Research Software Engineering in the Energy Domain as Part of NFDI4Energy

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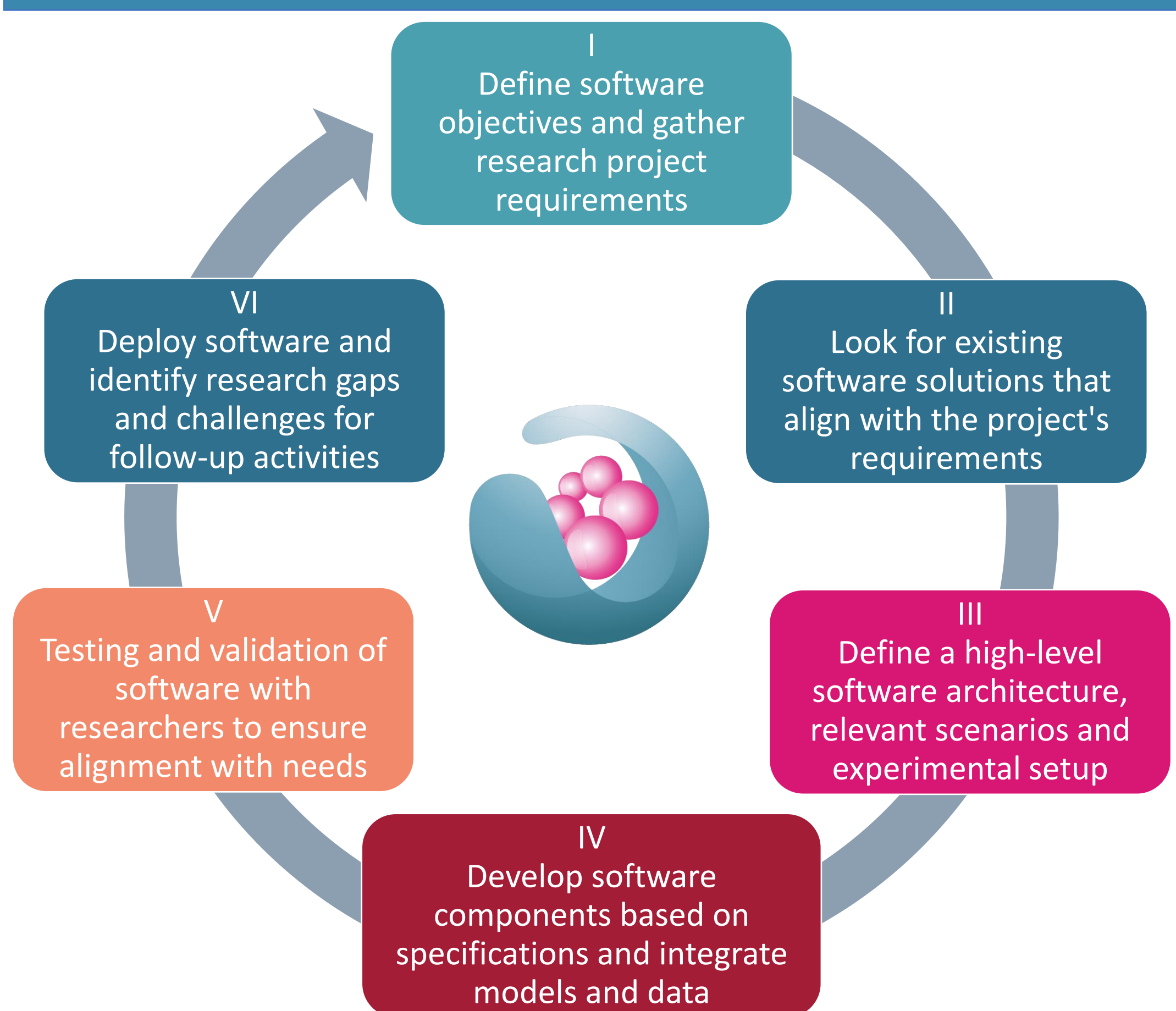[1] Friedrich-Alexander-Universität Erlangen-Nürnberg
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Motivation

- Usage of self-written software as starting point for research
- Software, like simulation tools, as results from analysis in this domain
- Addressing the handling of software across the entire research and transfer cycle within the National Research Data Infrastructure for the Interdisciplinary Energy System Research (NFDI4Energy)
- Application of FAIR data principles to data and software
- Providing a Simulation-as-a-Service Platform as better support for the use of simulation in the energy domain and software engineering

Software Life Cycle in Research Project

I Define software objectives and gather research project requirements

II Look for existing software solutions that align with the project's requirements

III Define a high-level software architecture, relevant scenarios and experimental setup

IV Develop software components based on specifications and integrate models and data

V Testing and validation of software with researchers to ensure alignment with needs

VI Deploy software and identify research gaps and challenges for follow-up activities

Main Aspects of Simulation in Interdisciplinary Energy Research in NFDI4Energy

Improve Findability

Software Registry

- Links to implementations of simulation techniques
- Test cases and other resources
- Providing guidance services for quick access and suitability finding

Energy Simulation Software Ontology

- Structured overview of different modeling approaches and guide for researchers
- Allowing experts to add details for their specific areas of expertise

Improve Interoperability

Simulation-as-a-Service

- Distributed simulation for the combination of existing models and running a comprehensive simulation
- Providing easy access to simulation middleware that enables different types of distributed simulation

Distributed Simulation Frameworks

Improve Reusability

Scenario Ontology

- Integration of semantics and domain knowledge in the process of planning, execution, and evaluation of simulations
- Integrate specialized hardware-in-the-loop (HIL) and laboratory testing in power system simulation scenarios

Information Model

- Formalizing relationships and properties of simulation models and components
- Including references to external model and component registries and the domain-specific ontology