# Performance Evaluation and Networks
# INFO4104

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**Tutorials:** Ni Luh Dewi SINTIARI, Enguerrand PREBET

# Performance Evaluation ?

Studying the performances of computer/communication systems/networks (but not only, e.g. transport networks, supply chains), with three complementary features:

- observation
- prediction
- control/optimisation

# Systems / Performances

**Systems:**

- architectures / hardware (micro-processors, PC clusters, supercomputers)
- code / software (runtime, compilation)
- communication networks (internet, telecom, embedded) / distributed systems (cloud)
- logistics, industrial processes, transport networks, ...

**Performances:**

- metrics: throughput, latency, utilization, workload, losses ...
- worst case, on average (under probabilistic hyp.), equity ...

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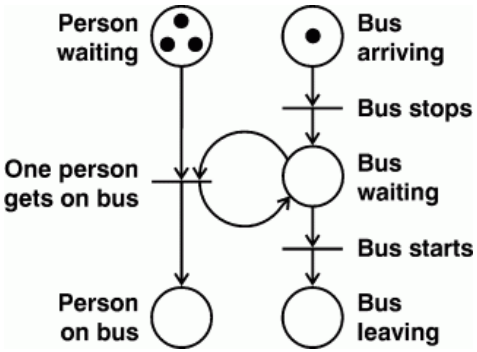
# Studying the performances of a system

**Investigation tools:**

- mathematical/numerical analysis of abstract models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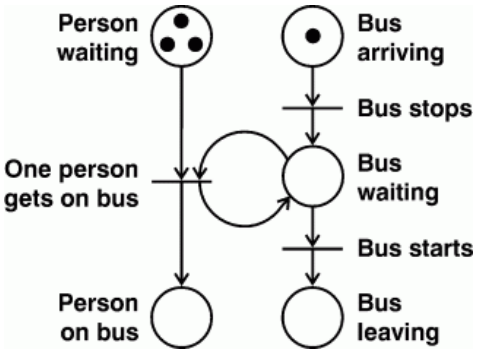
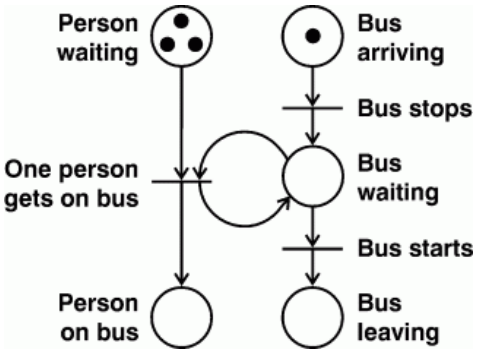



# Studying the performances of a system

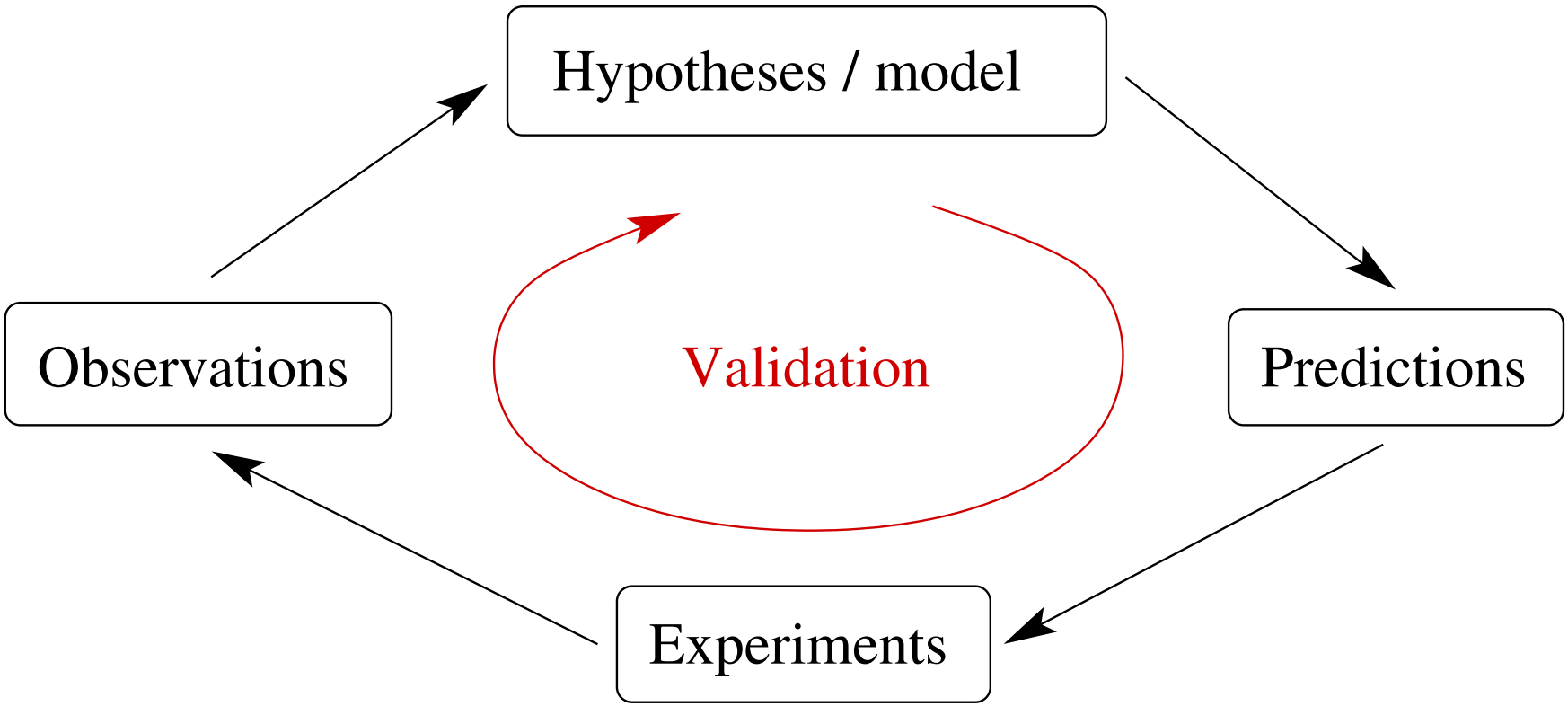
**Investigation tools:**

- mathematical/numerical analysis of abstract models
- simulation (math model, scale model)
- experiments/measures on real system

} data analysis (statistics)


# Reminder: the scientific method



# Course objectives

**Objectives:**

- designing and analysing mathematical models, in particular with probabilistic assumptions
- reinforcing knowledge about probabilistic/statistical tools
- reinforcing knowledge about communication networks
- practicing performance evaluation through simulations
- no direct measures on real system this year (but data analysis of collected measures)

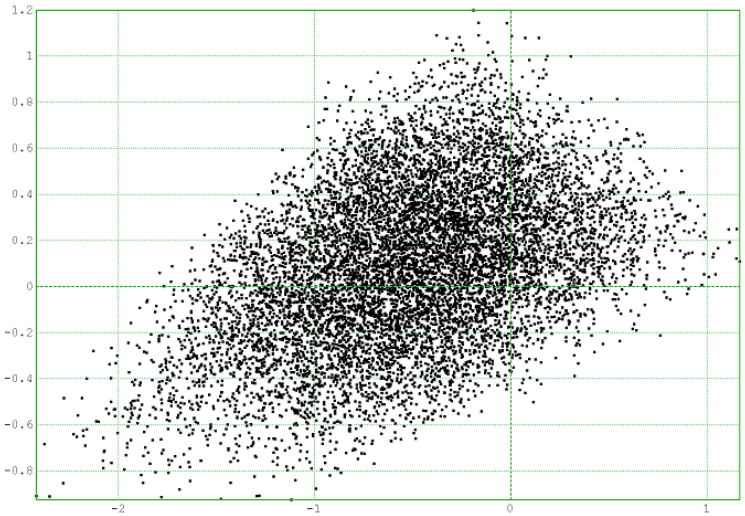
**Prerequisites:**

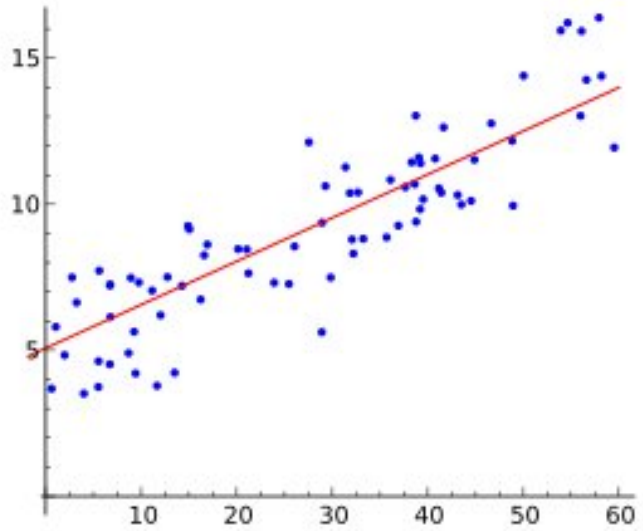
- basics in Probability and Python (for data analysis)
- knowledge about networks is good, but not essential

# Why so many probabilities ?

- **Intrinsic randomness:** real systems / math models where randomness is desired or suffered
- **The art of reasoning "à la louche" / "gross estimation":** quantifying frequent vs rare, rich bestiary of inequalities, probability in statistics.
- **Probabilistic/stochastic models:** good in practice

# Cloud of $n$ experimental measures

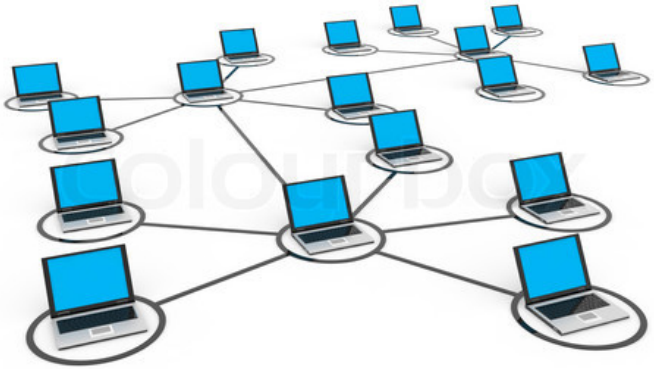


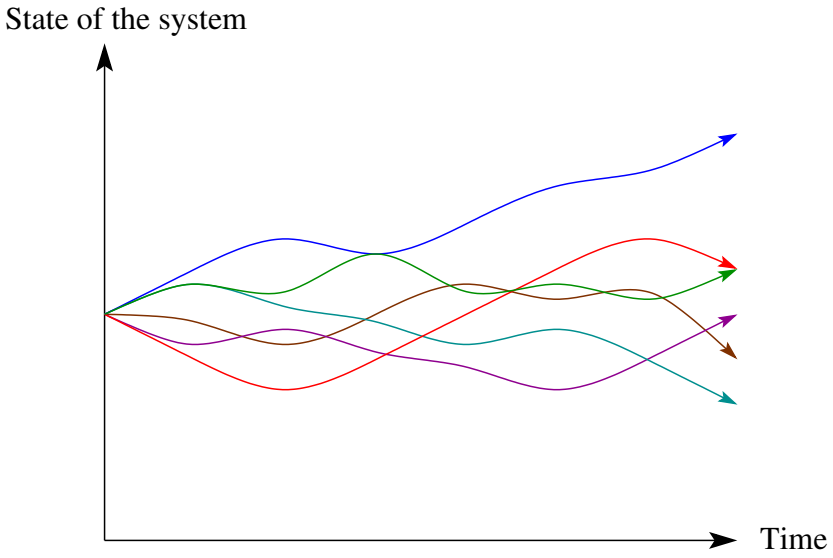




Execution time of a task with regard to its size

- Which information can be retrieved ?
- Should we carry out more measures ?

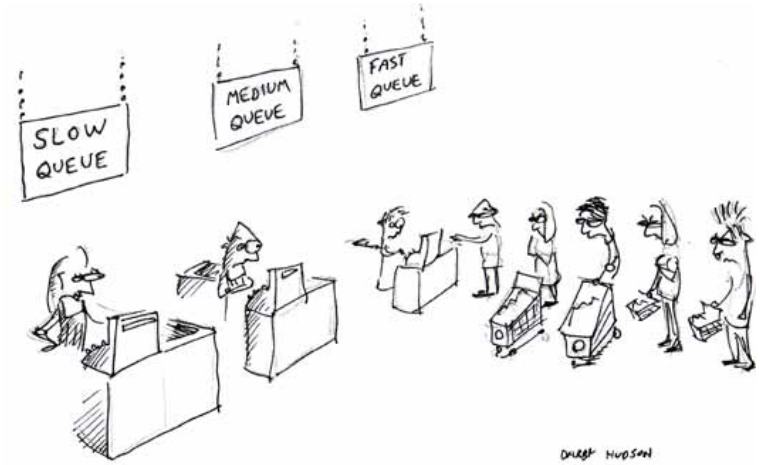
# Trajectories of $n$ simulation runs

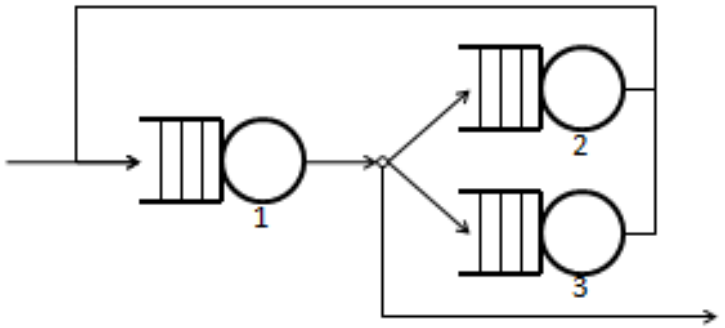





- What can be deduced about the transitory/asymptotic behavior of the system ?
- Should we make the simulations last longer ?

# Analyzing a network of queues




- Does the system risk overload ?
- How long will I wait before being served ?

# Schedule

For now, online lectures and hybrid tutorials.
Check the M1IF Pad

# Grading and ressources

**Grading:**

- 3 hours exam in January (coeff = 1/2)
- continuous assessment including a 2 hours mid-term exam, a couple of homeworks and some assignments during lectures (coeff = 1/2)

⚠ attending lectures & tutorials = good for performances

**Ressources:**

- Web site: INFO4104 (PEN) on "Portail des études"
- Contacts:
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  enguerrand.prebet@ens-lyon.fr

# Short Bibliography


- **Performance Evaluation of Computer and Communication Systems.** J.-Y. Le Boudec. EPFL Press, 2011.
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