FREEDM SYSTEMS CENTER

Pathway Towards an Open-Source Ecosystem for Power System Software

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February 11, 2025

Software as the Catalyst for Power System Evolution

Software Enables Modern Power Systems

- Models complex, decentralized systems
- Accelerates innovation cycles
- Bridges research and real-world deployment

Power System Challenges Demand Better Tools

- Scalability for renewable integration
- Interoperability across systems
- Real-time decision-making capabilities

To improve the power grid, we must continuously improve the software tools powering it.

United States transmission grid

The Innovation Paradox in Power Systems

Current Reality

- Closed software silos
- Duplicated efforts
- Slow innovation cycle

Potential Future

- Collaborative development
- Fast adoption of new technologies
- Shared benchmarks and reproducible results

COLLABORATION

The pace of innovation in power systems is constrained by outdated tools and fragmented development

Open Source Movement: Lessons From Other Fields

In the 1960s, IBM freely provides software to users

- Policy changed in the mid-1970s

Linux Kernel

- Started as a personal project
- Linux wants to offer a free alternative to Unix
- Power 95% of the servers and phones worldwide

python™

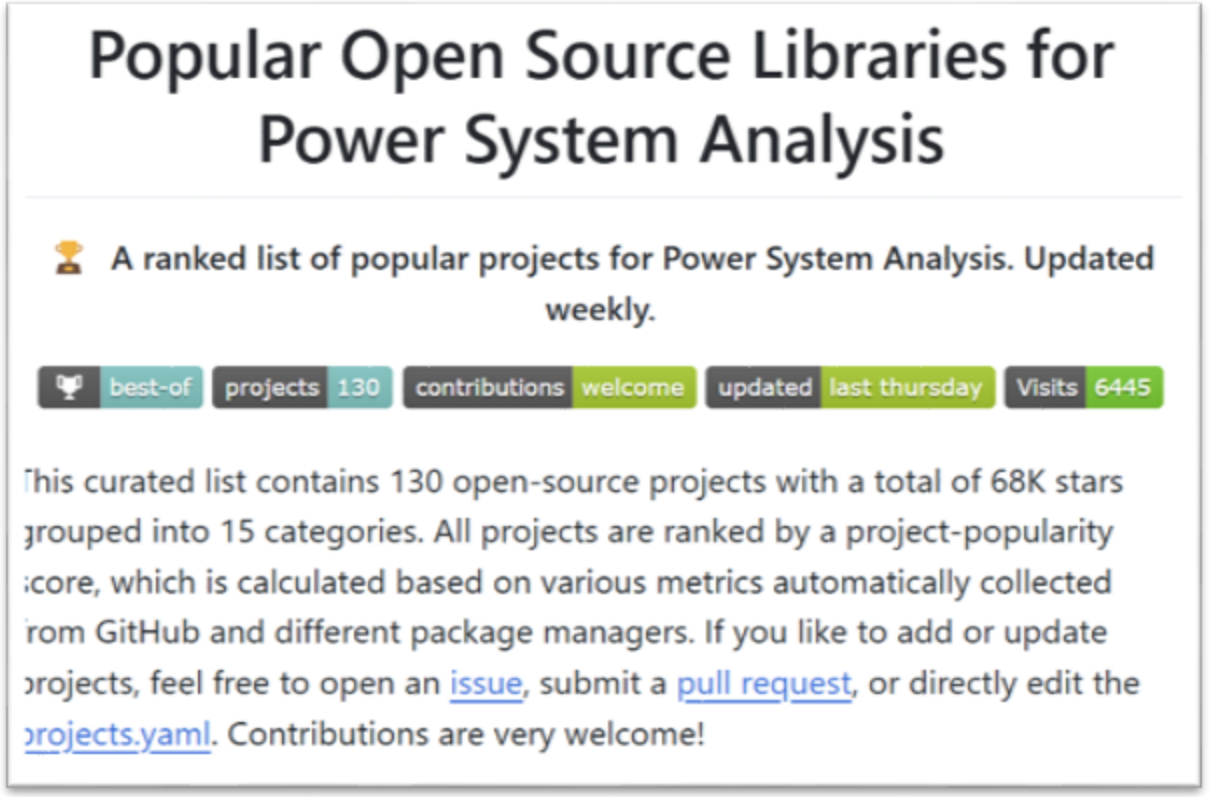
- A personal project created out of boredom
- Community-driven development
- Foundation for data science and others

TensorFlow

PyTorch

- Corporate-sponsored open-source projects
- Corner-stones for machine learning innovations
- Industry-academia synergy

Open Source Movement in Power Systems



Popular Open Source Libraries for Power System Analysis

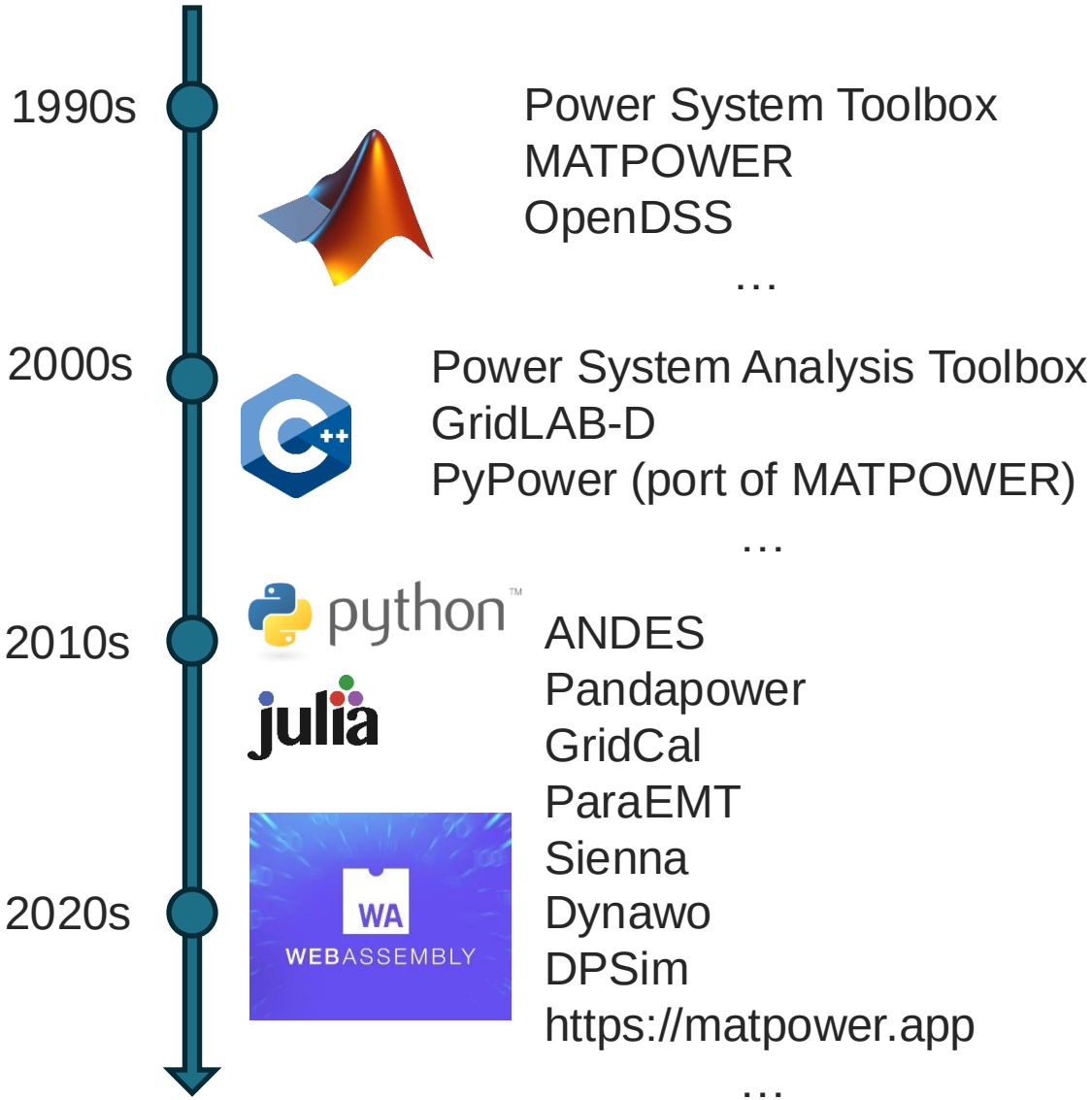
A ranked list of popular projects for Power System Analysis. Updated weekly.

best-of | projects 130 | contributions welcome | updated last thursday | Visits 6445

This curated list contains 130 open-source projects with a total of 68K stars grouped into 15 categories. All projects are ranked by a project-popularity score, which is calculated based on various metrics automatically collected from GitHub and different package managers. If you like to add or update projects, feel free to open an issue, submit a pull request, or directly edit the projects.yaml. Contributions are very welcome!

https://github.com/jinningwang/best-of-ps

Open-source tools are important learning resources and collaboration platforms



Myths and Reality of Open-Source Software

Myth 1: Open-Source = No $ Value

- Reality: Sustainable business models exist
  - Red Hat ($34B acquisition)
  - Elastic (NYSE: ESTC)

Myth 2: No Professional Support

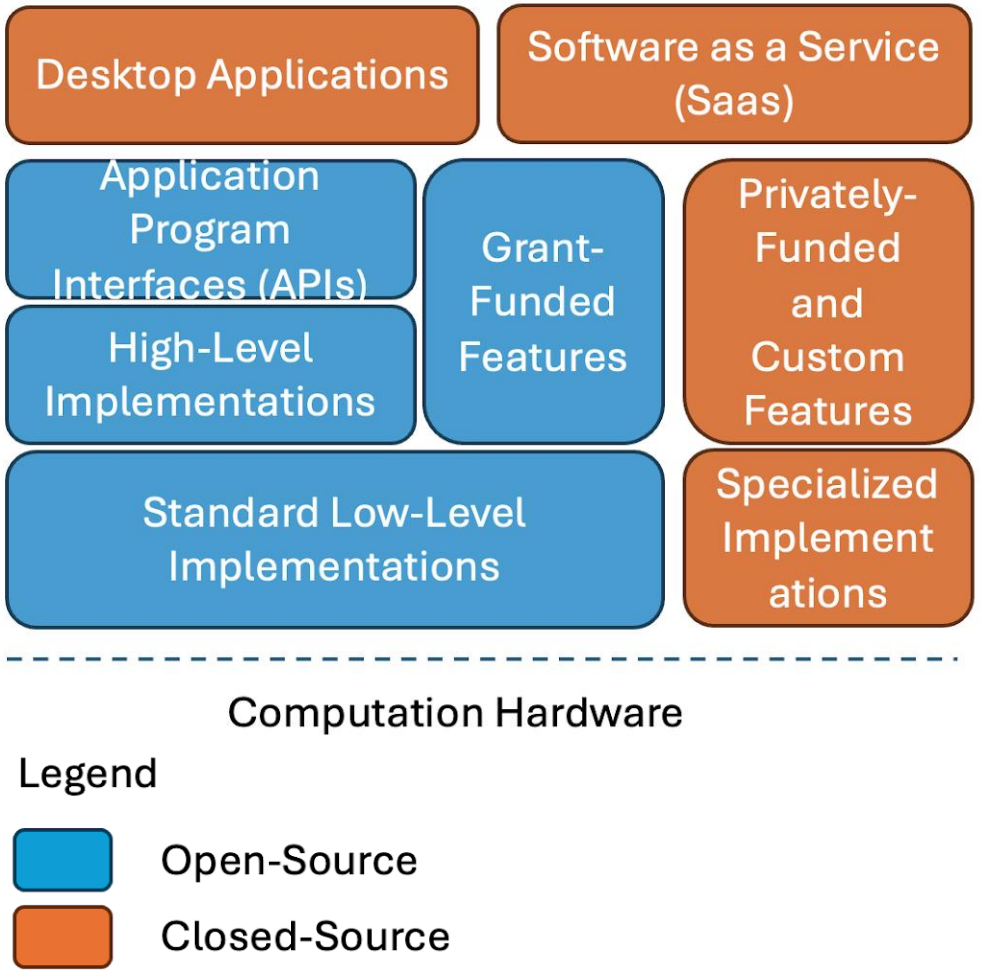
- Reality: Paid Enterprise support available
- OpenPDC and OpenHistorian by Grid Protection Alliance (GPA)

Myth 3: Anti-Competition

- Reality: Collaborative Innovation
- Open-source software allow businesses to build more products and services

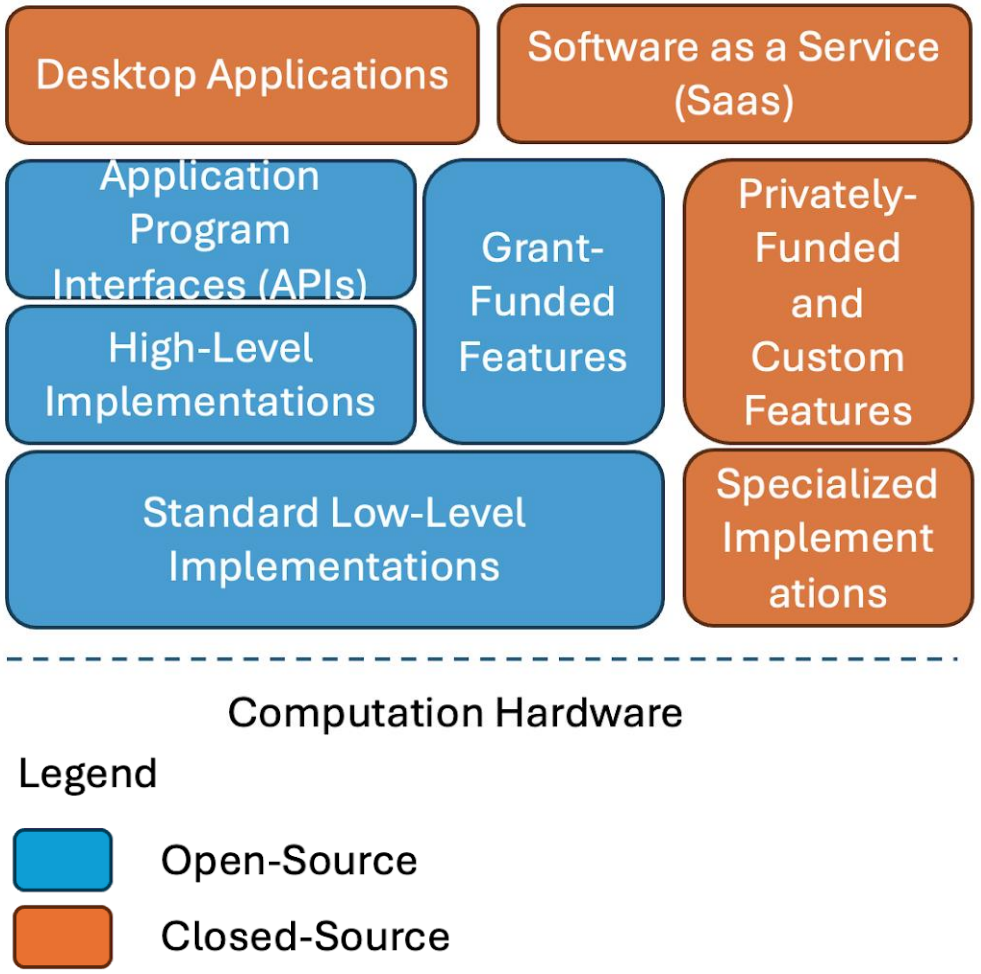
Open source is more than free software. It can be sustainable, collaborative, and professionally supported ecosystem driving innovation.

Sustainable Business Model for Open Source in Power Systems (1)



- Specialized domains like power systems are not large enough to build a community of contributors and users
- An open-source ecosystem is still feasible
- A potential pathway is through a business with a vision to offer products and publish open-source software

Sustainable Business Model for Open Source in Power Systems (2)



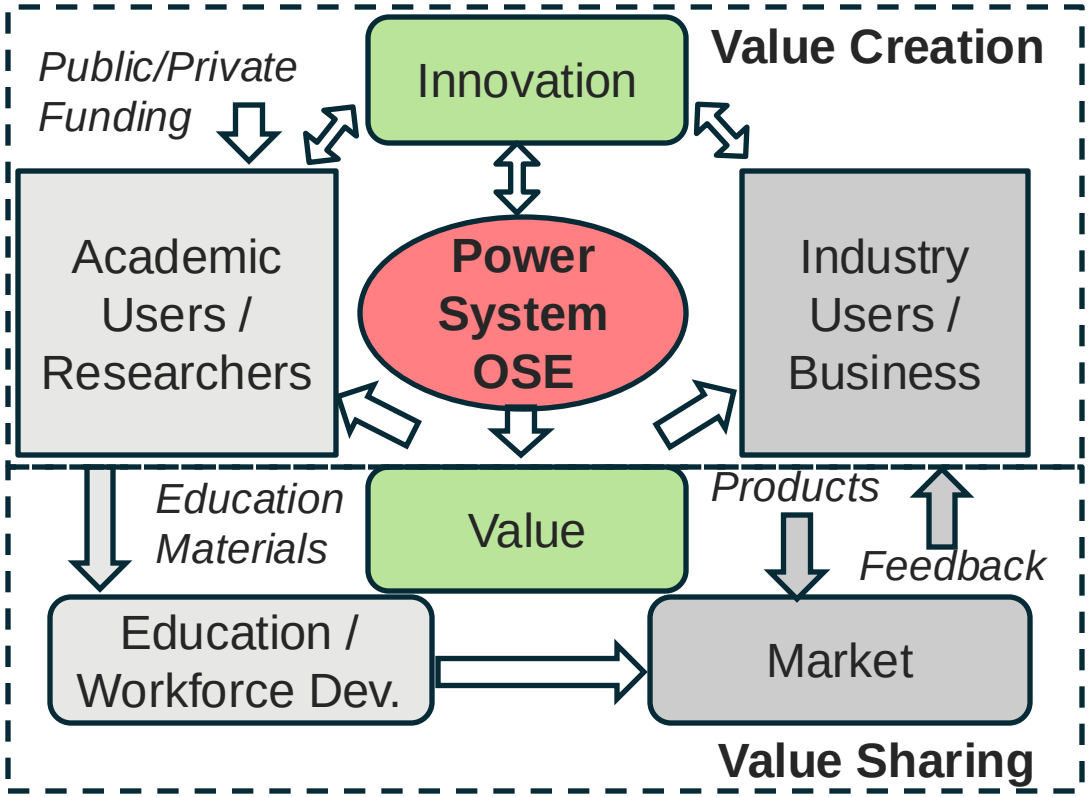
Business-Driven Open-Source

- Share the knowledge, and be strategic about sharing implementations
- Dual licensing: non-commercial community license & commercial license

Revenue Sources

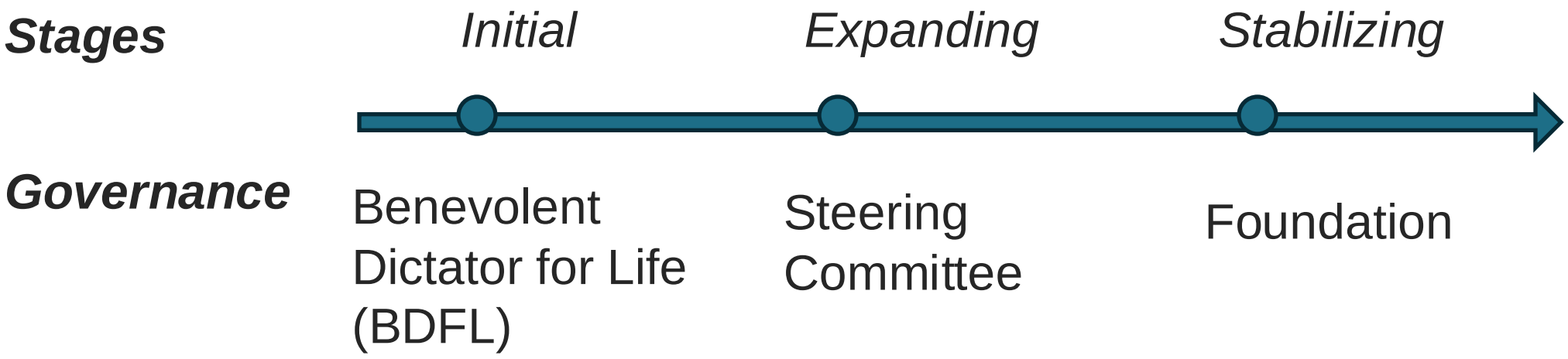
- Software as a service (Saas)
- Selling commercial licenses
- Selling value addon features
- Local and federal Innovation grants

OSE Engagement with Stakeholders



- A power system OSE will help strengthen the tie between academia and industry for innovation
- The OSE will also contribute to workforce development
  - Instructors will be able to point to the computer implementation of textbook theory

Governance Models for OSE Projects



Key Roles:

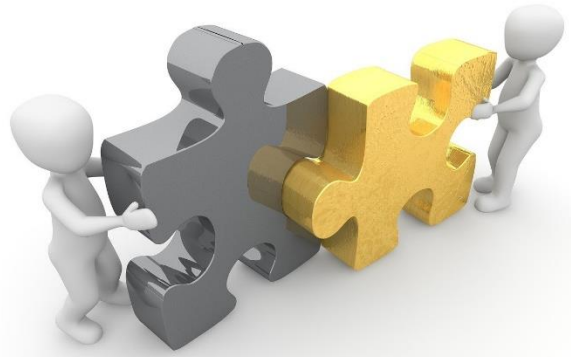
- Core Developers
- Community Managers
- Security Team

Processes:

- CI/CD Pipeline
- Request for Comment (RFC) System

Impact Opportunities

- **Education**
  - Curriculum Integration
  - Student Competition
  - Open Courseware
- **Benchmarking**
  - Standard Test Case
  - Performance Metrics
  - Validations
- **Interoperability**
  - Compatible Data Formats
  - API Standards
  - Co-Simulation and Integration



Acknowledgement

This material is based upon work supported by the National Science Foundation under Grant No. 2346213.

Opinions, findings, and conclusions or recommendations expressed in this material are my own and do not necessarily reflect the views of the National Science Foundation.

- Thanks to Ahmad Ali and Junjie (John) Yin (UT Knoxville) for joining me in the NSF POSE I-Corps interviews.
- Thanks to Dr. Robin Podmore (IncSys Inc.) for serving as our mentor.
- Thanks to the dozens of interviewees for sharing your valuable thoughts.