Workshop: Tools & Methods in Smart Grid Research

Focus topic 2021: FAIR Energy Research Software

Overview

In the third installment of this workshop on "Tools and methods in Smart Grid research" we want to focus on energy research software in the form of "best practice" examples. The signature feature of this workshop are the intense discussions of the group, and - if possible - hands-on presentations. For this reason, we invited relevant research groups to present their „bread-and-butter" tools and methods used for Smart Grid research – this year with a focus on FAIR energy research software.

Organizing committee:

- Astrid Nieße, Univerity of Oldenburg
- Stephan Ferenz, University of Oldenburg
- Sebastian Lehnhoff, OFFIS – Institute for Information Technology

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Focus Topic: FAIR Energy Research Software

In the energy domain, research software is used for multiple purposes – in the simulation of specified devices e.g. fuel cells [1], the co-simulation in the context of smart grids [2] or the analysis of future energy systems [3]. Since these simulations and, therefore, the used research software, get more complex, a sustainable development of research software becomes necessary.

In the context of research data, the FAIR principles, introduced in 2016, require data to be Findable, Accessible, Interoperable and Reusable [4]. They support best scientific practice and were adopted in the context of the EU Horizon 2020 program. These principles can be applied to research software, too [5]. While the precise definition of FAIR principles for research software is still part of ongoing scientific discussions [6], it already becomes clear that well defined and domain-specific metadata and platforms for their registration are essentially for FAIR research software [5].

In the German energy research context, multiple initiatives are already working on the fundamentals for FAIR research software in the energy domain. NFDI4ING tries to implement research data management for all engineering disciplines [7]. Ontologies, the foundation for good machine-readable metadata, are already under development for certain specialized areas as future energy system modeling [8] or automated co-simulation [9].

Other disciplines can serve an example how FAIR research software can be implemented: In life science, a registry for research software based on an ontology is already active (bio.tools, [10]).

In this workshop, we like to explore how all these different initiatives can support FAIR energy research software.

Workshop Format

As the focus is on discussion, we will invite 3 keynote speakers to start intense discussions.

Duration will be 1/2 day within the DACH+ Energy Informatics: 17/09/2021 09:00 – 13:00

Keynote Speakers

Dr. Dorothea Iglezakis (University Stuttgart) will give an overview about EngMeta and the developments of metadata within NFDI4Ing.

Christian Hofmann (Reiner Lemoine Institut) will introduce the Open Energy Ontology and the Open Energy Plattform.

Matus Kalas (University of Bergen) will outline the functionality of bio.tools, a registry for research software in Life Science, and will summarize the technical challenges when developing the platform.

Cooperation with DACH+ Conference on Energy Informatics: The workshop is organized in cooperation with the DACH+ Conference on Energy Informatics (https://www.energy-informatics.eu/). All presenters at the workshop are automatically registered for this conference.

[1]   W. Wu, J. S. Partridge, and R. W. G. Bucknall, "Simulation of a stabilised control strategy for PEM fuel cell and supercapacitor hybrid propulsion system for a city bus," *International Journal of Hydrogen Energy*, vol. 43, no. 42, pp. 19763–19777, Oct. 2018, doi: 10.1016/j.ijhydene.2018.09.004.

[2]   C. Steinbrink *et al.*, "CPES Testing with mosaik: Co-Simulation Planning, Execution and Analysis," *Applied Sciences*, vol. 9, no. 5, Art. no. 5, Jan. 2019, doi: 10.3390/app9050923.

[3]   K. Löffler, K. Hainsch, T. Burandt, P.-Y. Oei, C. Kemfert, and C. Von Hirschhausen, "Designing a Model for the Global Energy System—GENeSYS-MOD: An Application of the Open-Source Energy Modeling System (OSeMOSYS)," *Energies*, vol. 10, no. 10, Art. no. 10, Oct. 2017, doi: 10.3390/en10101468.

[4]   M. D. Wilkinson *et al.*, "The FAIR Guiding Principles for scientific data management and stewardship," *Sci Data*, vol. 3, no. 1, Art. no. 1, Mar. 2016, doi: 10.1038/sdata.2016.18.

[5]   A.-L. Lamprecht *et al.*, "Towards FAIR principles for research software," *Data Science*, vol. 3, no. 1, pp. 37–59, Jan. 2020, doi: 10.3233/DS-190026.

[6]   W. Hasselbring, L. Carr, S. Hettrick, H. Packer, and T. Tiropanis, "From FAIR research data toward FAIR and open research software," *it - Information Technology*, vol. 62, no. 1, pp. 39–47, Feb. 2020, doi: 10.1515/itit-2019-0040.

[7]   Schmitt, Robert H. *et al.*, "NFDI4Ing - the National Research Data Infrastructure for Engineering Sciences," Sep. 2020, doi: 10.5281/ZENODO.4015201.

[8]   M. Glauer *et al.*, "The Open Energy Ontology," Dec. 2020, Accessed: Feb. 05, 2021. [Online]. Available: https://openreview.net/forum?id=ofZ5BBg2lSe.

[9]   J. S. Schwarz, R. Elshinawy, R. P. Ramírez Acosta, and S. Lehnhoff, "Ontological Integration of Semantics and Domain Knowledge in Hardware and Software Co-simulation of the Smart Grid," in *Knowledge Discovery, Knowledge Engineering and Knowledge Management*, vol. 1297, A. Fred, A. Salgado, D. Aveiro, J. Dietz, J. Bernardino, and J. Filipe, Eds. Cham: Springer International Publishing, 2020, pp. 283–301.

[10] J. Ison *et al.*, "The bio.tools registry of software tools and data resources for the life sciences," *Genome Biology*, vol. 20, no. 1, p. 164, Aug. 2019, doi: 10.1186/s13059-019-1772-6.