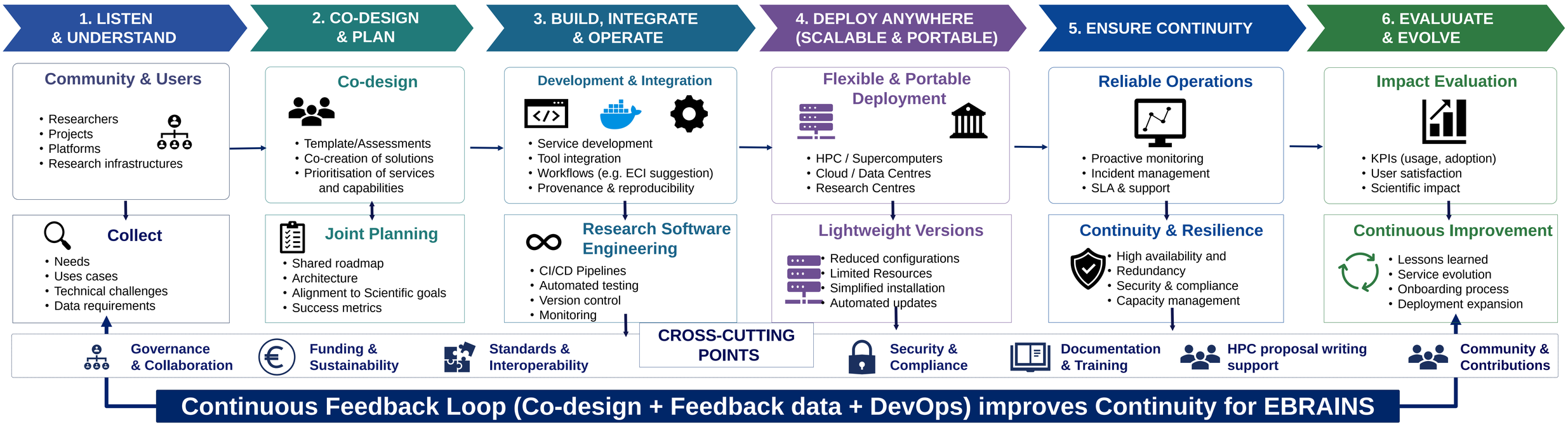
Co-design Initiatives for Collaborative and Standards-Driven Brain Research.

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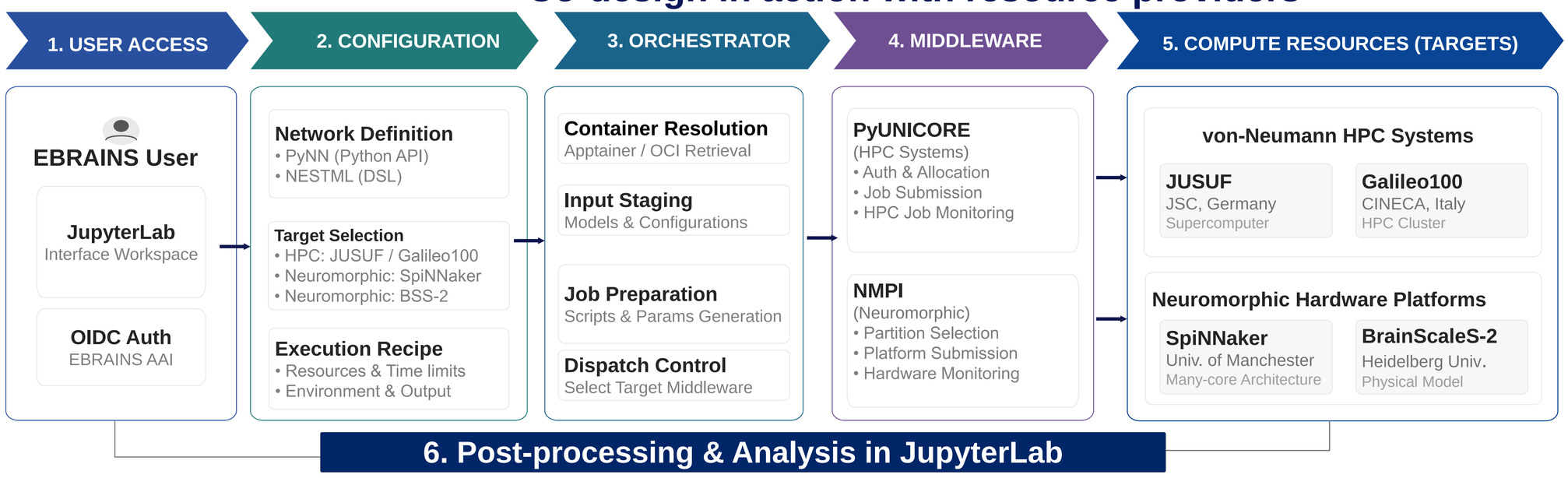
- EBRAINS Research Infrastructure integrates complex interdisciplinary workflows
- Co-design activities support this effort with a templated set of tools and processes, for the diverse projects under the EBRAINS-RI umbrella including the Virtual Brain Twin project (VBT)
- The Co-design template integrates expert information from multiple stakeholders and employs feedback mechanisms to ensure design decisions align with user needs.
- An example workflow illustrates Co-Design of a simulation-based inference workflow for virtual brain models running in a clinical setting of the VBT project

Workflow / science life cycle in EBRAINS



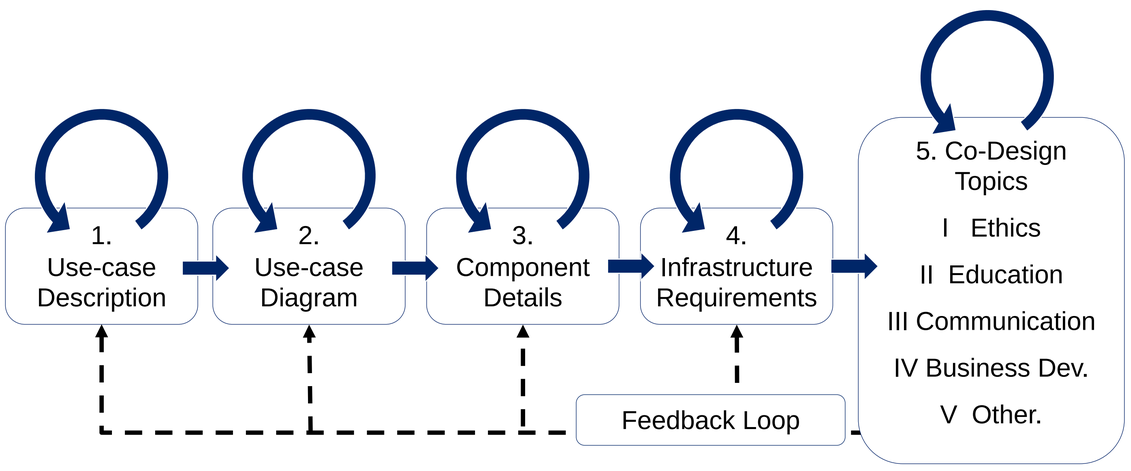
Science & Workflow lifecycle in EBRAINS. The Co-Design Template is primarily facilitating work in phase 1 and 2. Standardized CI/CD tooling is valuable in phase 3. Deployment standardization into portable containers phase 4.

Co-design in action with resource providers



Overview of the unified EBRAINS workflow architecture. The multi-stage pipeline spans from user entry in JupyterLab through configuration, containerized orchestration, middleware execution (PyUNICORE and NMPI), compute target execution (von-Neumann HPC and neuromorphic platforms), and automated post-processing.

EBRAINS Templated Co-Design Process

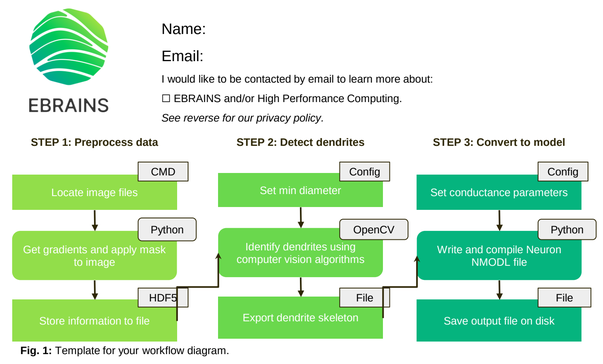


Schematic of the co-design template process. The process starts with the use-case description, followed by the use-case diagram; component details; infrastructure requirements; and supplementary co-design topics Systematic documentation workflows separating scientific requirements from technical details.

Git versioning supports iterative collaboration maintaining history and attribution.

Licensing supports open access and restricted projects producing clean documentation.

Simplified Co-Design Template: Scientific Workflow formalization for outreach and teaching


EBRAINS

Name:

Email:

I would like to be contacted by email to learn more about:

☐ EBRAINS and/or High Performance Computing.

See reverse for our privacy policy.

Fig. 1: Template for your workflow diagram.

This template breaks down your scientific workflow into discrete steps and facilitates analysis by our co-design experts. Please complete the details of your workflow below:

STEP 1: _____

Input: _____

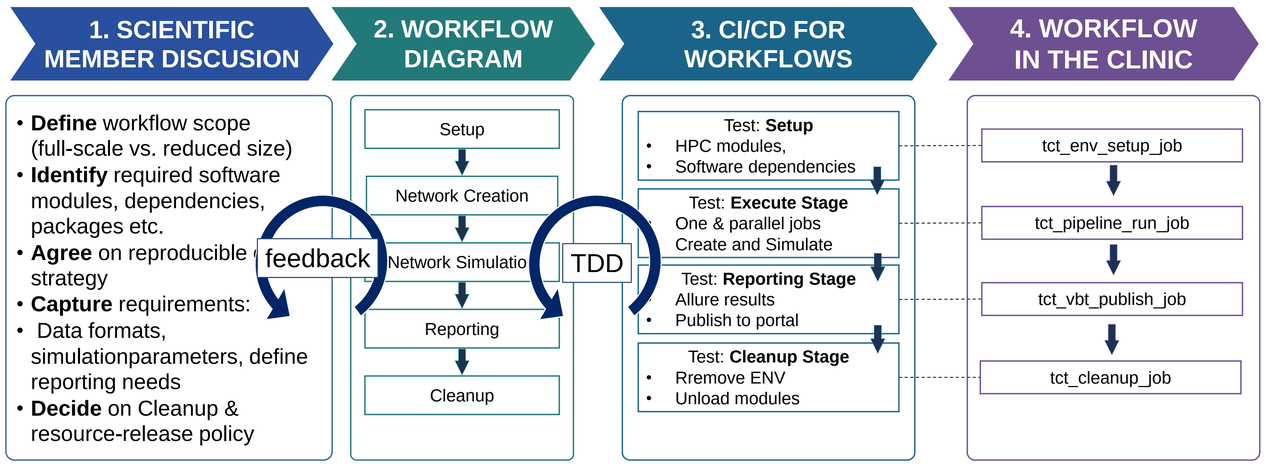
Process: _____

Output: _____

In addition to the extended Co-Design Template, a simplified version has been developed. It facilitates one of the most important stages in Co-Design: the breakdown of science ideas into clear steps with well defined input and outputs.

Ask For a Co-Design Template To Fill Out!

Co-design in action in the Virtual Brain Twin project



Co-design in action. Co-Design with engineers and domain experts towards an templated approach for CI/CD facilitating deployment of a Simulation based Inference workflow in GDPR sensitive clinical setting.

Related literature:

Abrams, M., Denker, M., Depannemaecker, D., Ferreira, J. A., Frings, M., Hashemi, M., ... & Passecker, J. (2026). The neuroscience education readiness checklist for digital tools and methods. Frontiers in Computational Neuroscience, 20, 1812915.

Singh, K. K., Müller, E., Mathioulaki, E., Klijn, W., & Oden, L. (2026). HPC Containers for EBRAINS: Towards Portable Cross-Domain Software Environment. arXiv preprint arXiv:2603.12044.

Singh, K. K., Linssen, C., Müller, E., Mathioulaki, E., Klijn, W., & Oden, L. (2026). Unifying von-Neumann HPC and Neuromorphic Acceleration via the EBRAINS Research Infrastructure: A Framework for High-Performance Workflows. arXiv preprint arXiv:2606.08515

Amunts, K., Axer, M., Banerjee, S., Bitsch, L., Bjaalie, J. G., Brauner, P., ... & Zaborszky, L. (2024). The coming decade of digital brain research: A vision for neuroscience at the intersection of technology and computing. *Imaging neuroscience*, *2*, imag-2.

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EBRAINS

An open research infrastructure that gathers data, tools and computing facilities for brain related research, built with interoperability at the core.

VIRTUAL BRAIN TWIN

Generating virtual brain twins for psychiatric patients, through an ecosystem that utilises neuronal microcircuit simulation, mathematical analysis, innovative AI tools, and insights from psychiatric care and clinical studies