

Petri net modeling and simulation of biological networks

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Motivation and Aim: Modeling and simulation of metabolic networks is a classical topic of Bioinformatics and Chemical Informatics. However, first publications can be found published in the field of Biophysics/Biomathematics more than 60 years ago. Considering the classical papers we can identify two fundamental classes of models. Discrete models like automata or formal languages and analytical models like complex differential equations. At the end of the last century more and more discrete models were published for modeling and simulation of metabolic networks. The main reason for discrete models was (is) the gap of relevant molecular data. Based on new omics technologies this situation changed during the last years. Therefore, “Quantitative Biology” came up as a new research topic. Therefore, flexible methods for modeling biological networks are useful. Today it seems that the Petri net approach is the “best method” for modeling and simulation of complex biological networks.

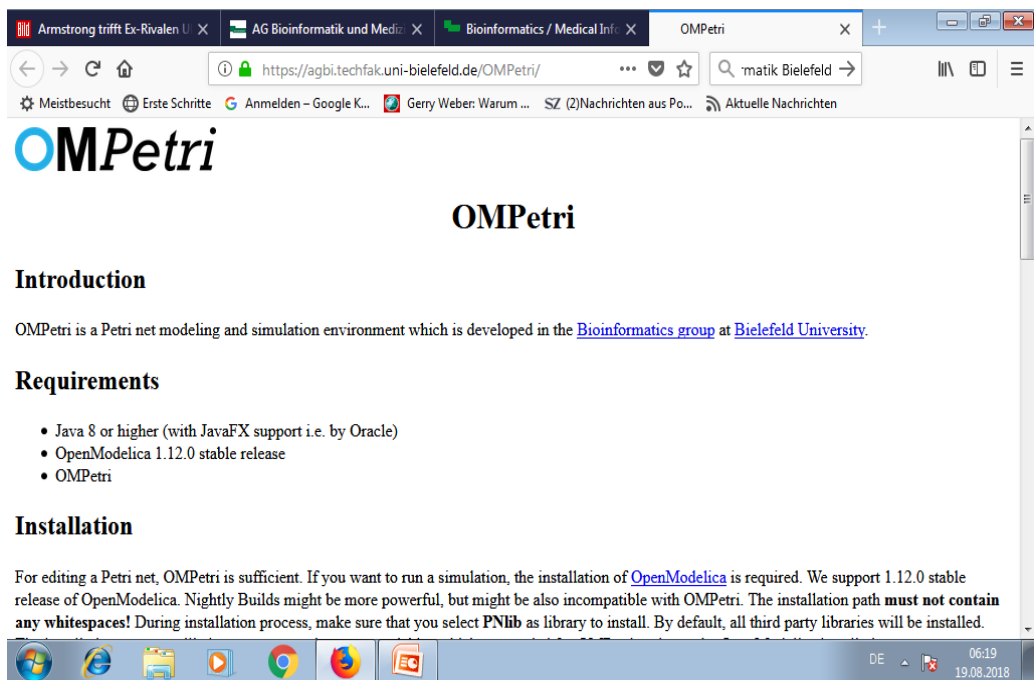


Fig. 1. The tool OMPetri is available via <https://agbi.techfak.uni-bielefeld.de/OMPetri>

Results: This presentation will discuss the key features of Petri nets, the advantages of Petri nets for modeling and simulation of biological networks, the relevant simulation tools and the OMPetri net tool, which allows the user friendly access to this new and powerful Petri net simulation tool. OMPetri based on the OpenModelica environment and the library PNlib which is specified entirely and transparently.

Conclusion: The new Petri net simulation tool is available via: <https://agbi.techfak.uni-bielefeld.de/OMPetri>. This tool is useful for modeling and simulation of biological networks and can be characterized by the following features:

- discrete and continuous places,
- discrete, continuous and stochastic transitions,
- extended arcs,
- arc weight functions,
- capacities,
- enabling function for places / arc to discrete transitions,
- delay for discrete transitions,
- maximum speed function for continuous transition,
- random delay parameter for stochastic transitions,
- condition function for each transition and
- valid marking.

References

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