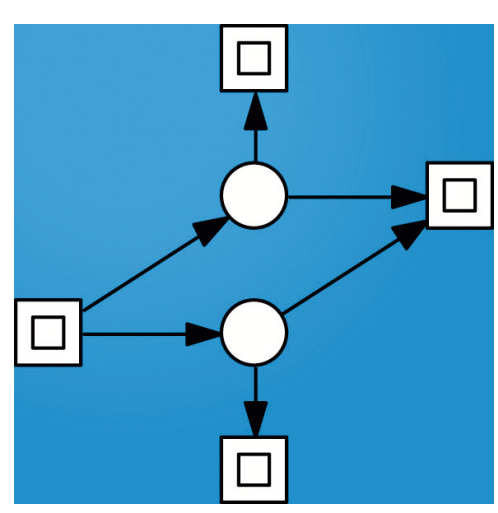


# Distributed Collaborative and Interactive Simulation of Large Scale Biochemical Networks

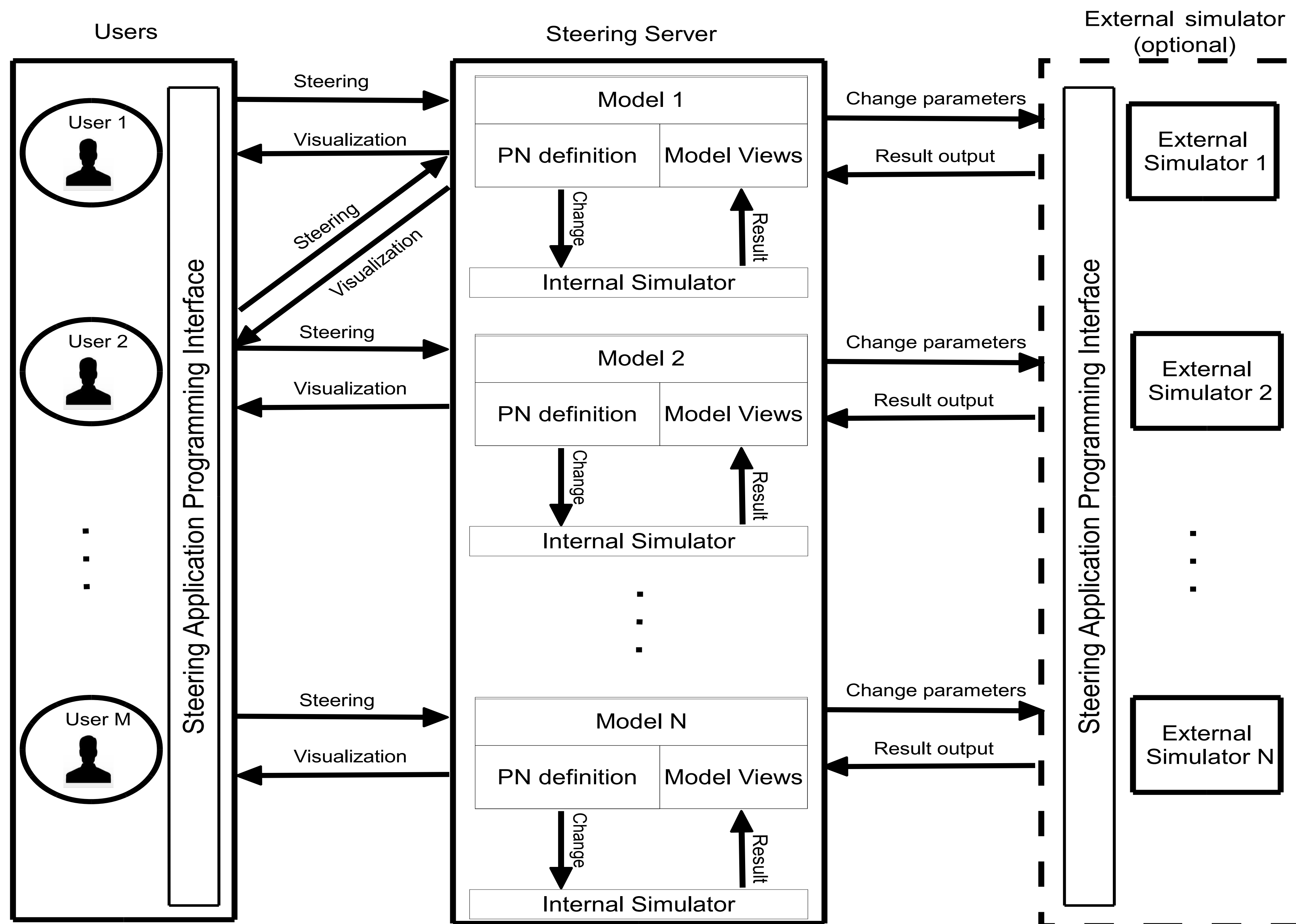
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Data Structures and Software Dependability



Brandenburg  
University of Technology  
Cottbus



## Framework



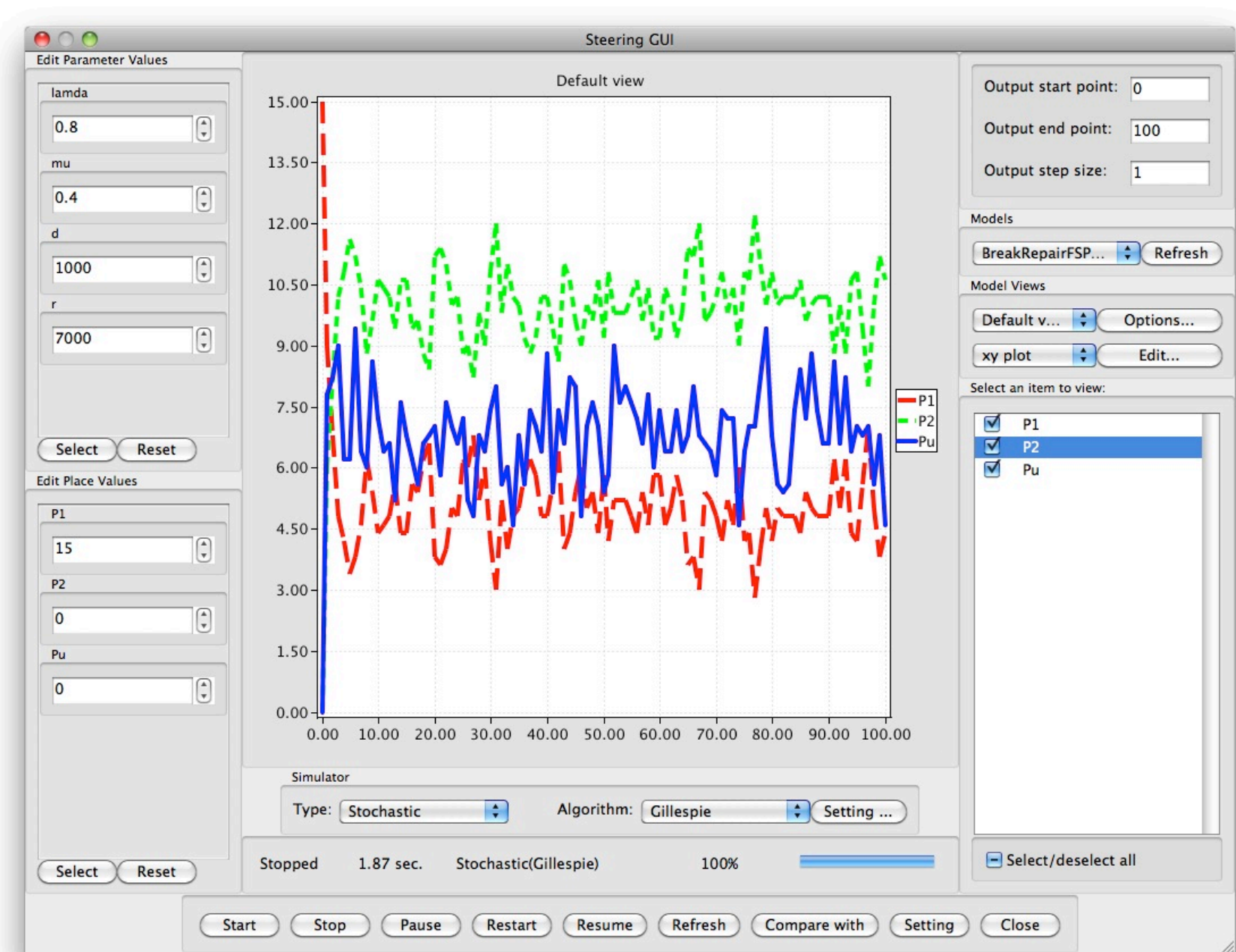
## Components

- Steering server
- Steering graphical user interface (GUI)
- Steering application programming interface (Steering API)
- Simulators (internal and external)

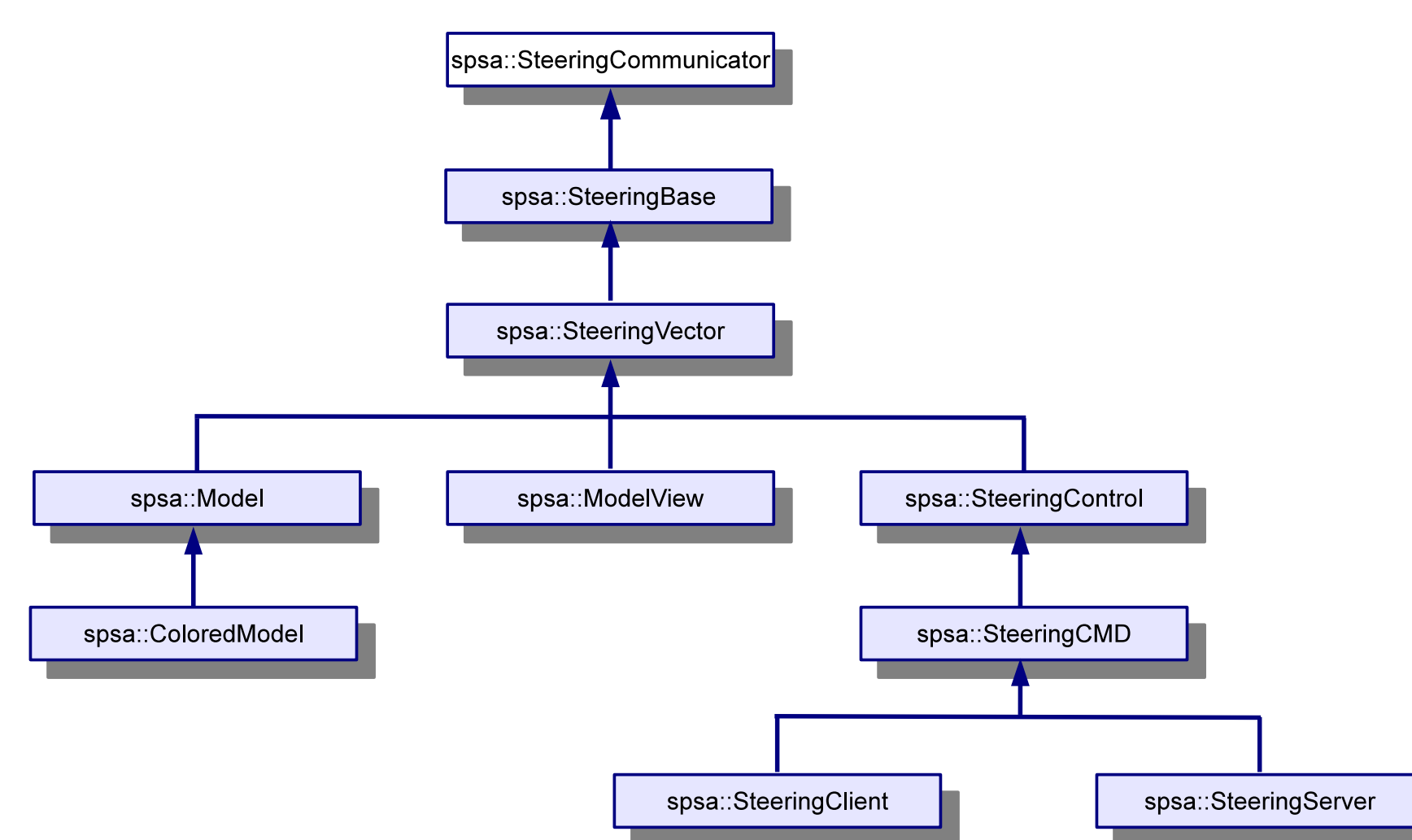
## Features

- Intuitive and understandable representation of reaction networks with the help of Petri nets
- Distributed collaborative and interactive simulation of biochemical networks
- Tight coupling of visualization and simulation
- Extendibility to include further simulators provided by the users
- Support for coloured and uncoloured Petri nets

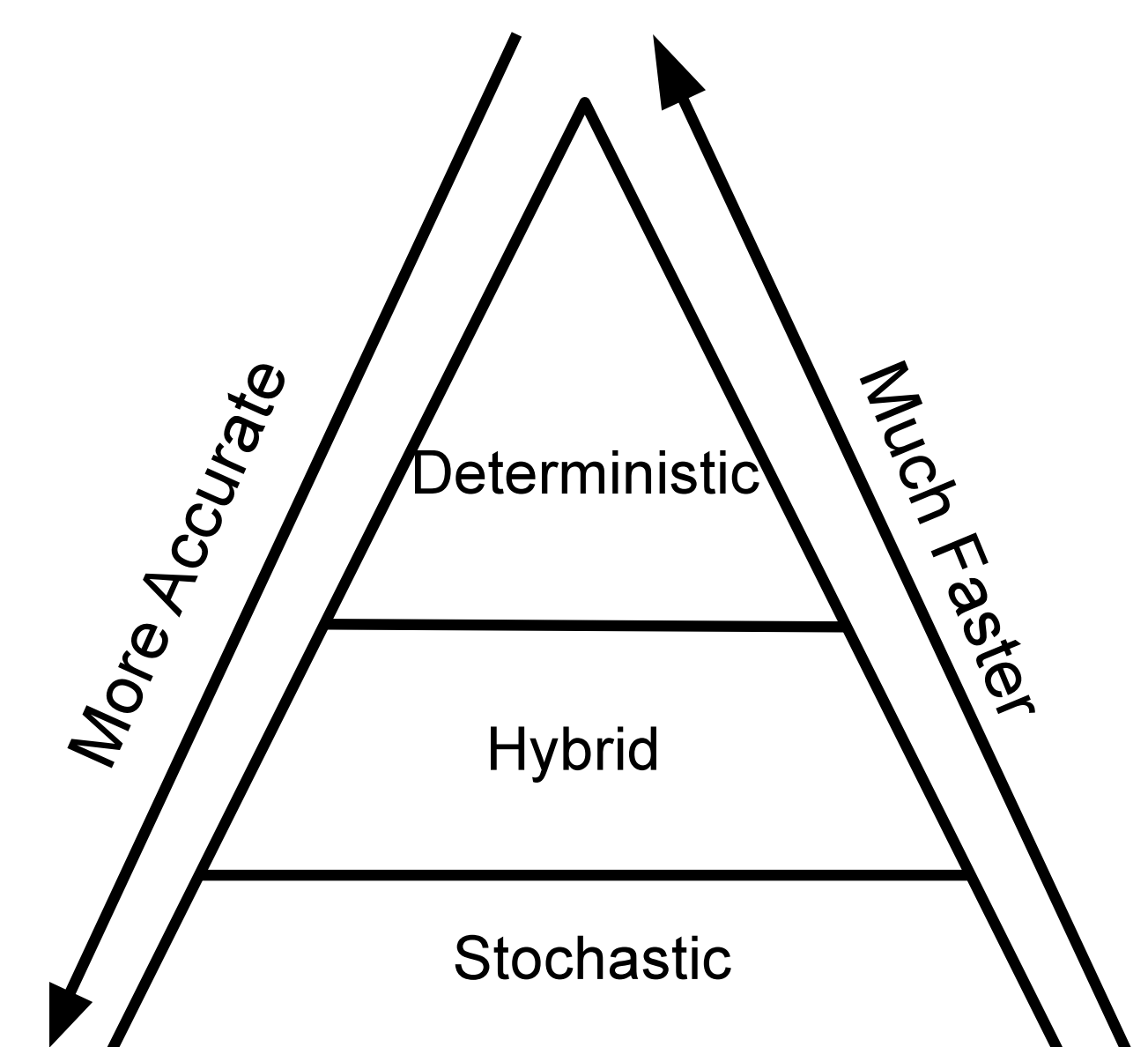
## Steering GUI



## Steering API

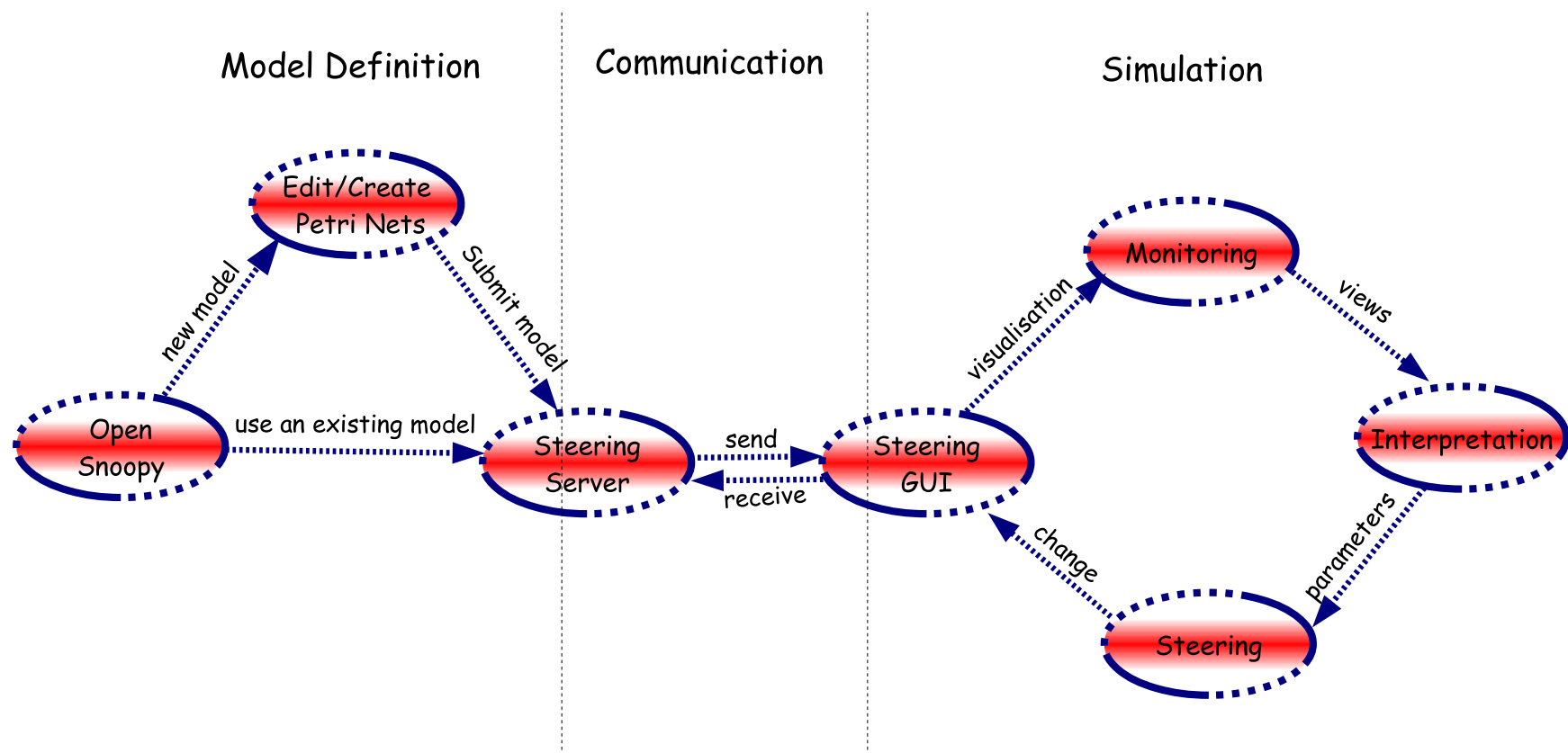


## Simulators

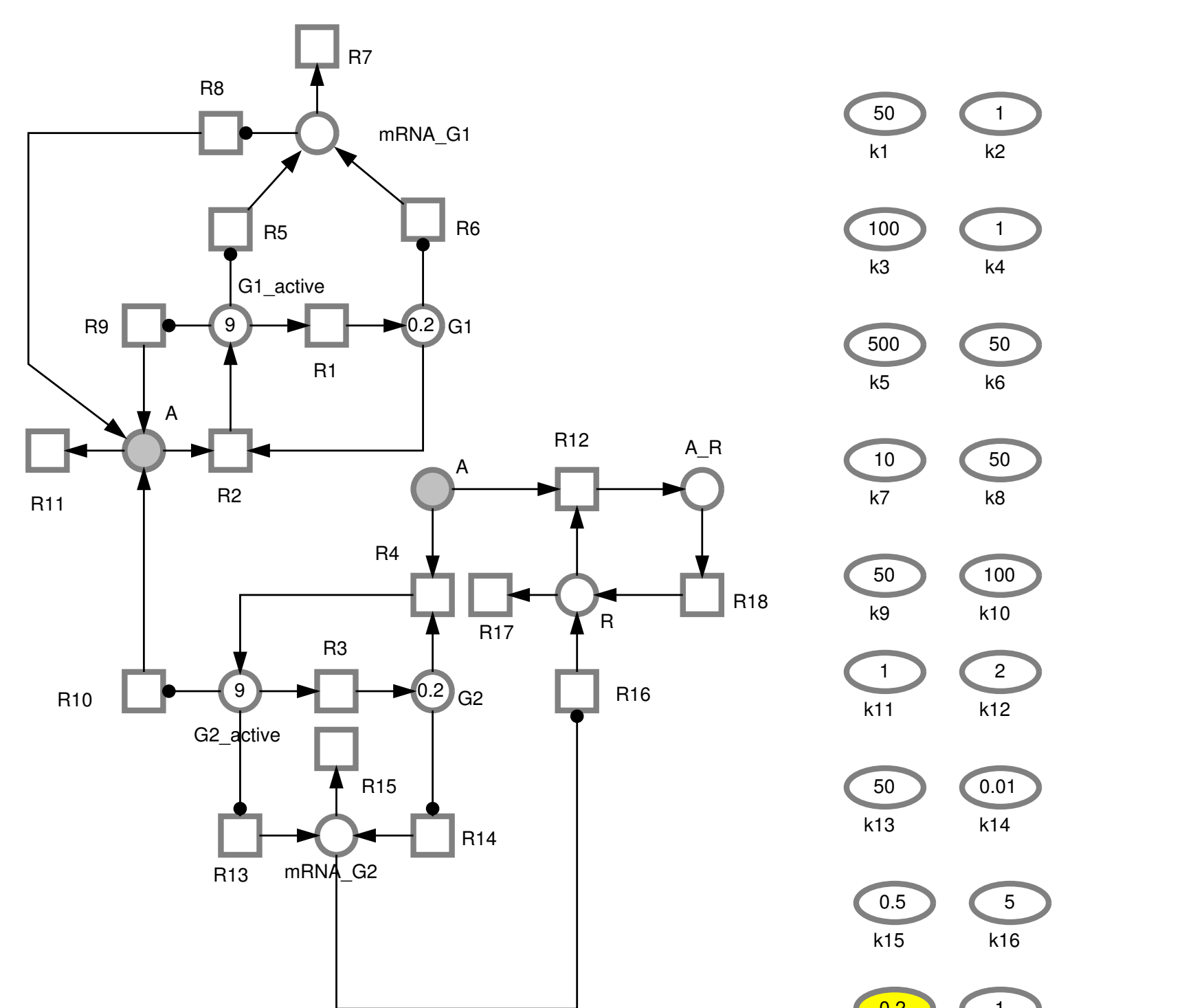


- Deterministic (ODEs)
- Stochastic (SSA)
- Hybrid with static partitioning
- Hybrid with dynamic partitioning
- User-defined simulator

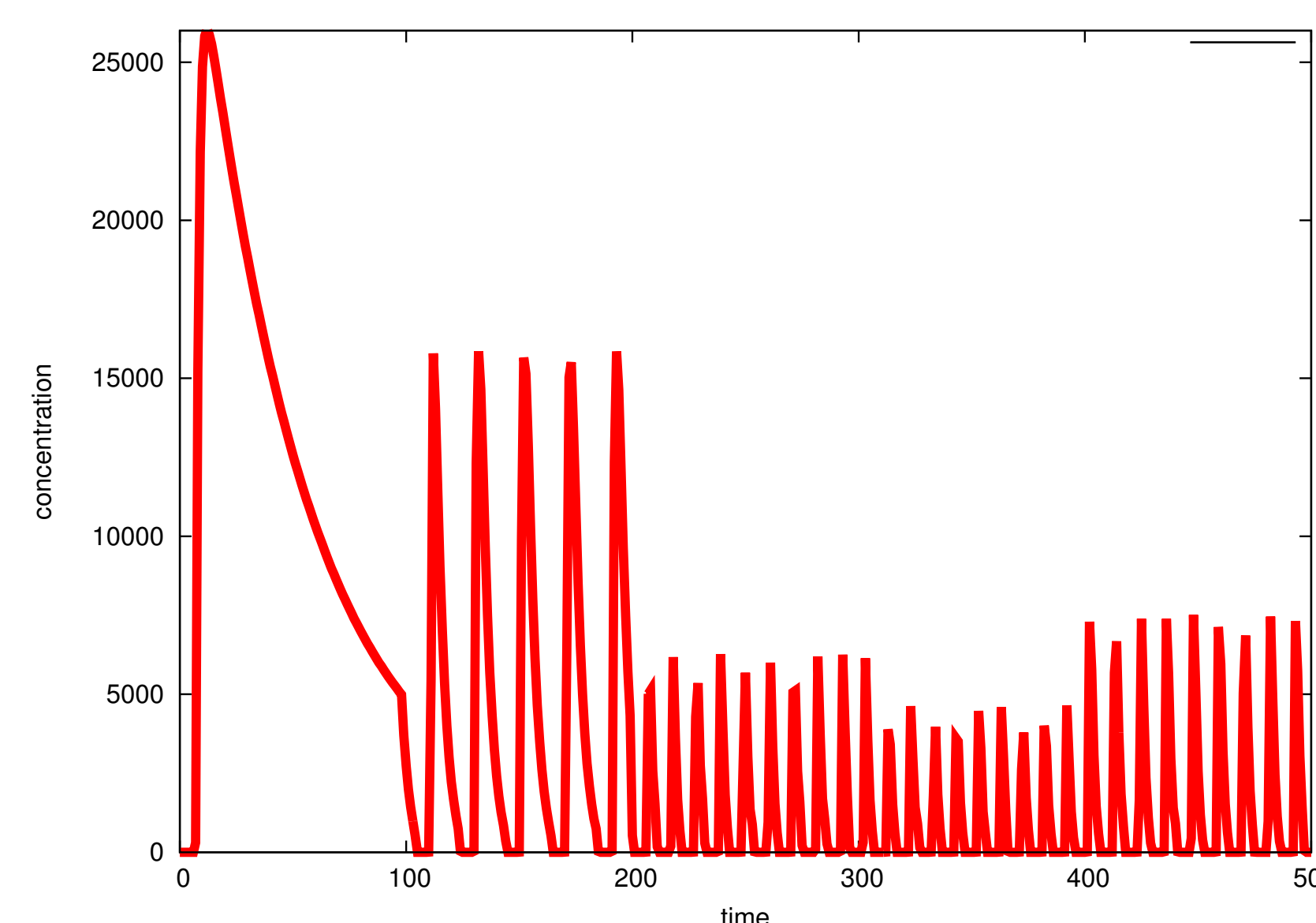
## Scenario



## Case Study



Circadian Oscillation Model



Continuous Simulation Output

## References

- [1] M. Heiner, M. Herajy, F. Liu, C. Rohr, and M. Schwarick. Snoopy – a unifying Petri net tool. In *Proc. PETRI NETS 2012*, LNCS, pages 398–407, Hamburg, 2012. Springer.
- [2] M. Herajy and M. Heiner. Hybrid representation and simulation of stiff biochemical networks. *Non-linear Analysis: Hybrid Systems*, 2012.
- [3] M. Herajy and M. Schwarick. A hybrid Petri net model of the eukaryotic cell cycle. In *BioPPN12*, Hamburg, 2012.

## Implementation

- Implemented in C++
- Platform-independent
- Implemented using wxWidgets

## Outlook

- Condition-based steering
- Backtracking
- Steering the model's structure
- Wrapper APIs
- Web-based and mobile steering GUI