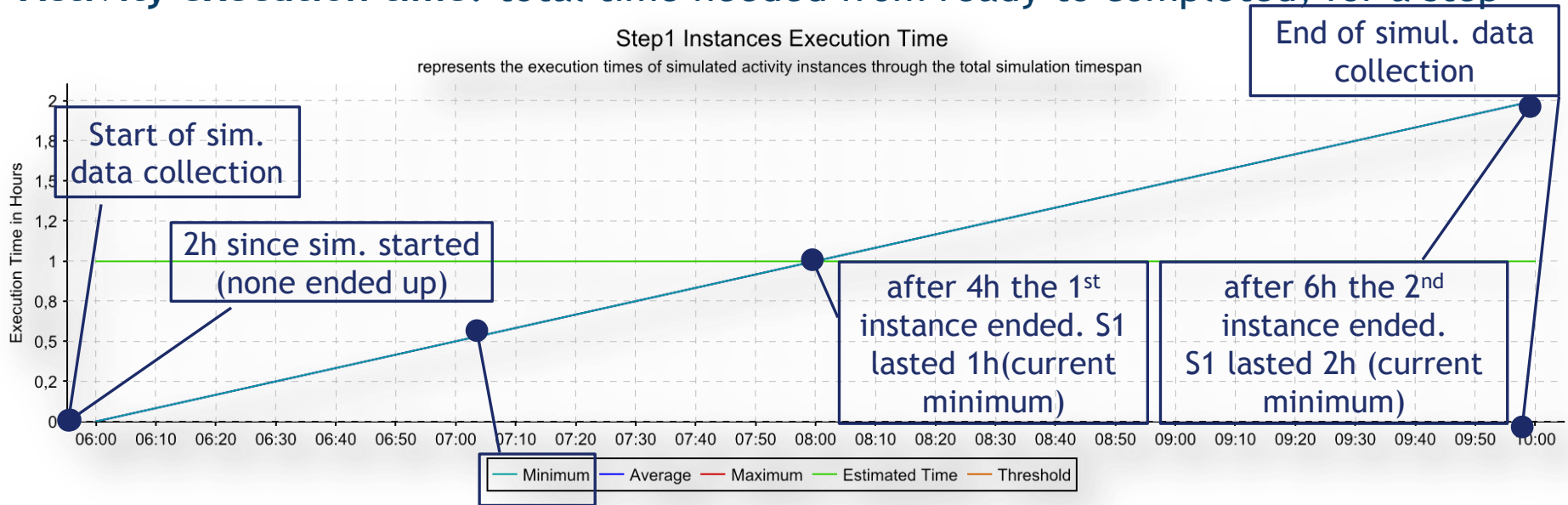
**Cumulated execution time:** sum of all execution times of process instances

**Cumulated Waiting time:** sum of all inactive time of process instances

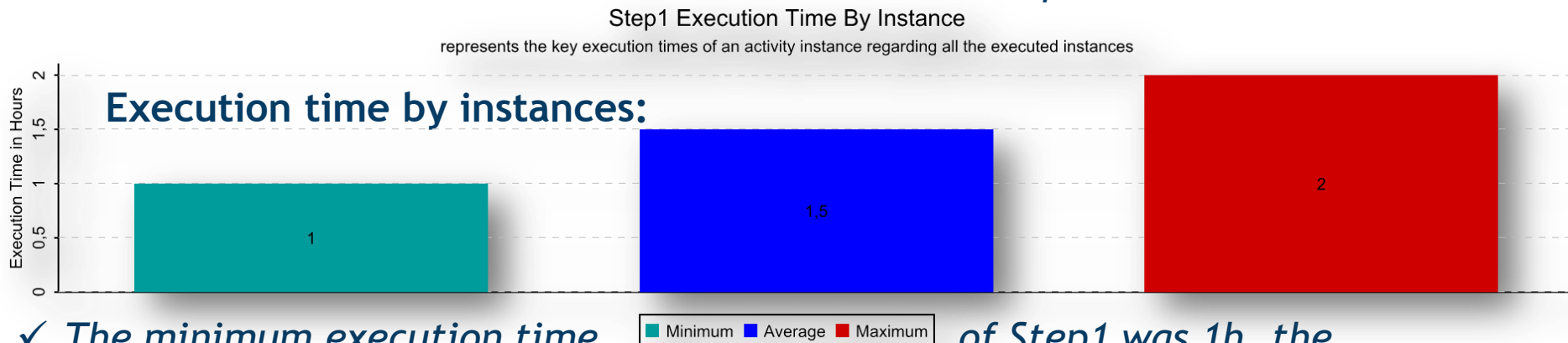


- ✓ *The total execution time is  $4+6=10$ . The process instances were never inactive, i.e., the pool was continuously working.*

**Activity execution time:** total time needed from ready to completed, for a step

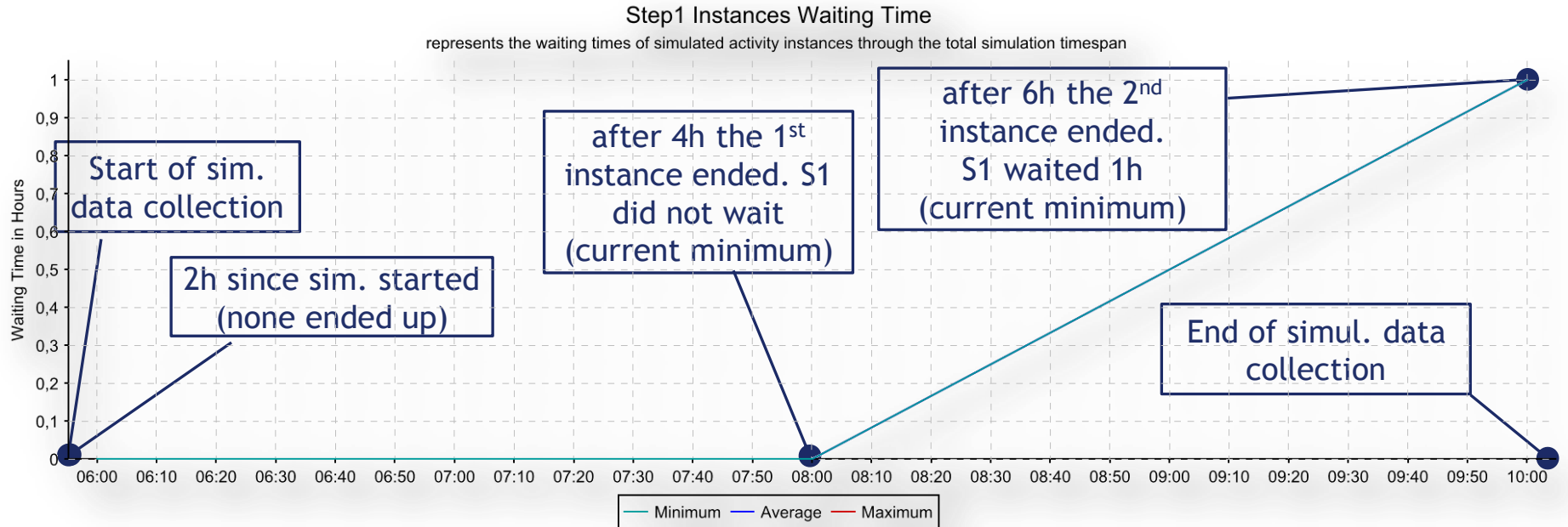


✓ The minimum execution time of Step1 instances was 1h after 4h and 2h after 6h, where minimum is calculated between the current Step1 instances.

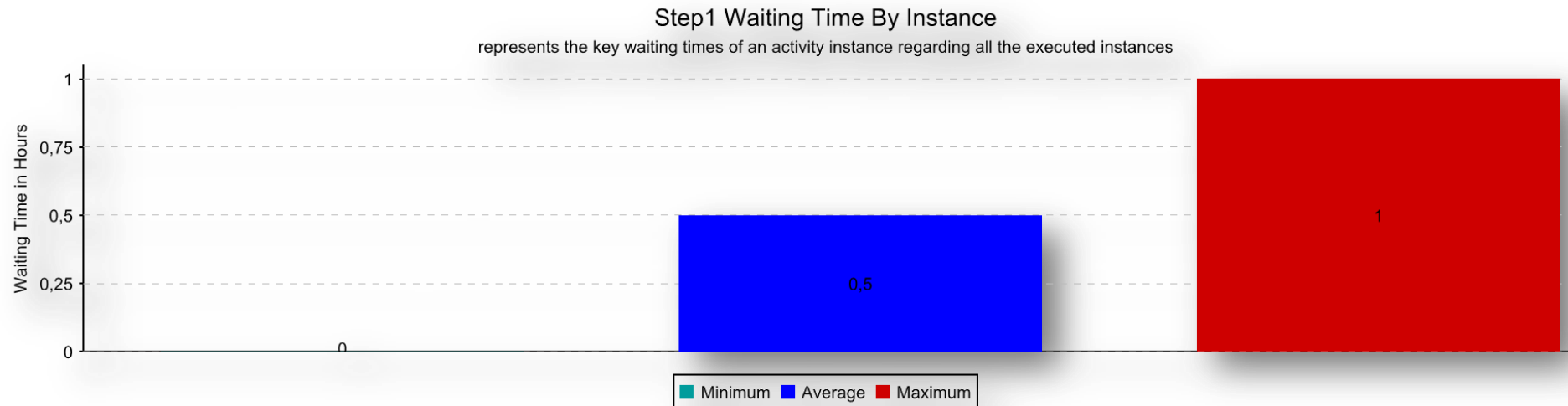


✓ The minimum execution time of Step1 was 1h, the maximum was 2h. The mean over two instances is  $(1+2)/2=1.5$ .

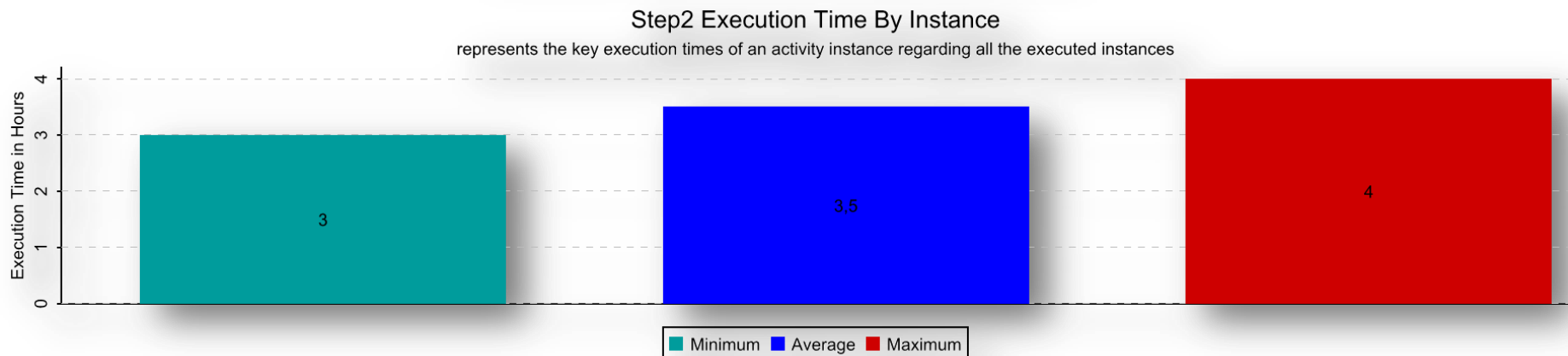
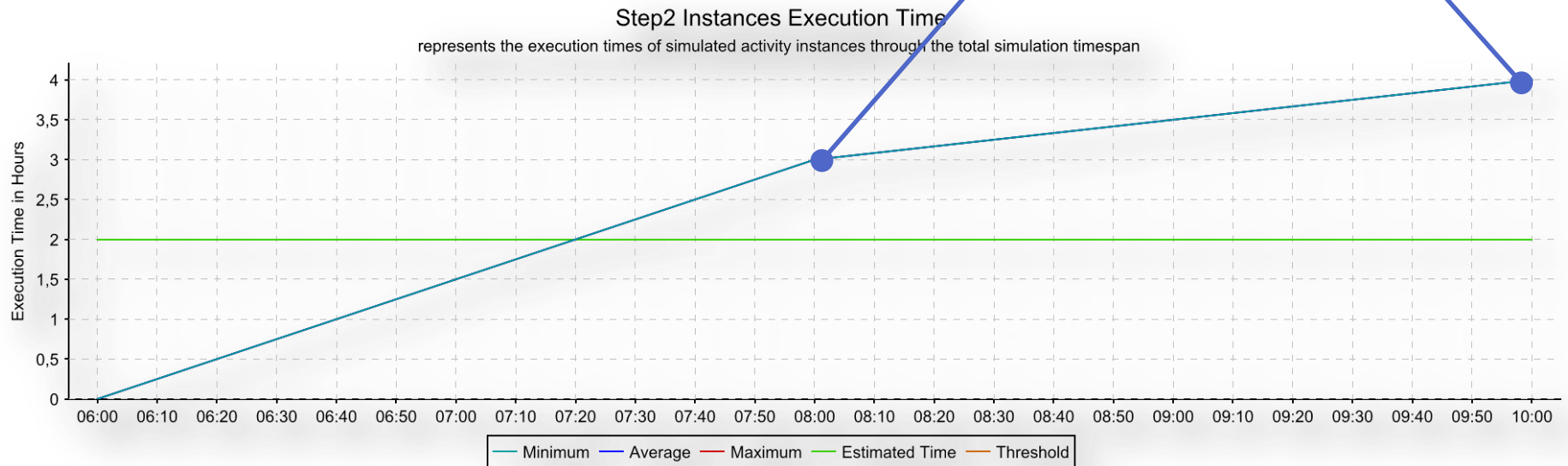
## Instances Waiting time for a step: how long a step waited for available resources

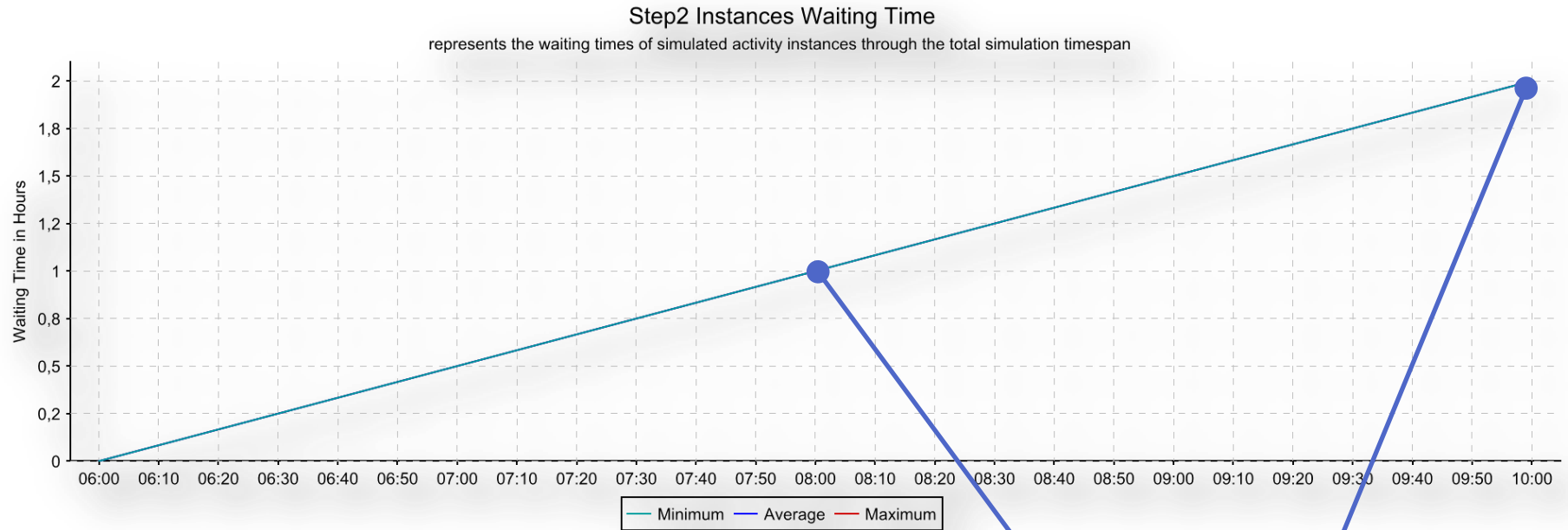


✓ The minimum waiting time of Step1 instances was 0h after 4h and 1h after 6h.

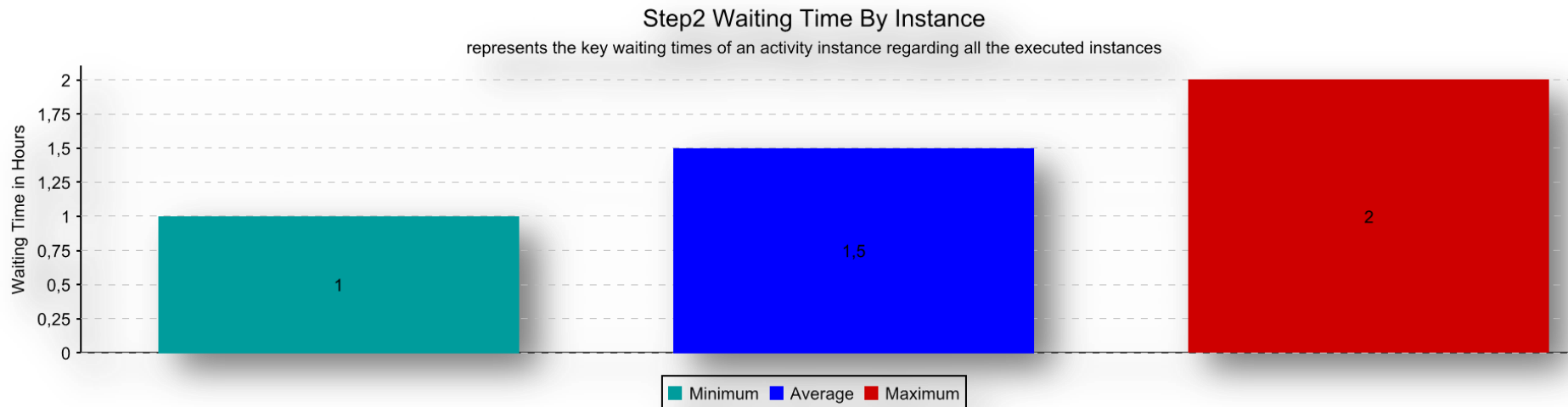


- ✓ The minimum execution time of Step2 instances was 3h after 4h and 4h after 6h, where minimum is calculated between the current Step2 instances.

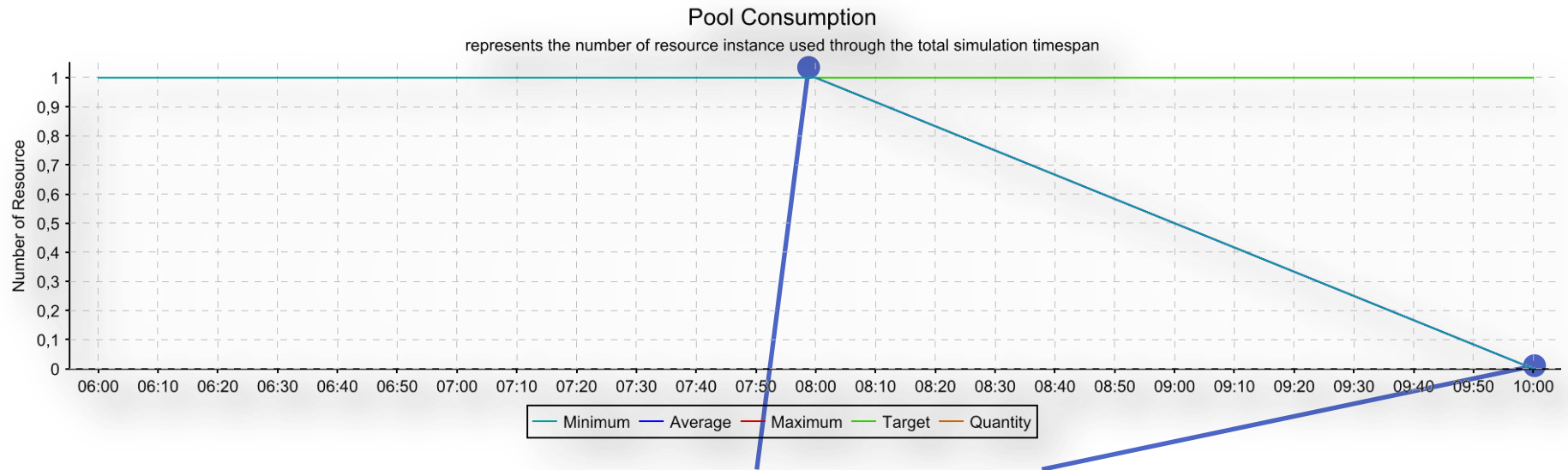




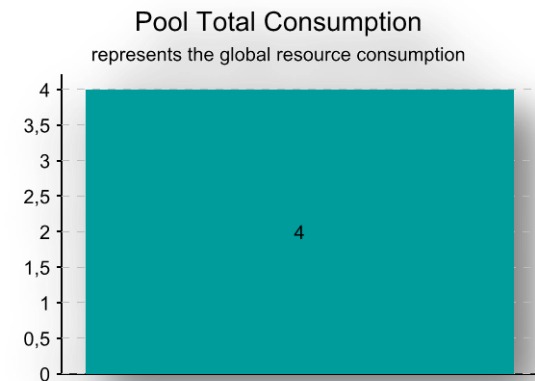
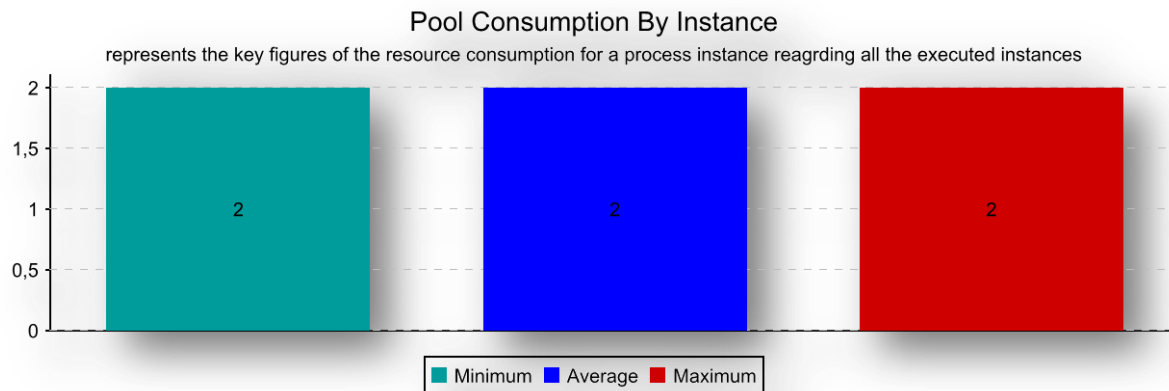
✓ The minimum waiting time of Step2 instances was 1h after 4h and 2h after 6h.



Consumption: number/amount of the resource consumed or used vs date

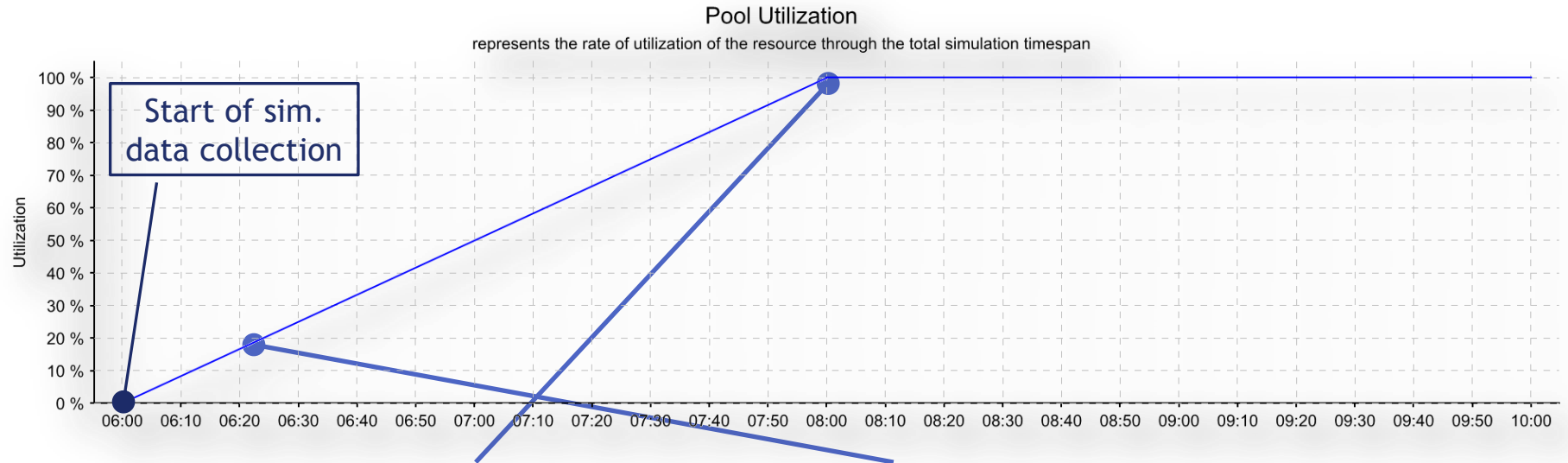


✓ The minimum Pool consumption was 1 after 4h and 0 after 6h.

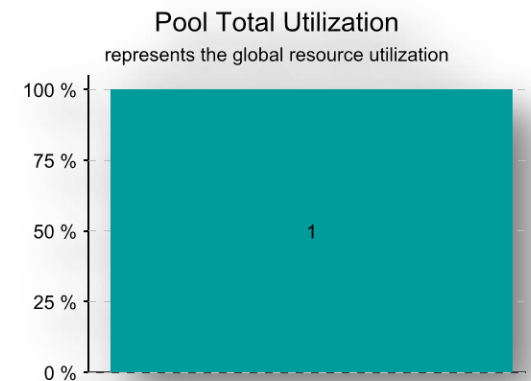
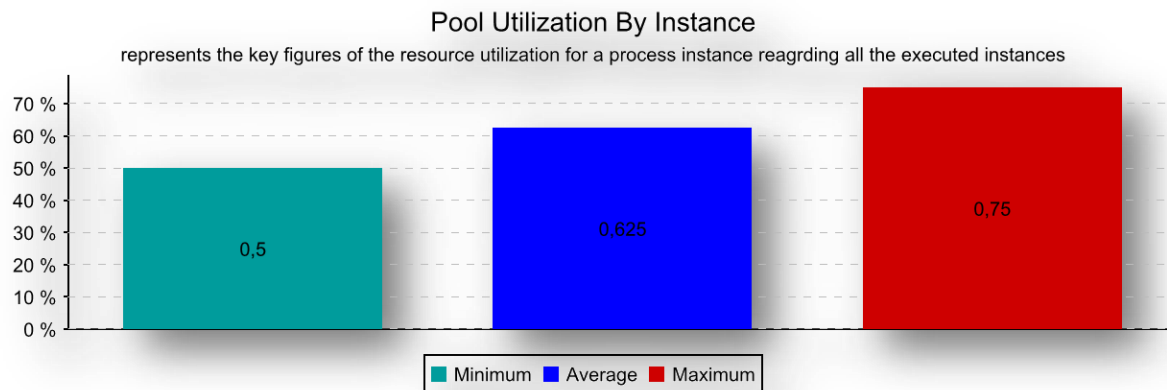


✓ For each process instance 2 Pool instances are consumed: one for Step1 and another for step2. With 2 instances, 4 Pool instances are consumed.

## Utilization: rate of utilization of the unique Pool resource



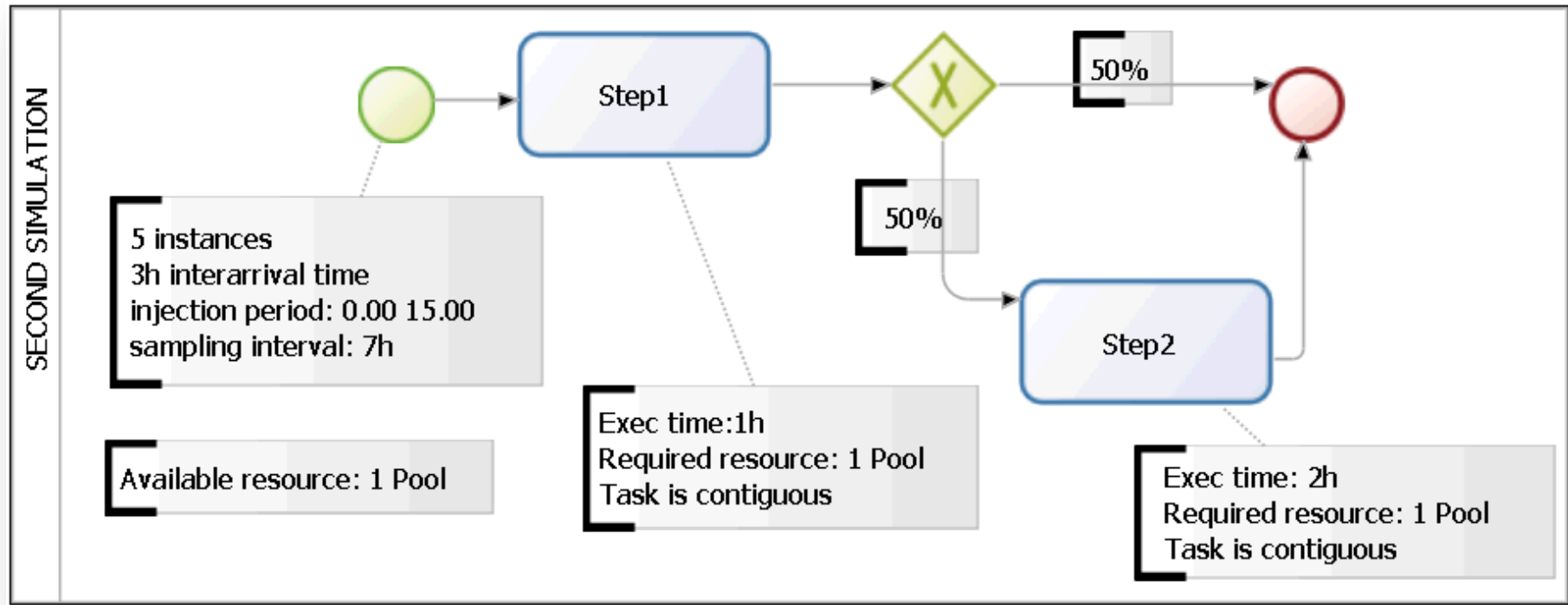
✓ *The Pool is always fully utilized, though data collection started after 2h since process began.*



✓ *See slide 7 to calculate the Pool utilization by instance.*

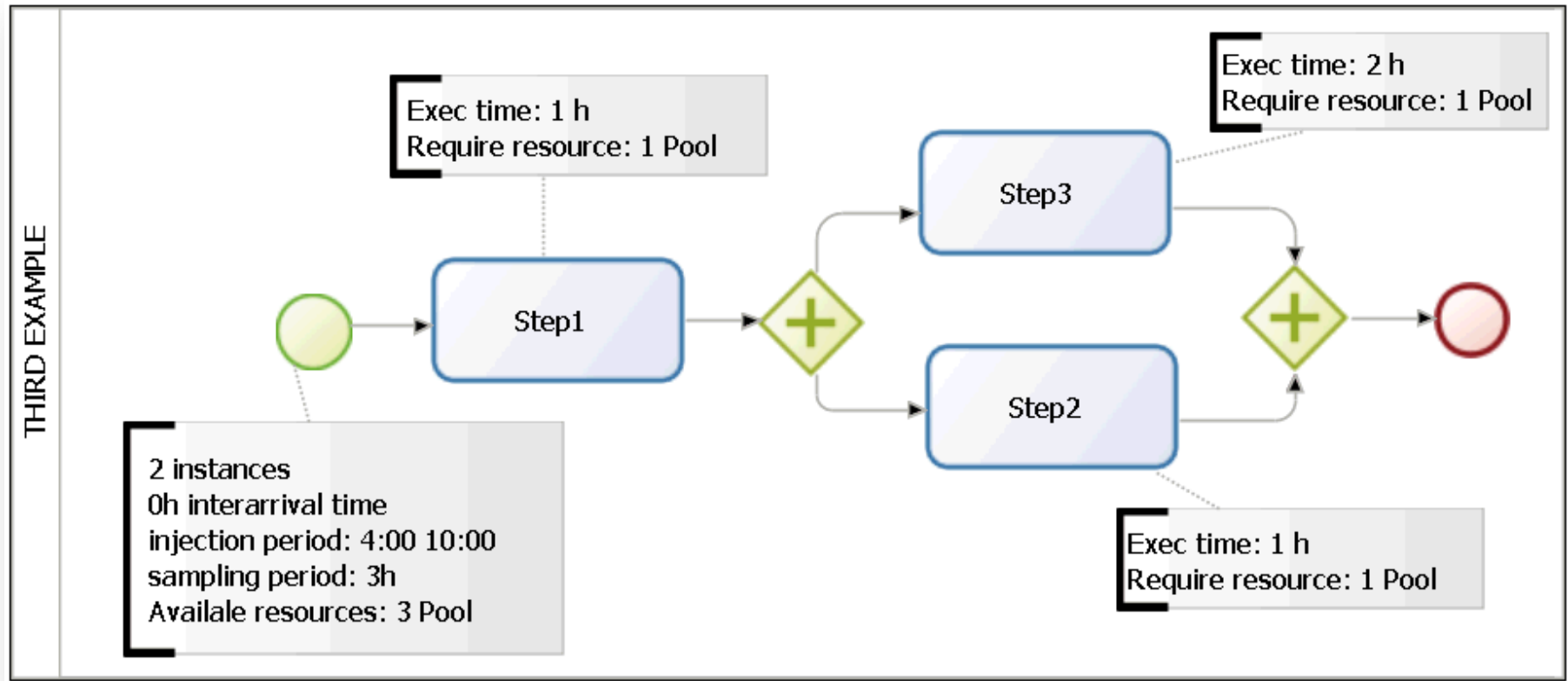


## ✓ Second example



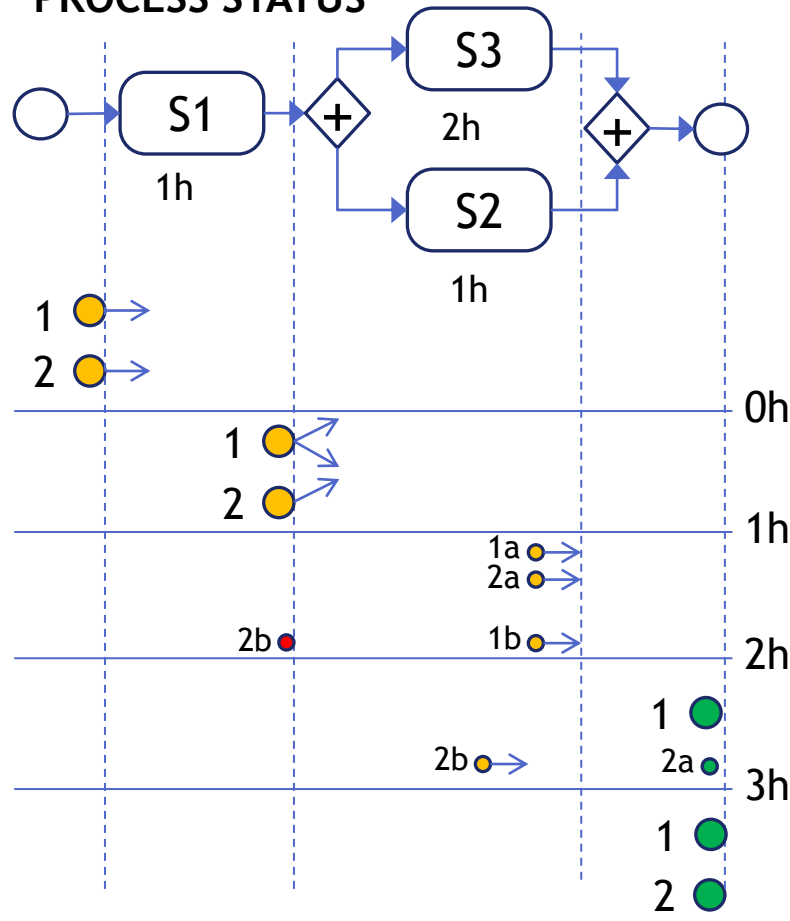
- ✓ Import SECOND-SIMULATION.bos
- ✓ See SECOND-SIMULATION-report.pdf

## ✓ Third example



- ✓ Import THIRD-SIMULATION.bos
- ✓ See THIRD-SIMULATION-report.pdf

## PROCESS STATUS



## LEGEND

- processing
- waiting
- completed

## RESOURCE UTILIZATION

Token		1h	2h	3h
1	Step1	●		
	Step2		●	
	Step3		●	●
2	Step1	●		
	Step2		w	●
	Step3		●	●
Resource		2/3	3/3	3/3

$$(2/3+3/3+3/3)/3 = 0.8888$$

✓ The Pool instances consumed depend on the diagram complexity (steps, gateways, etc.): 7 Pool instances are consumed per process instance.