POLITECNICO
MILANO 1863

PERFORMANCE EVALUATION AND APPLICATIONS

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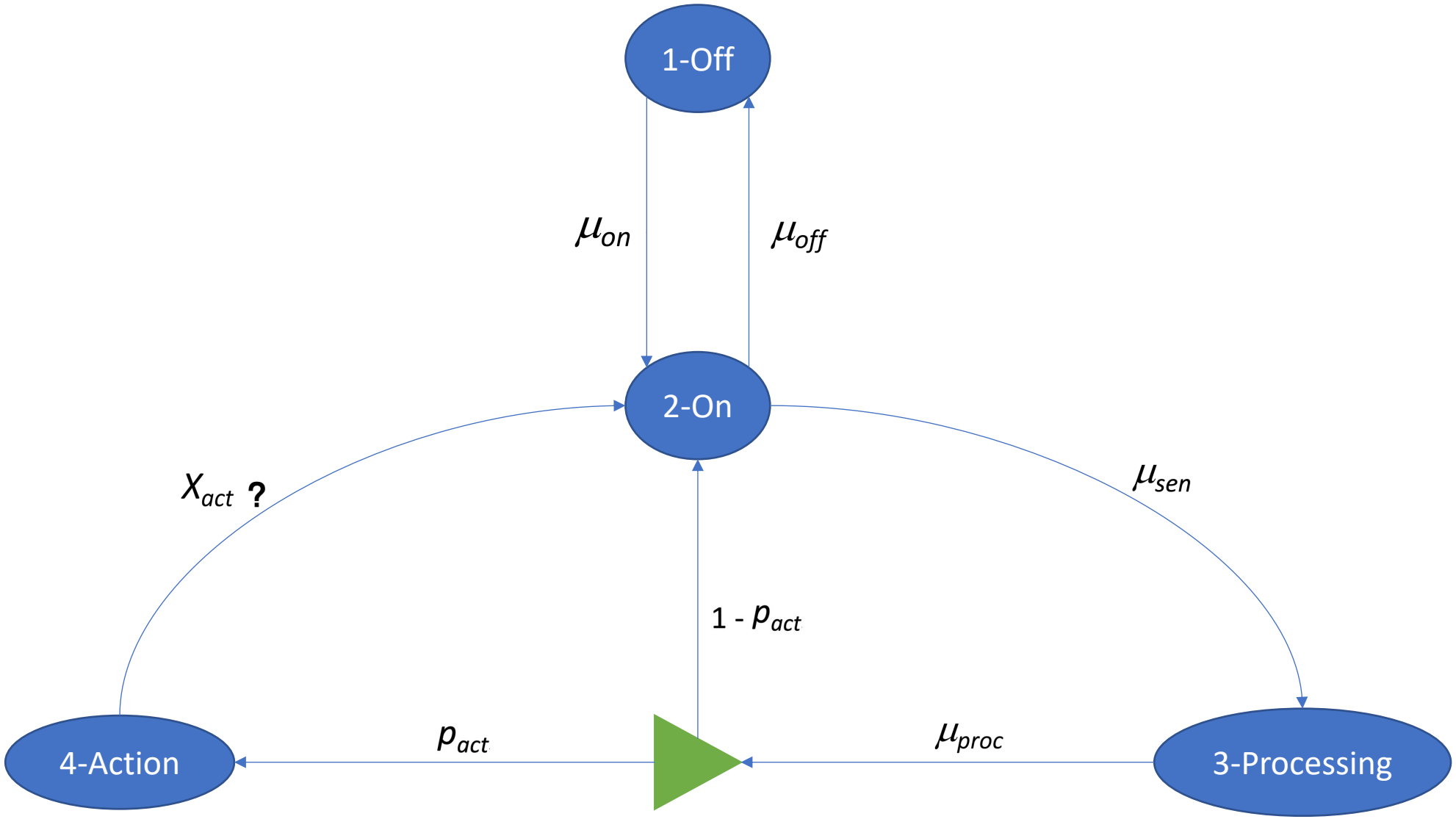
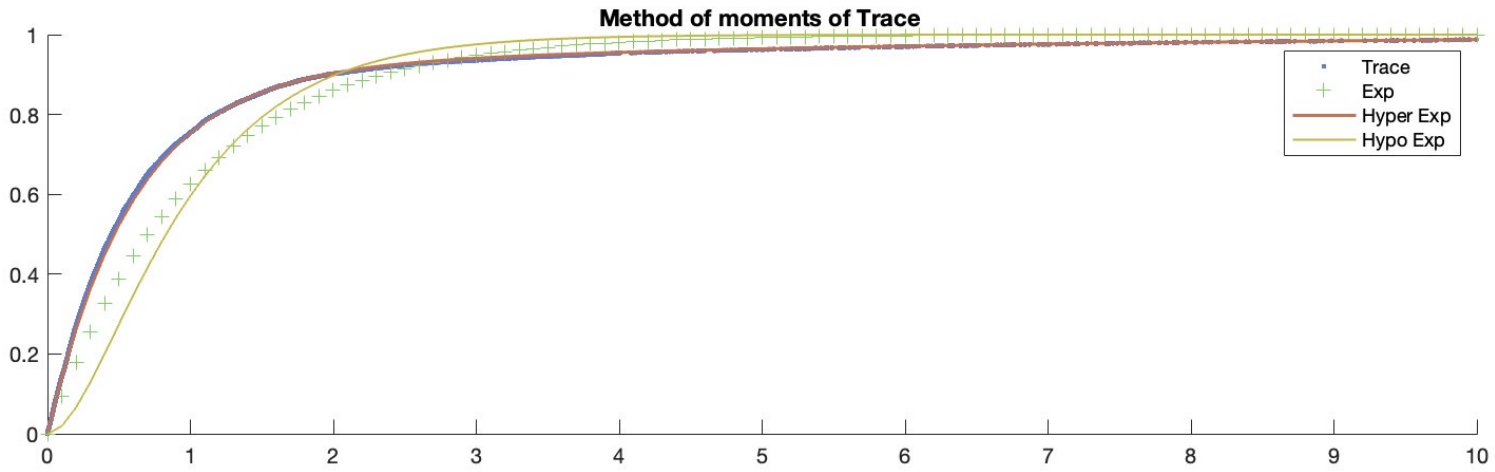
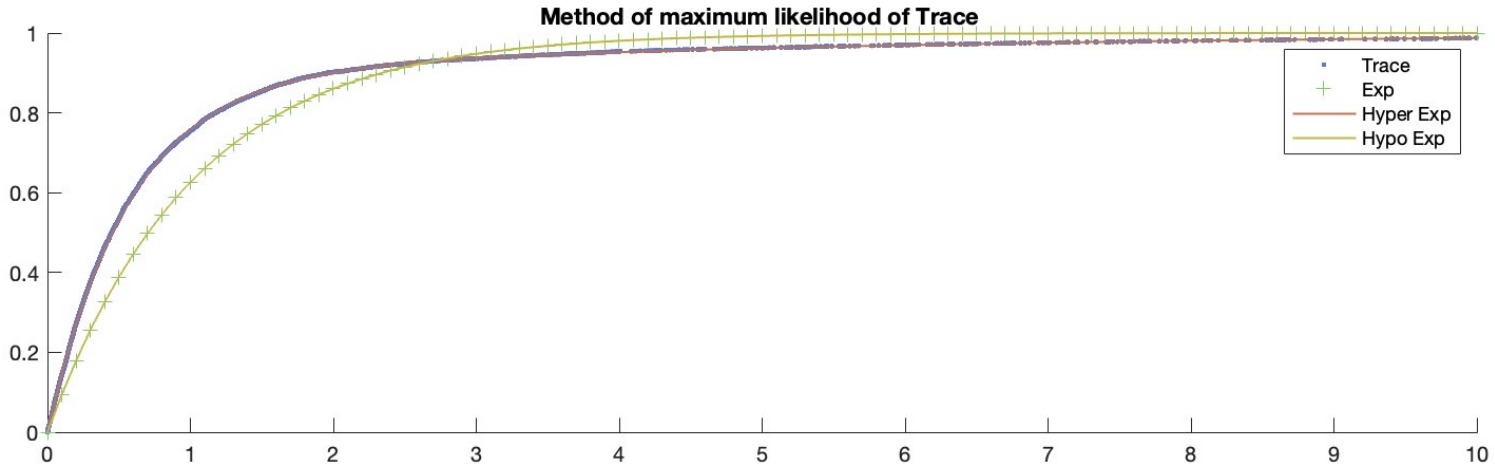
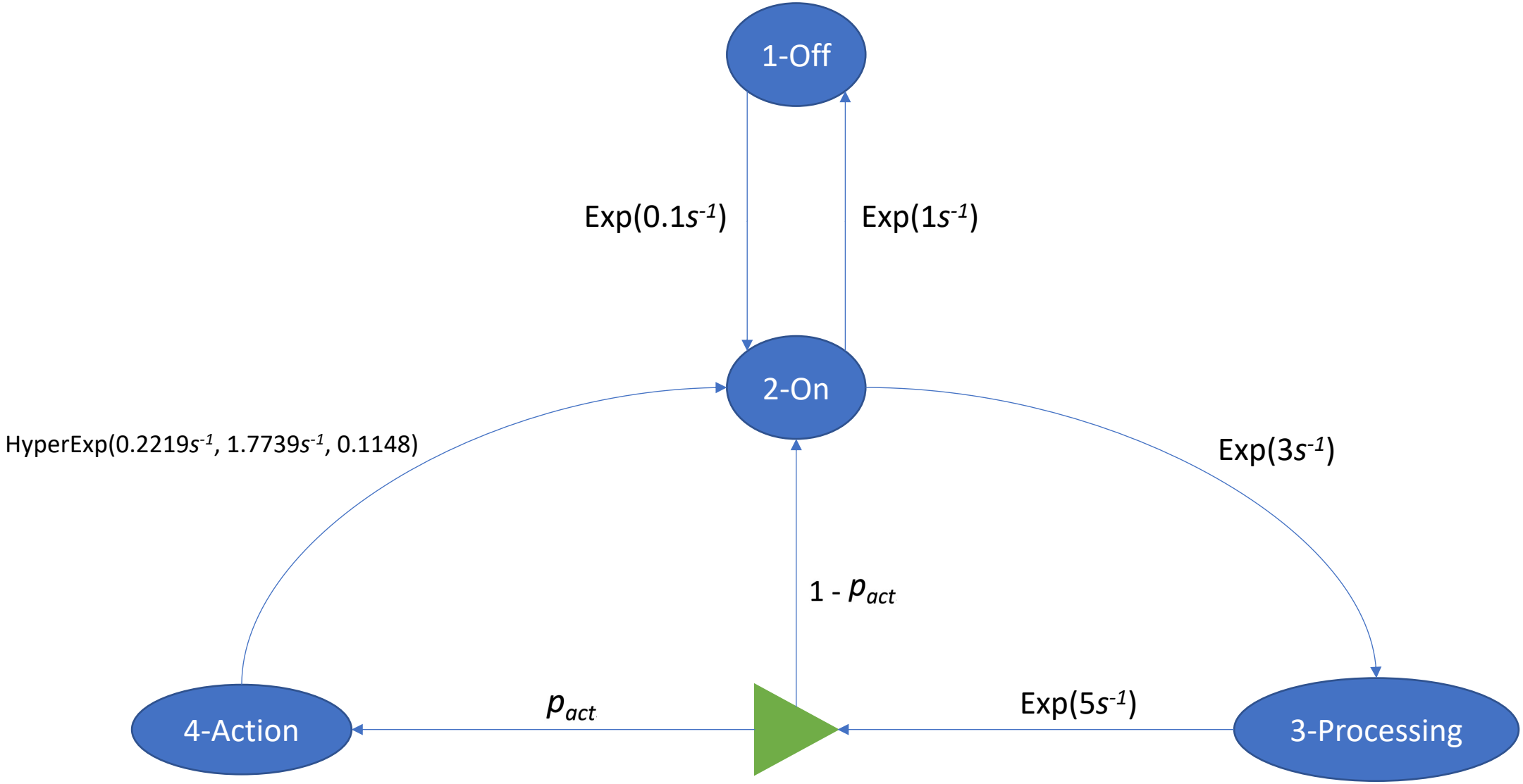
Outline

- Simulation with MATLAB
  - Fit the unknown distribution
  - Rebuild the model with Phase-Type distributions
  - Solve the ode45 function, plot the probability of the various states for the time T = [0, 20] and T = [0, 10000]
  - Compute the steady-state
  - Compute the average energy consumption through state rewards
  - Computer the on frequency through transition reward
- Simulation with Java Modelling Tools (Double-check the result of MATLAB)
  - Build the model
  - Compute the average energy consumption through the steady-state
  - Compute the on frequency through the throughput

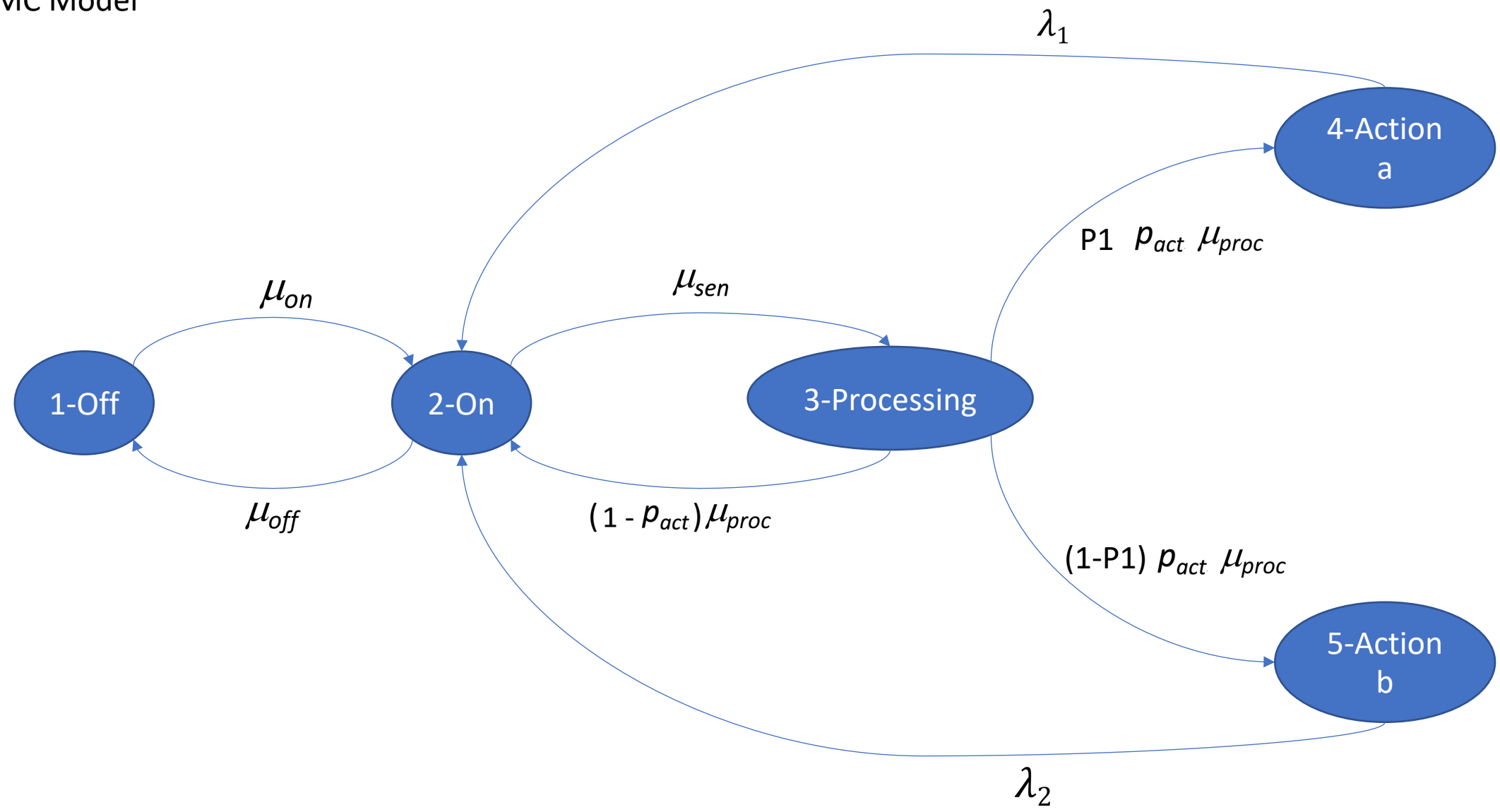

1-Off
μ_{on}
μ_{off}
2-On
X_{act} ?
μ_{sen}
1 - p_{act}
4-Action
p_{act}
μ_{proc}
3-Processing


Method of moments of Trace
Trace
Exp
Hyper Exp
Hypo Exp
0
0.2
0.4
0.6
0.8
1
0
1
2
3
4
5
6
7
8
9
10

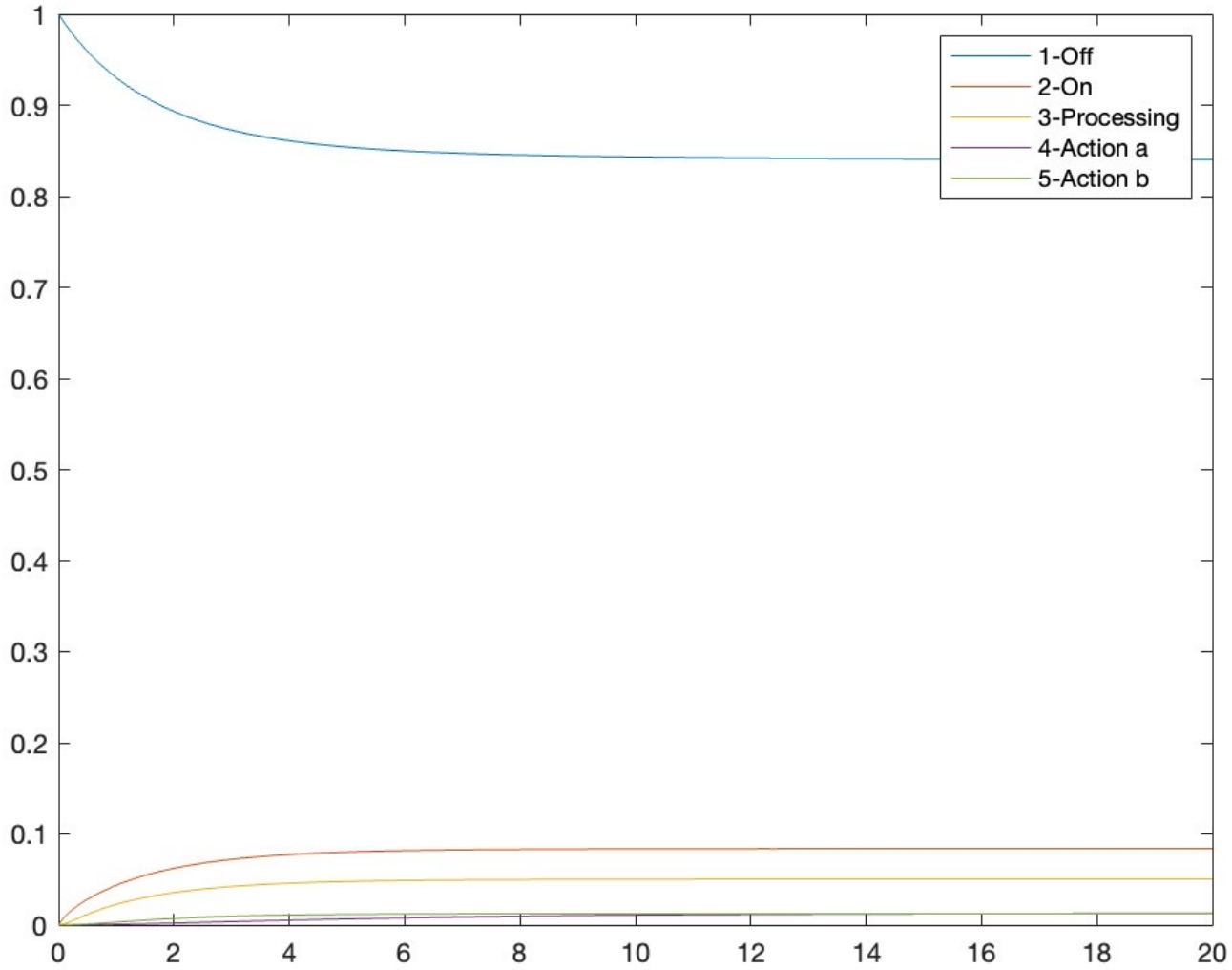

Method of maximum likelihood of Trace
Trace
Exp
Hyper Exp
Hypo Exp
0
0.2
0.4
0.6
0.8
1
0
1
2
3
4
5
6
7
8
9
10


1-Off
Exp(0.1s^{-1})
Exp(1s^{-1})
2-On
HyperExp(0.2219s^{-1}, 1.7739s^{-1}, 0.1148)
Exp(3s^{-1})
1 - p_{act}
4-Action
p_{act}
Exp(5s^{-1})
3-Processing

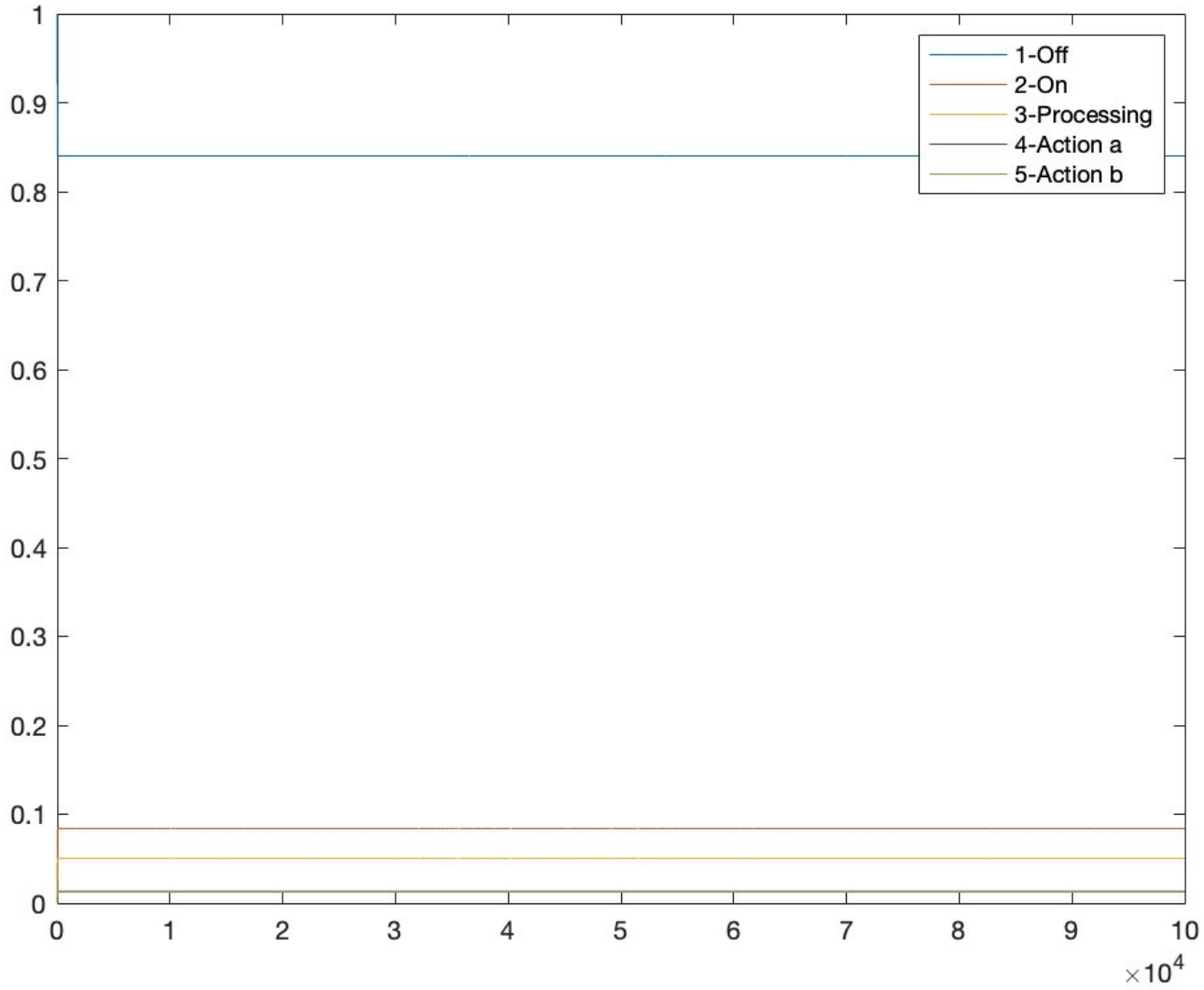
CTMC Model


λ_1
4-Action a
P1 p_{act} μ_{proc}
μ_{on}
μ_{sen}
1-Off
2-On
3-Processing
μ_{off}
$(1 - p_{act})\mu_{proc}$
(1-P1) p_{act} μ_{proc}
5-Action b
λ_2

Probability of the various states for the time T = [0, 20]



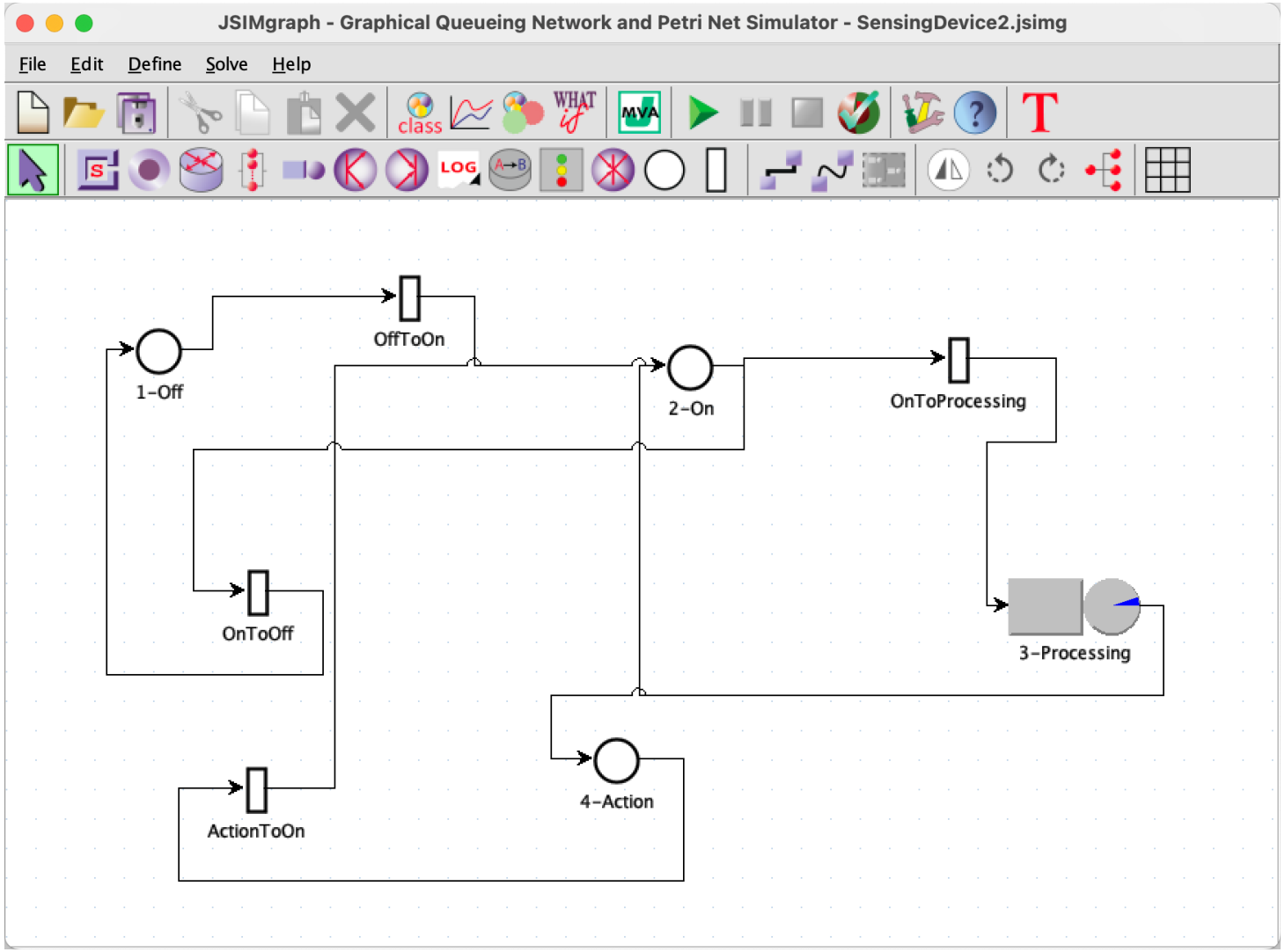
Probability of the various states for the time T = [0, 10000]



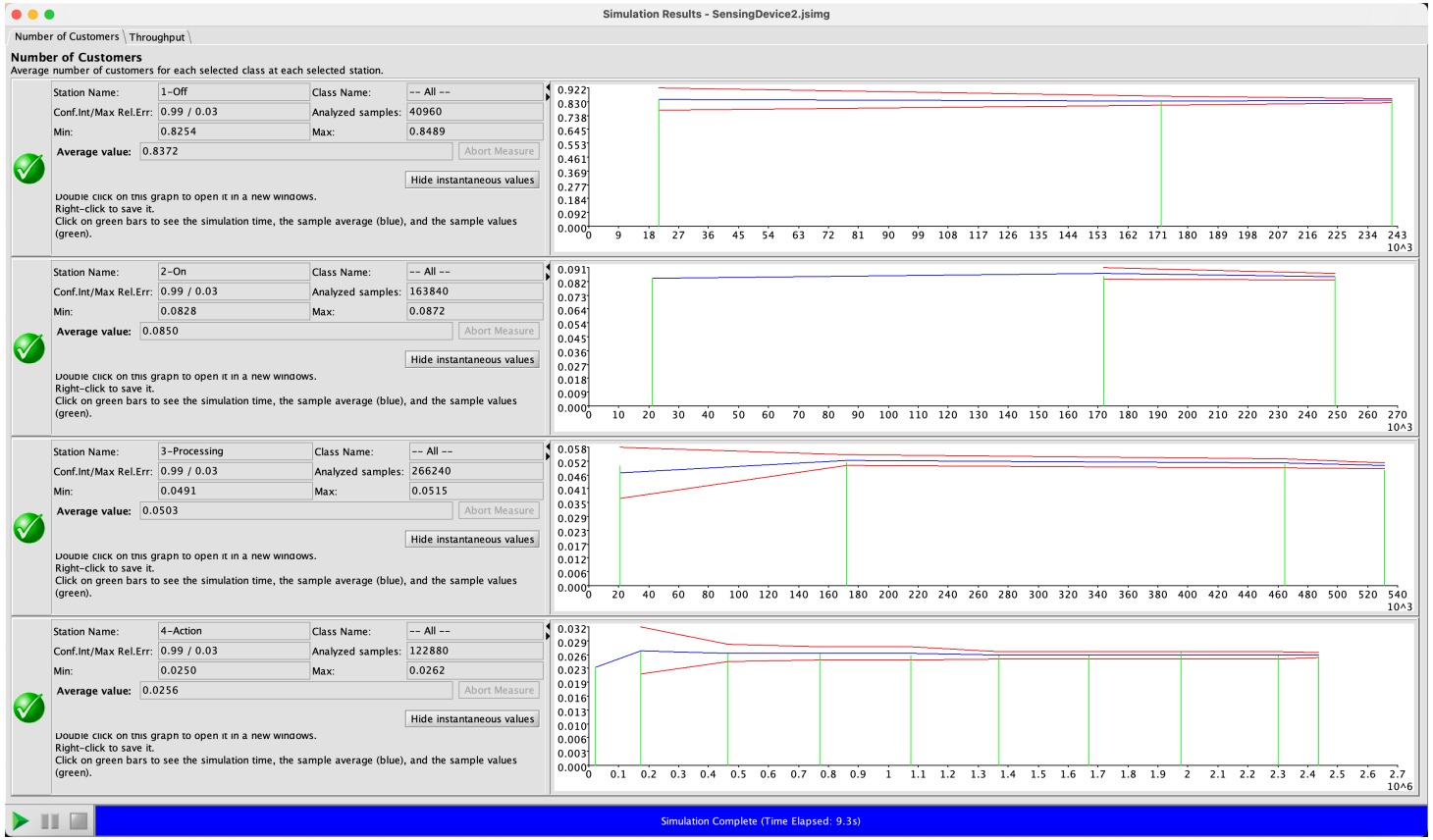
Result

- Steady-state: pi = [0.8400, 0.0840, 0.0504, 0.0130, 0.0126]
- Average energy consumption: 1.7003 mW
- On frequency: 0.3360

- JSIMgraph


JSIMgraph - Graphical Queueing Network and Petri Net Simulator - SensingDevice2.jsimg
File
Edit
Define
Solve
Help
1-Off
OffToOn
2-On
OnToProcessing
OnToOff
3-Processing
4-Action
ActionToOn

- Double-Check the result of MATLAB simulation



Steady-state: 0.8372 0.0850 0.0503 0.0256

Average energy consumption

$[0.8372, 0.0850, 0.0503, 0.0256] \cdot [\varepsilon_{off}, \varepsilon_{on}, \varepsilon_{proc}, \varepsilon_{act}]^T = 1.7002$ mW

- On frequency