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POWER GRID MODEL

Power Grid Model

A High-Performance Distribution Grid Calculation Library

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REC This session is being recorded.

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Summary

- Power Grid Model: an open-source project for distribution power system calculation
  - https://github.com/PowerGridModel
- In this presentation
  - Why a new project?
  - What is Power Grid Model?
  - How does it perform?
  - Deployment inside Alliander
  - Road to open-source

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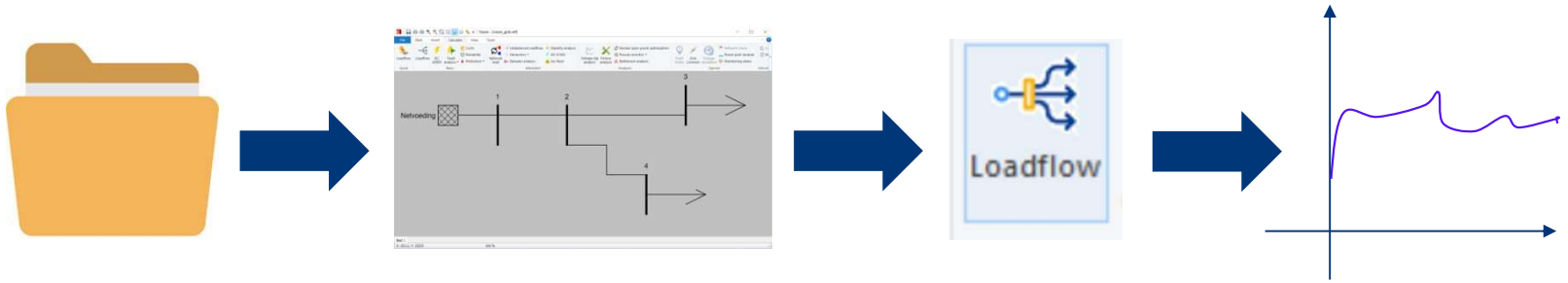
Traditional workflow for power system analysis



Data files | Commercial software* | Built-in function* | Results

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* https://www.phasetophase.nl/en/vision-network-analysis.html

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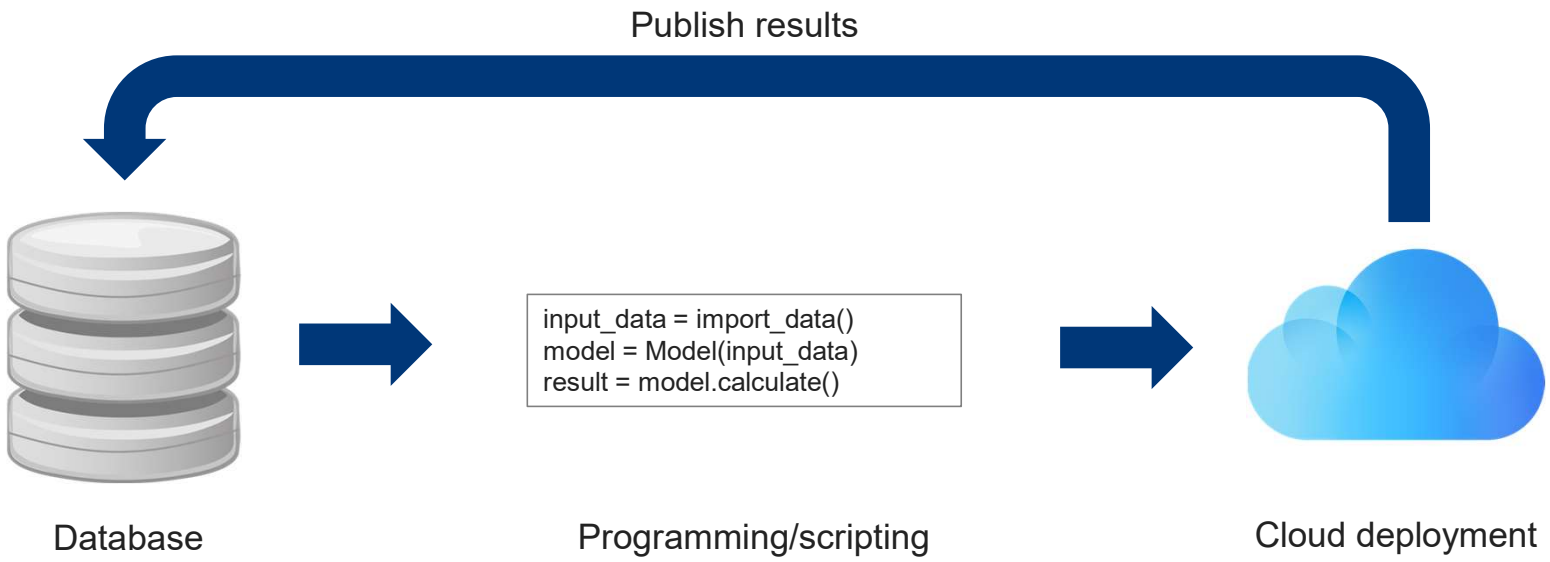
Modern workflow for power system analysis



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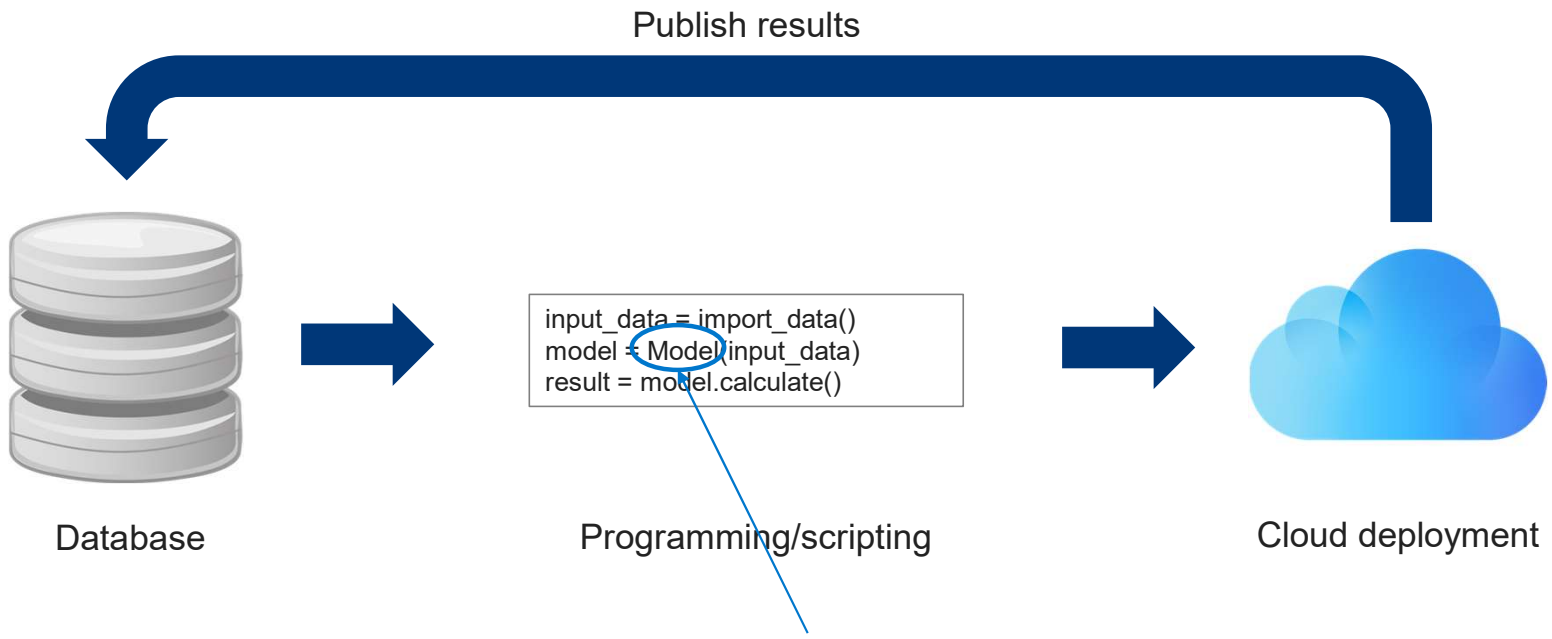
Modern workflow for power system analysis



What makes a good power system calculation model/library?

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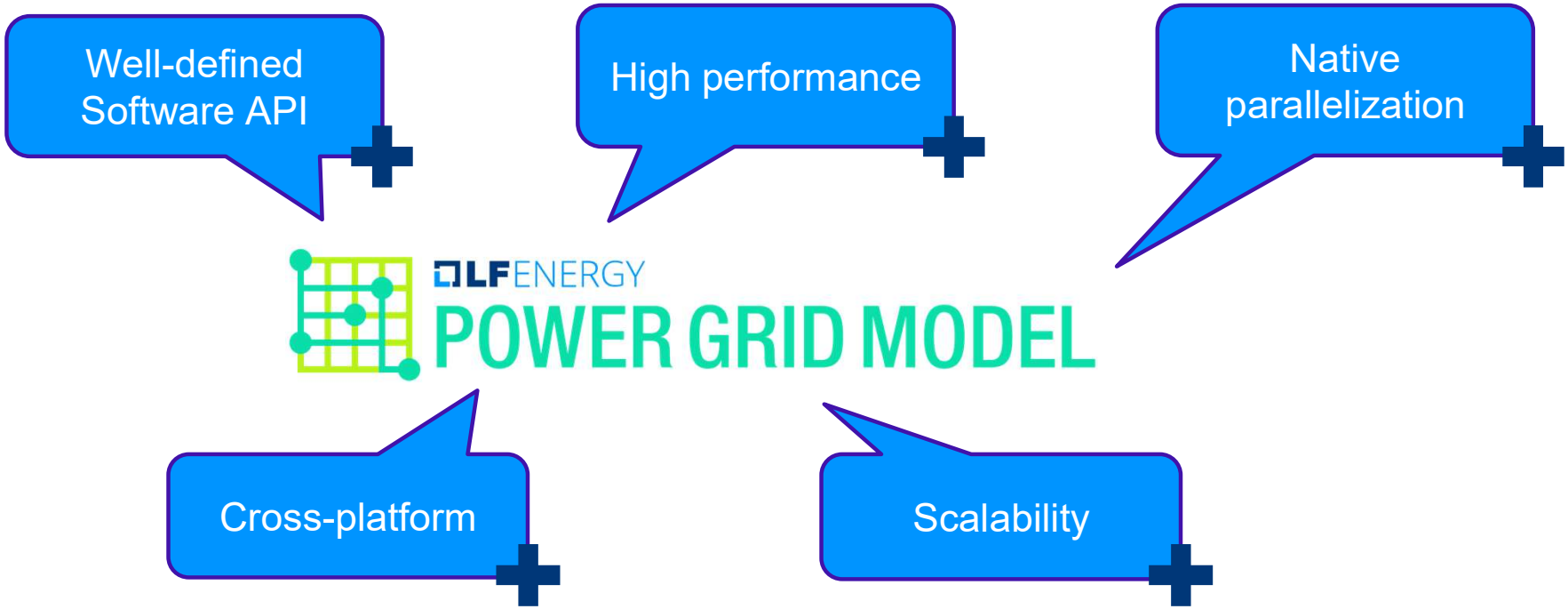
Why Power Grid Model (PGM)?

- Unique propositions of Power Grid Model



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Power Grid Model

- Power System Calculation Functionalities
- Symmetric and asymmetric calculation
- Power flow
  - Newton-Raphson
  - Iterative current (equivalent to backwards/forwards for radial network)
  - Linear current (approximation)
  - Linear impedance (approximation)
- State estimation
  - Iterative linear method
- Short circuit calculation

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Power Grid Model

- Power System Calculation Functionalities
- Efficient implementation in C++
  - Native shared-memory multi-threading for parallelization in batch calculations
- API in Python
  - Stable and easy-to-use
  - Well-documented
- Cross-platform
  - Publish binary Python packages in PyPI and conda-forge
  - https://pypi.org/project/power-grid-model/
  - https://anaconda.org/conda-forge/power-grid-model
  - Built for Windows (x64), Linux (x64/arm64), macOS (x64/arm64)

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Model Validation

- Validation of the library against reference models with 80+ test cases
  - Hand calculation
  - Vision
  - Gaia
  - PowerFactory
  - PandaPower
- Continuous validation as part of CI pipeline in GitHub Actions

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Performance Benchmark

- Compare performance of Power Grid Model, PandaPower, and OpenDSS
  - https://github.com/PowerGridModel/power-grid-model-benchmark
  - 1000 nodes radial network
  - Time-series symmetric and asymmetric power flow calculation in 1000 steps
  - Testing environment: Intel i7-12700H, 64 GB RAM, single-thread in Linux (WSL)
  - Library version:

    power-grid-model == 1.4.65

    Pandapower == 2.12.1

    dss-python == 0.14.1

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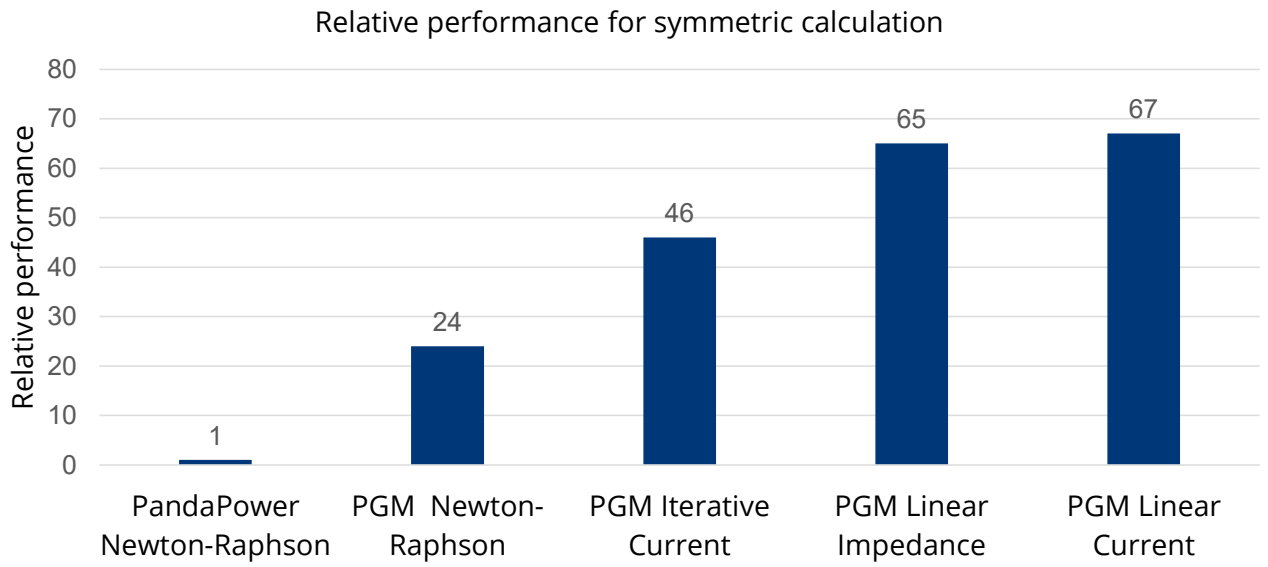
Performance Benchmark



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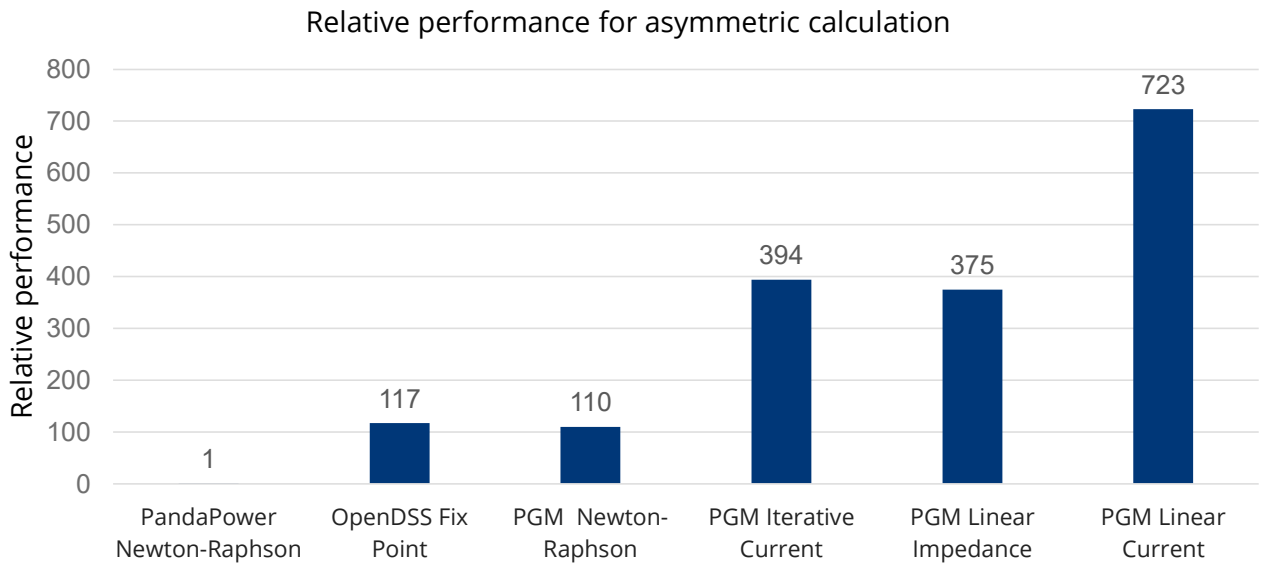
Performance Benchmark



OpenDSS Fix point algorithm is comparable to PGM iterative current

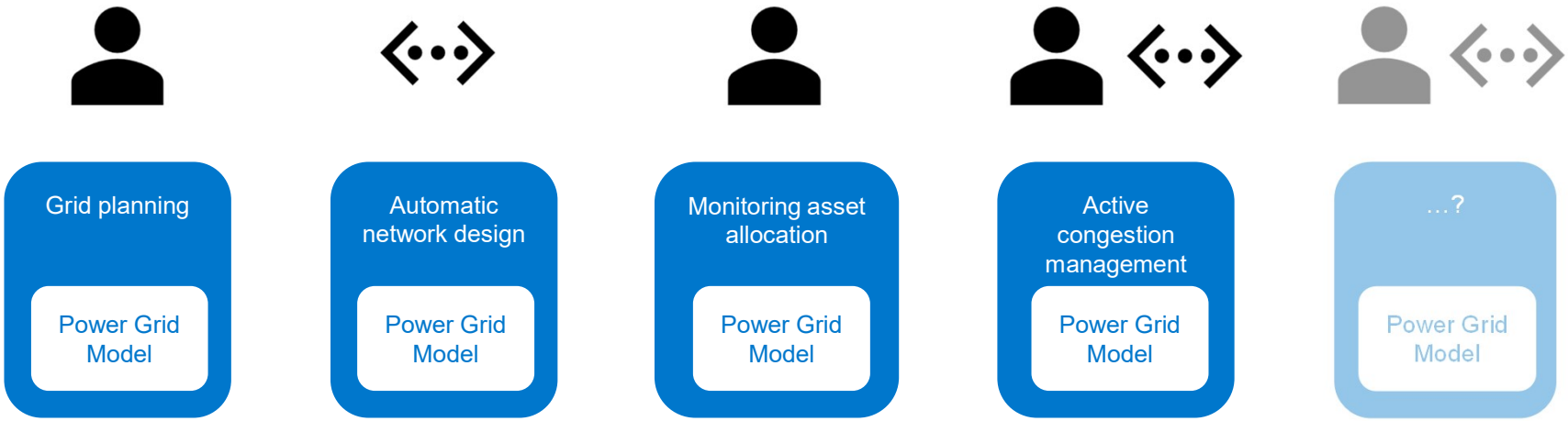
Current Deployment

- Data conversions
  - CIM
  - Vision
  - GridCal
  - PandaPower
  - Gaia (pending)

Current Deployment

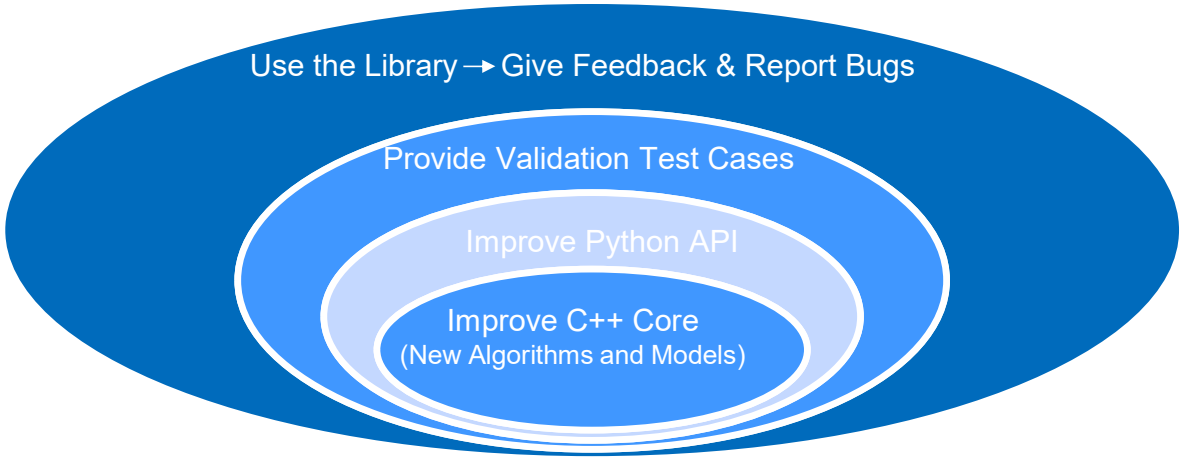
A fundamental building block for Alliander

- Deployed in 10+ applications inside Alliander



Road to Open Source

- Ways of collaboration and contribution*



* https://github.com/PowerGridModel/.github/blob/main/CONTRIBUTING.md

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Road to Open Source

- Current active partner

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