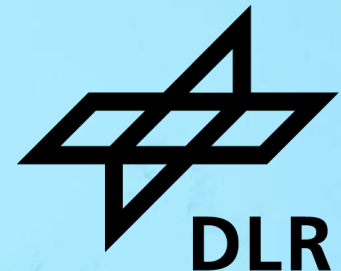


ELECTRICITY MARKET SIMULATIONS WITH AMIRIS

Christoph Schimeczek on behalf of team AMIRIS



Overview – What is AMIRIS?

The open **A**gent-based **M**arket model for the **I**nvestigation of **R**enewable and **I**ntegrated energy **S**ystems



AMIRIS





- is an **agent-based** model for power markets.
- models **business-oriented** dispatch decision making under different regulatory framework conditions.
- focuses on **renewable** energy sources and **flexibility** options.
- is available **open source** at <https://gitlab.com/dlr-ve/esy/amiris>.



AMIRIS

Key functionalities







-  Simulate trading and operation of power generation plants and flexibility options
-  Model business-oriented behaviour under uncertainty
-  Temporal resolution: \leq hourly
-  Spatial resolution: market zone(s)

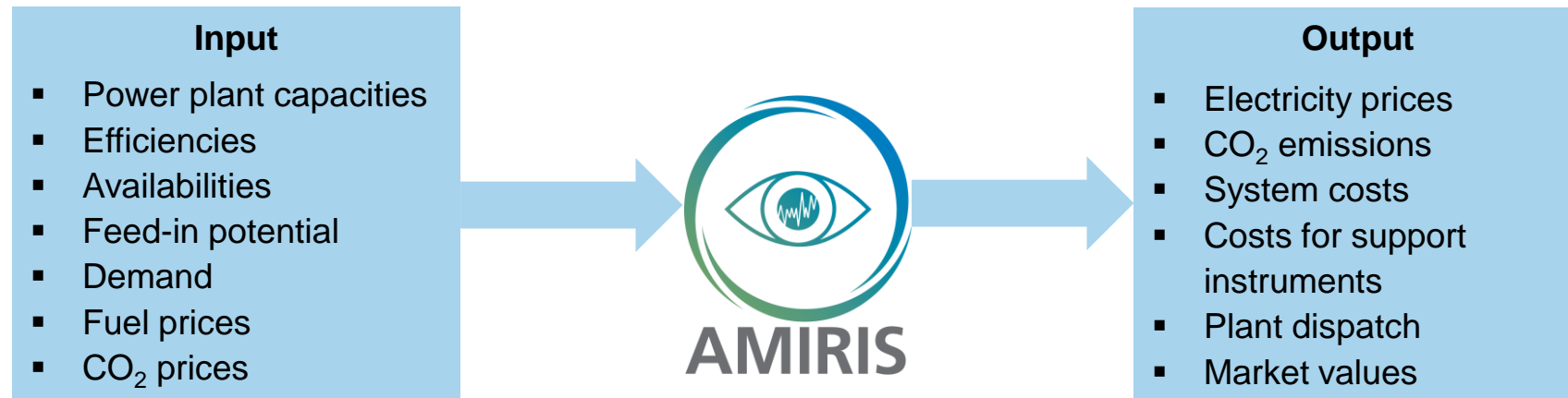


AMIRIS

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Federal Ministry
for Economic Affairs
and Climate Action



Federal Ministry
of Education
and Research



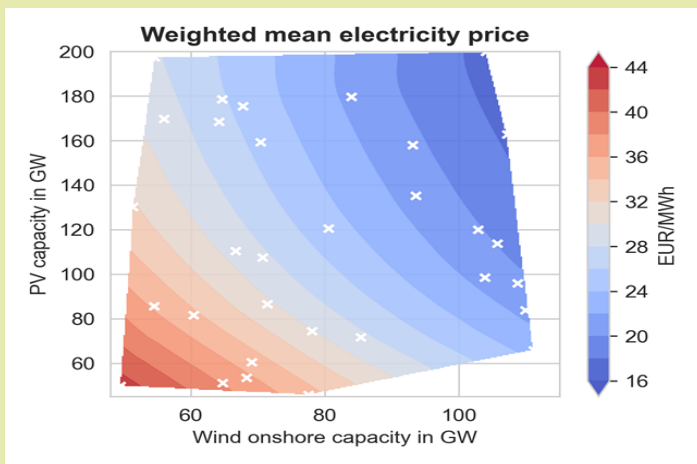
Bundesministerium
für Umwelt, Naturschutz, nukleare Sicherheit
und Verbraucherschutz



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864276

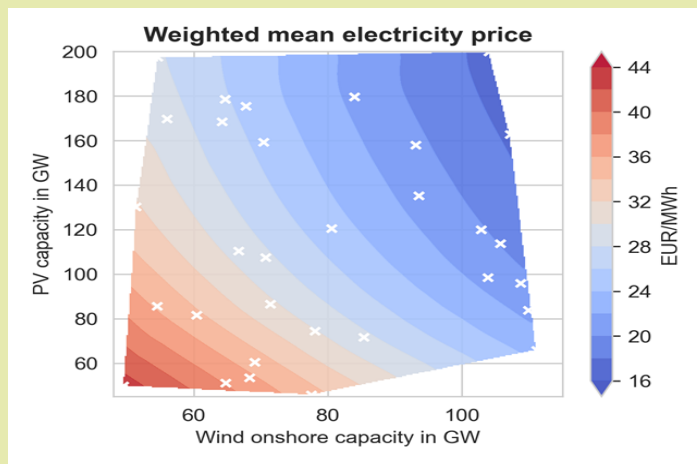
Market dynamics

- How will electricity prices evolve in future scenarios?



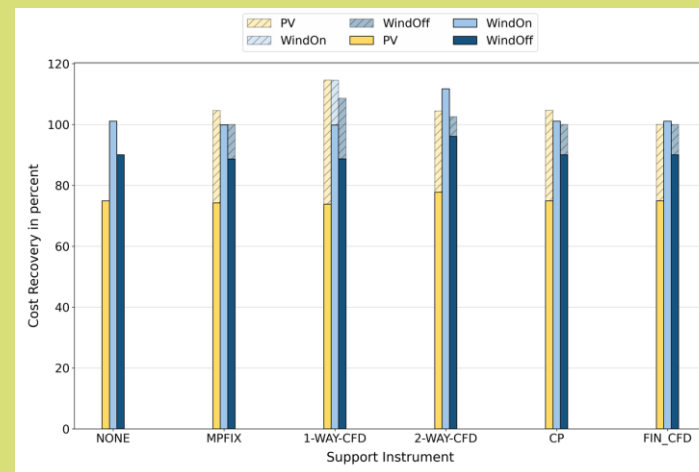
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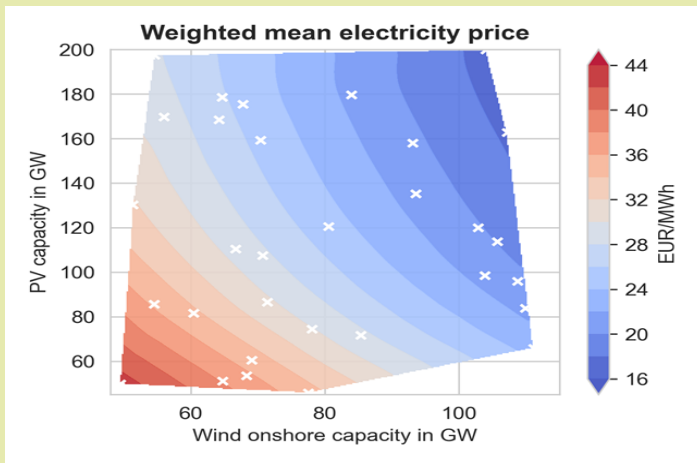
Support instruments

- Is there enough / too much support for renewable energies?



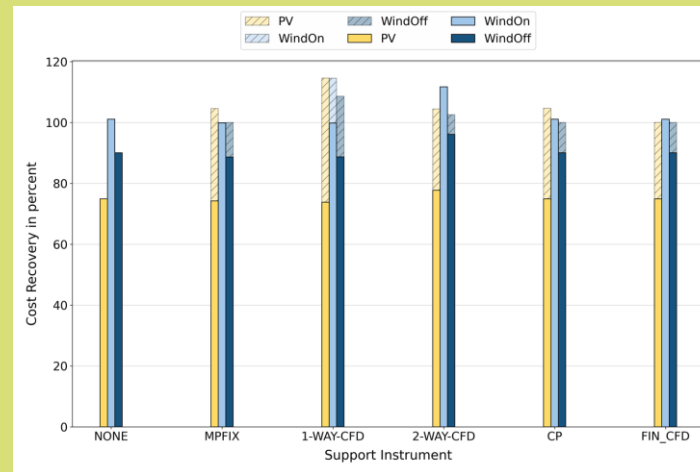
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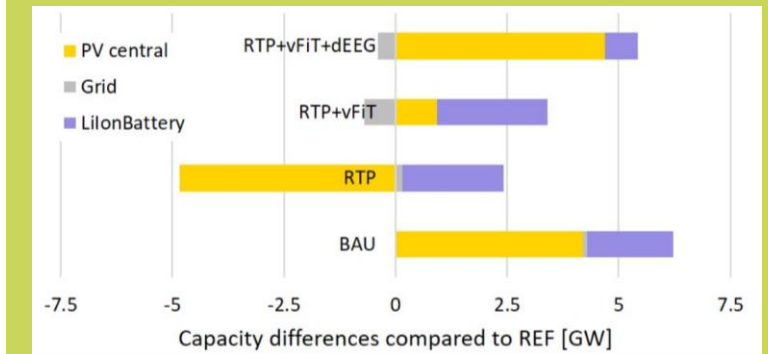
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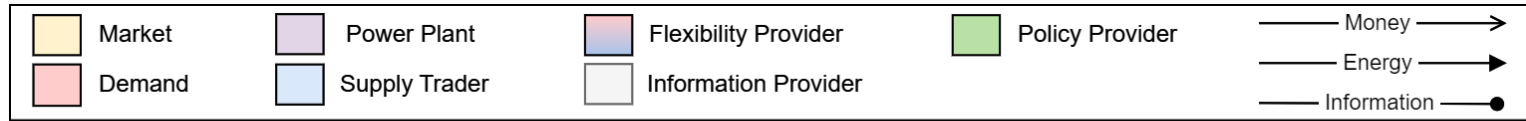
Decentral Flexibilities

- How can electricity tariffs leverage private household flexibility from heat pumps, electric vehicles, storages?



AMIRIS

Agent types



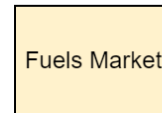
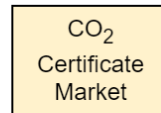
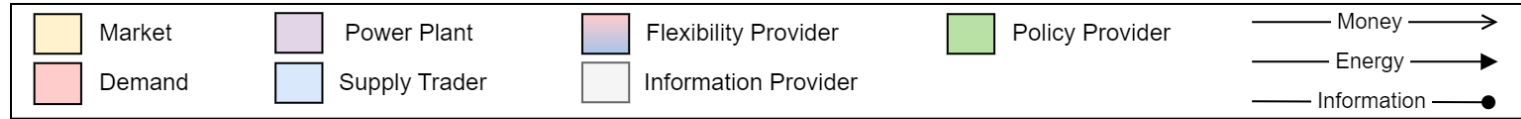
AMIRIS

Agent types



Markets

- Determine prices



AMIRIS

Agent types

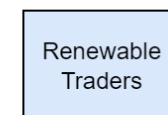
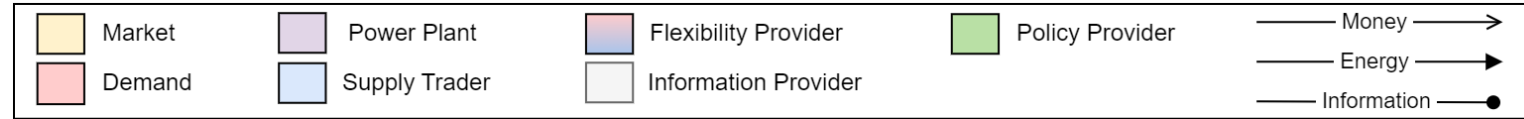


Markets

- Determine prices

Traders

- Fulfil marketing strategies



AMIRIS

Agent types



Markets

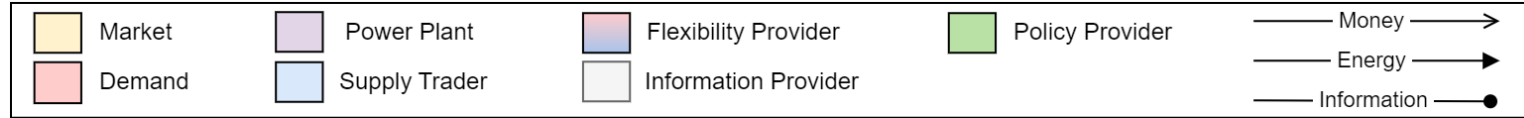
- Determine prices

Traders

- Fulfil marketing strategies

Plant operators

- Control power plants



Conventional
Power Plant
Operators

Renewable
Power Plant
Operators

Markets

- Determine prices

Traders

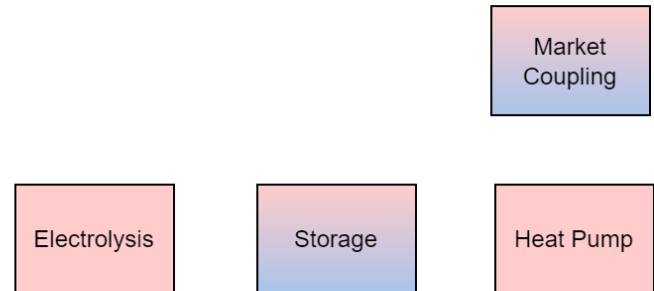
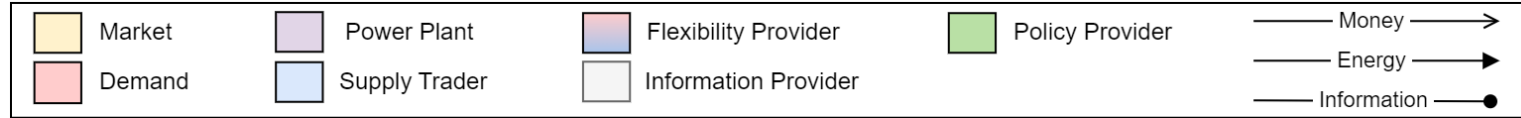
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- Optimise dispatch



AMIRIS

Agent types



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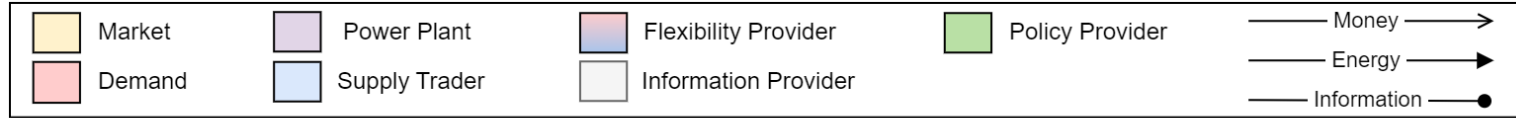
- Control power plants

Flexibility providers

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Information provider

- Create forecasts



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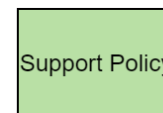
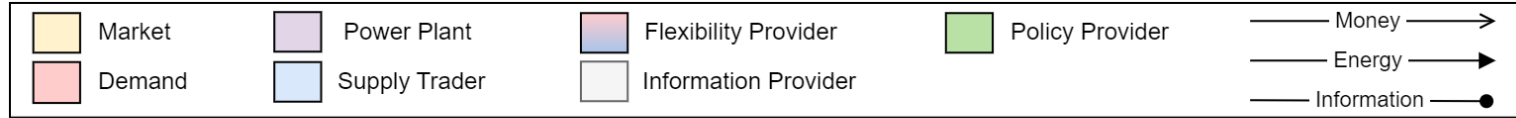
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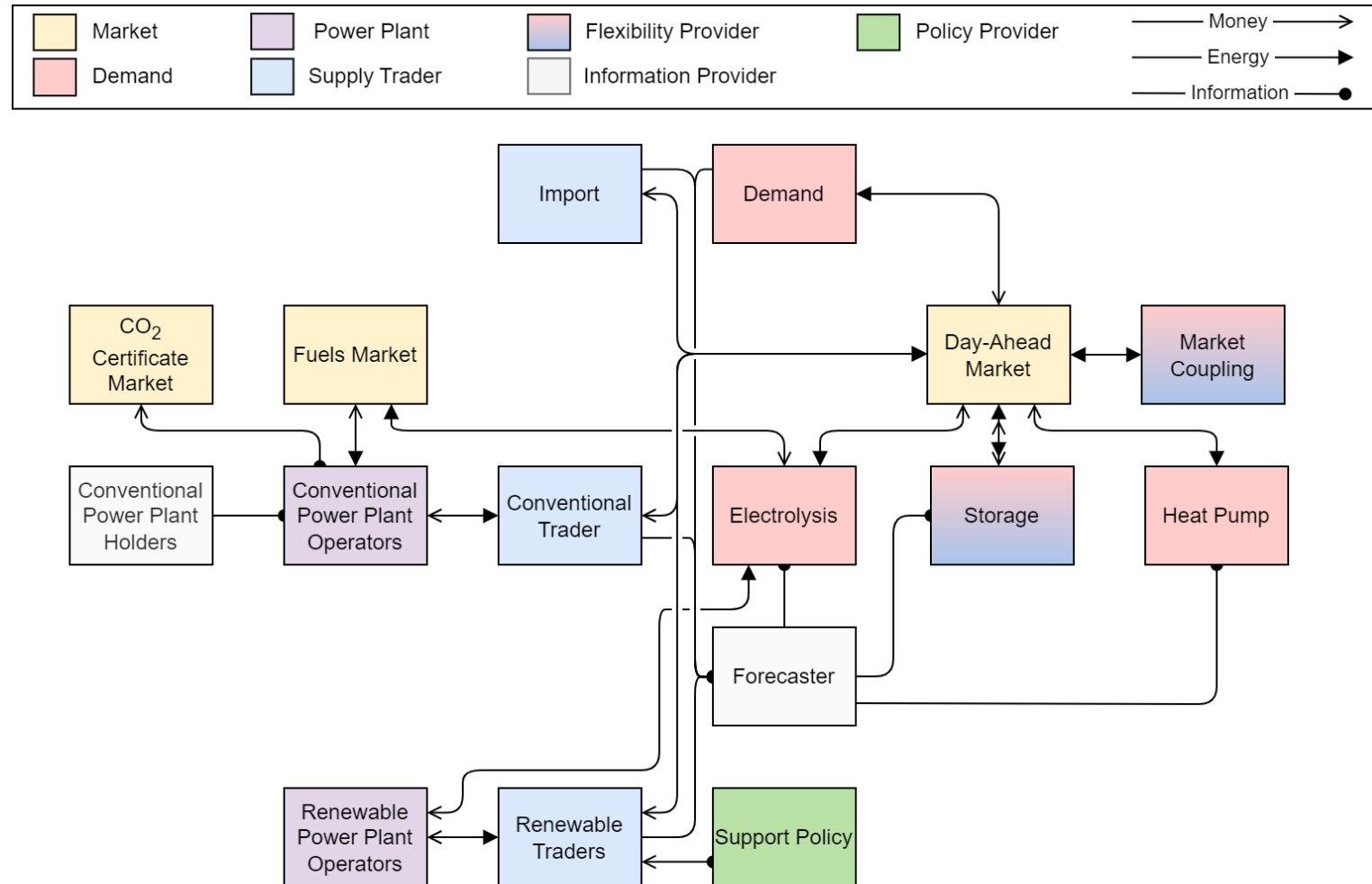
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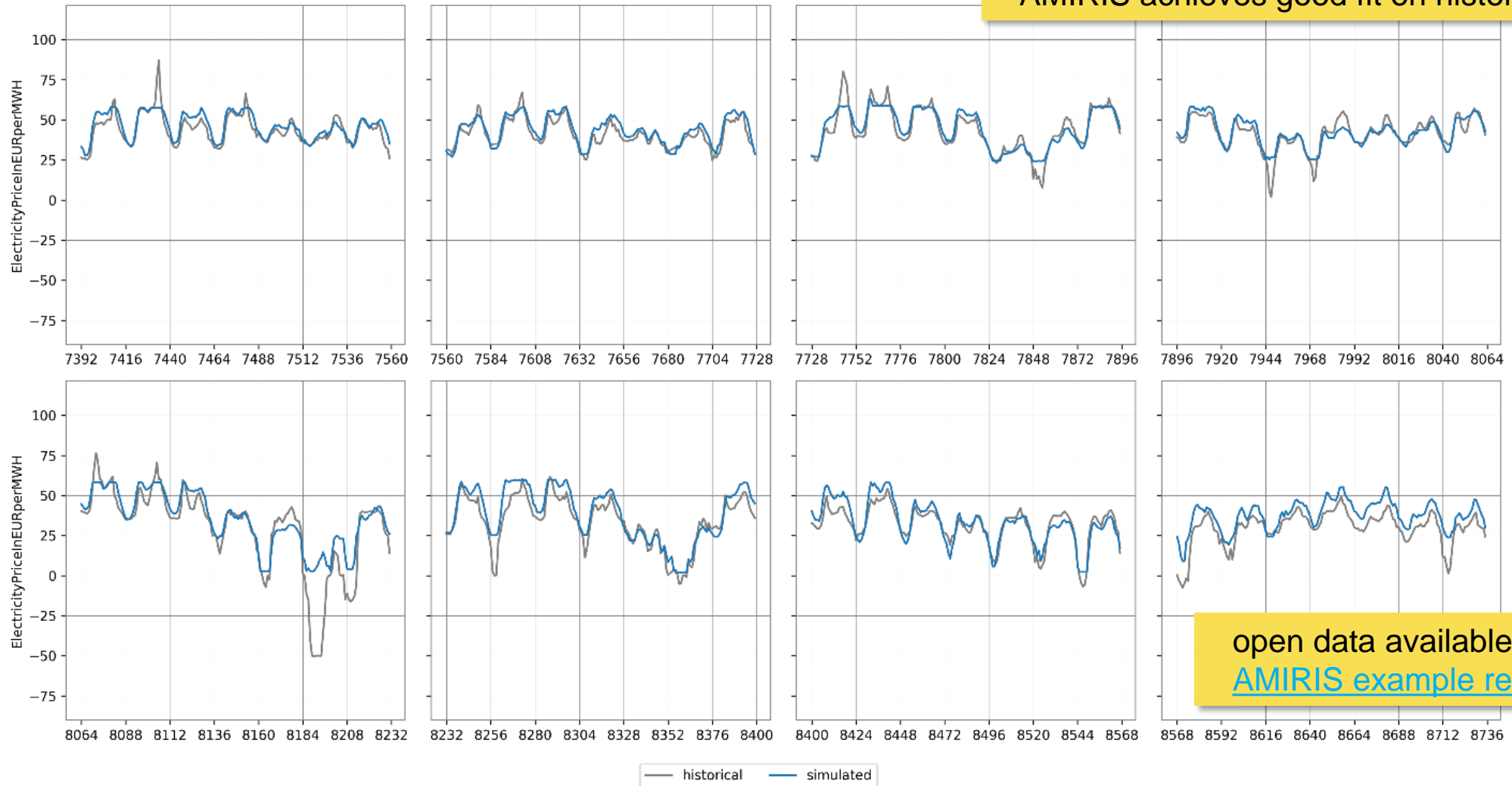


AMIRIS Examples: Backtesting 2019

Exemplary weeks



AMIRIS achieves good fit on historical data

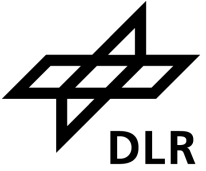


open data available at
[AMIRIS example repository](#)

How to use AMIRIS

AMIRIS: based on FAME

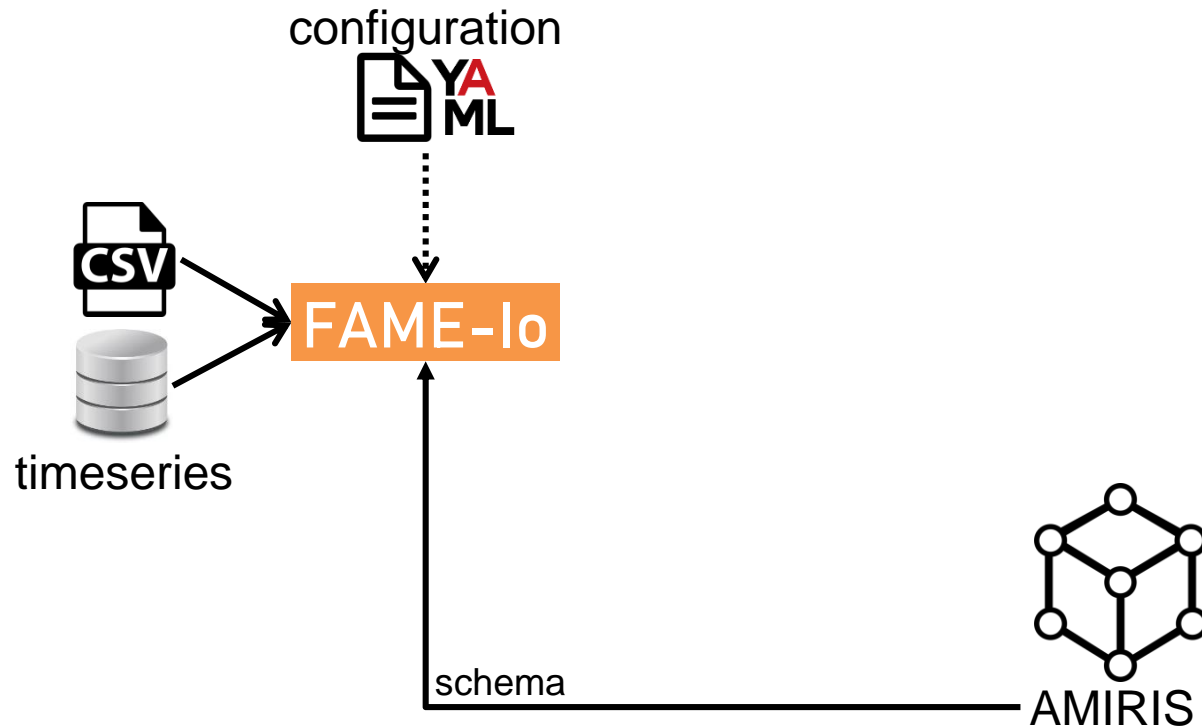
The open Framework for distributed Agent-based Modelling of Energy systems



FAME-Core: <https://joss.theoj.org/papers/10.21105/joss.05087>
FAME-Io: <https://joss.theoj.org/papers/10.21105/joss.04958>

AMIRIS: based on FAME

The open Framework for distributed Agent-based Modelling of Energy systems

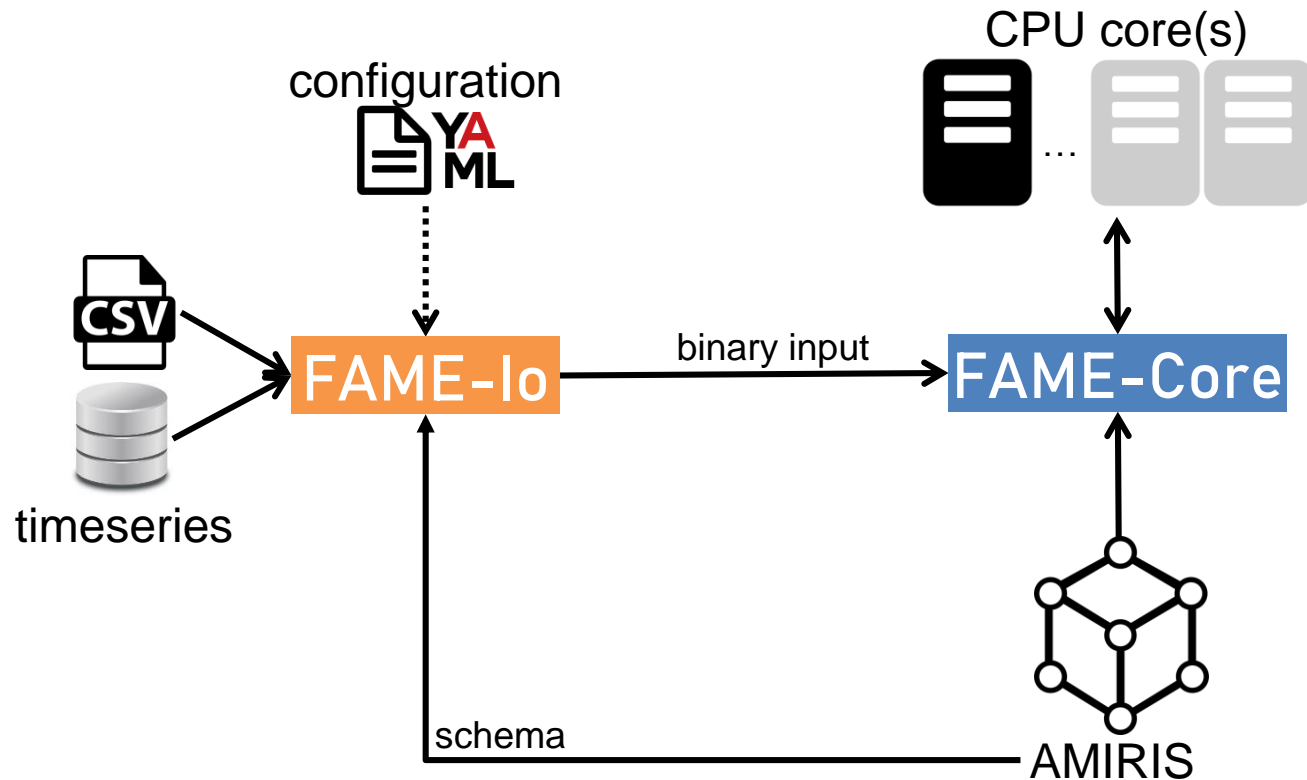


FAME-Core: <https://joss.theoj.org/papers/10.21105/joss.05087>

FAME-Io: <https://joss.theoj.org/papers/10.21105/joss.04958>

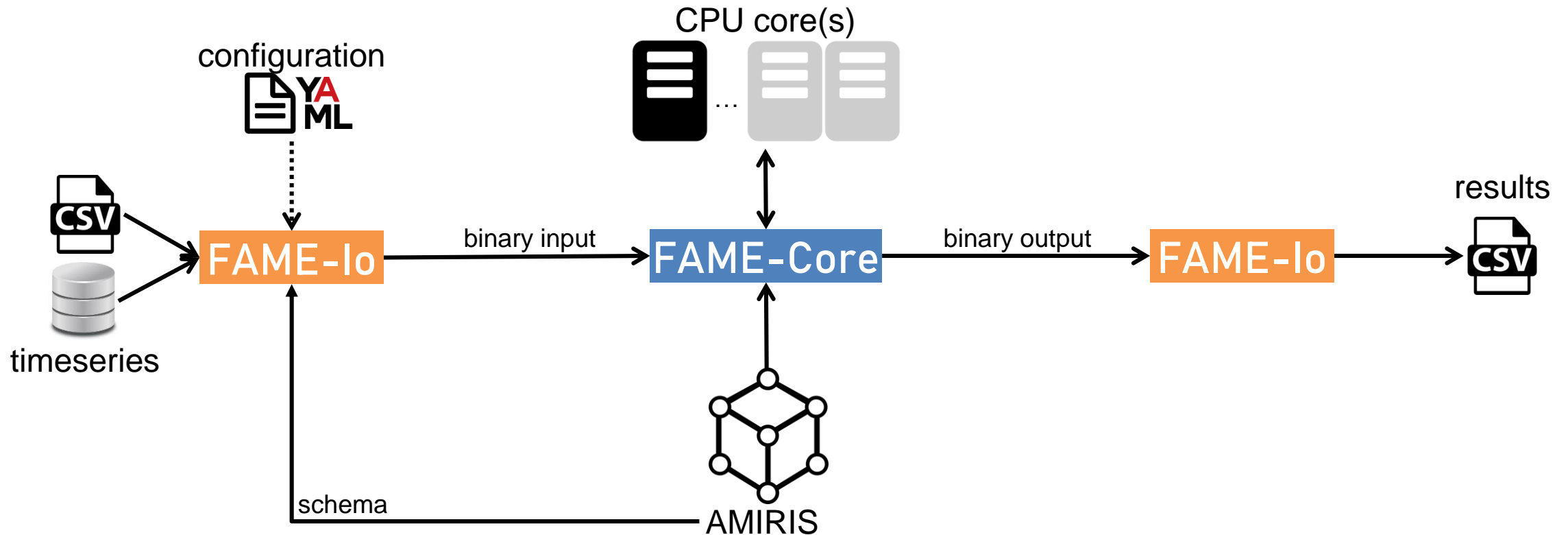
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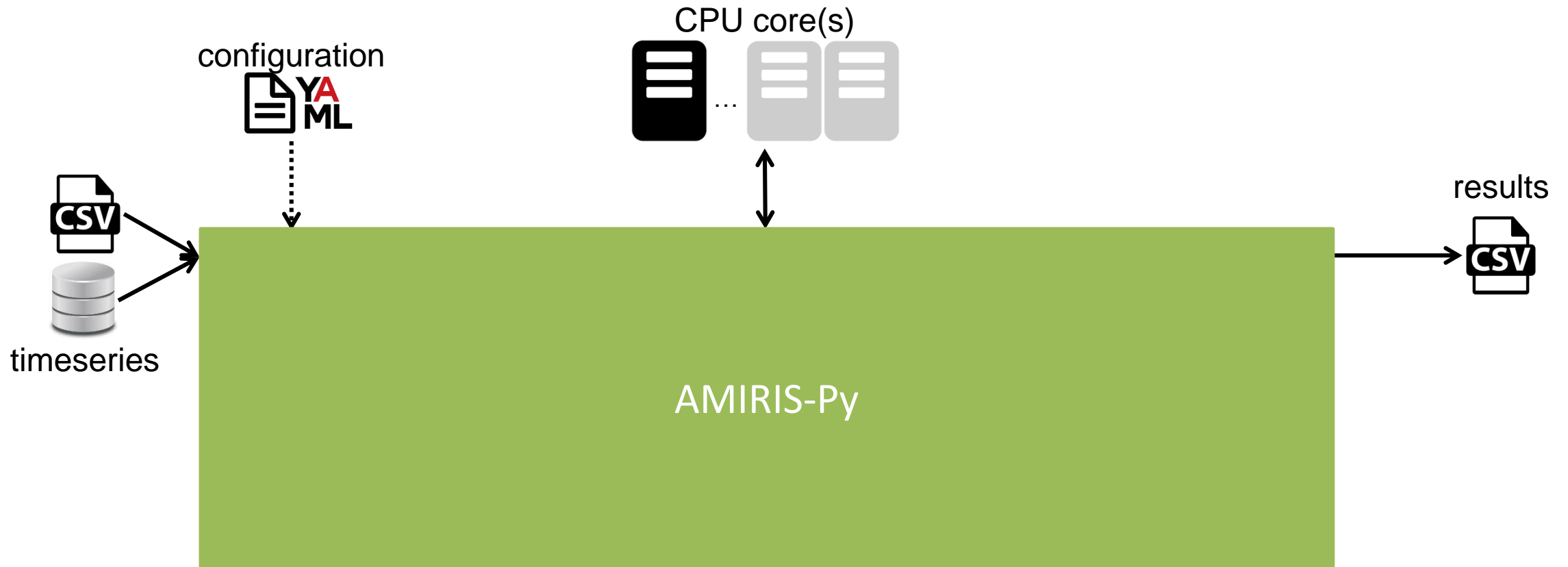
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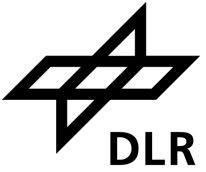
AMIRIS: based on FAME

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AMIRIS Setup

Requires Java 11+ and Python 3.9+



- Install *amirispys*

```
(AmirisEnv) PS C:\> pip install amirispys
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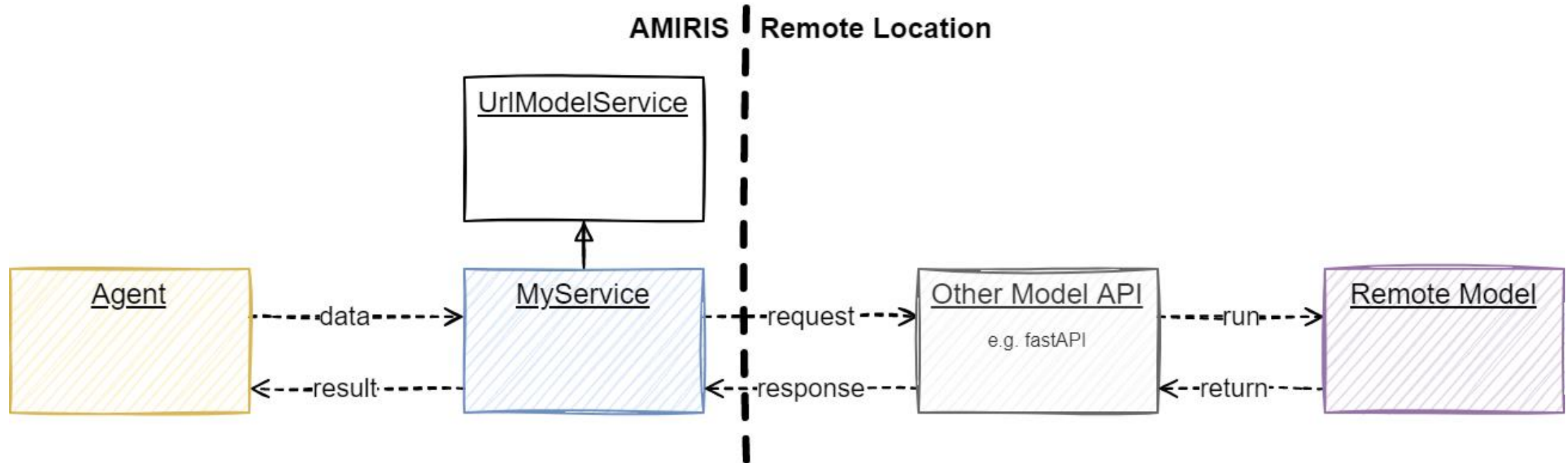
- Run AMIRIS

```
(amirisEnv) amiris run -j .\amiris-core_3.3.0-jar-with-dependencies.jar  
-s .\examples\Germany2019\scenario.yaml
```

From environment creation to first result in under 5 minutes!

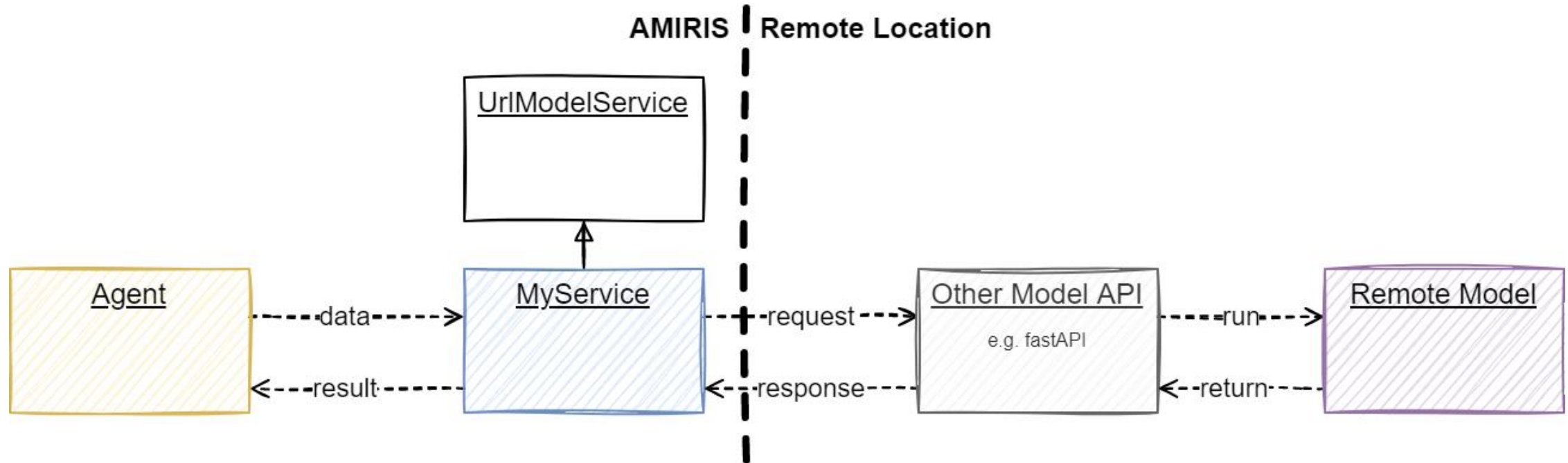
Couple with your own model

It's easy!



Couple with your own model

It's easy!



Benefits

- *Easy* setup
- Couple with virtually *any* model
- Allows coupling during *runtime*

Examples

- Load shifting optimisation
- Heat pump operation
- Machine-Learning based Forecasts

AMIRIS

Following FAIR4RS Principles



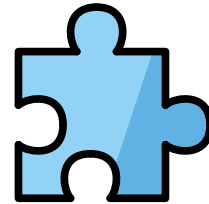
Findable

- [Website](#)
- [DOI](#)
- [Wikipedia](#)
- [COMSES](#)
- [HECI](#)
- [OEP](#)
- [openmod](#)



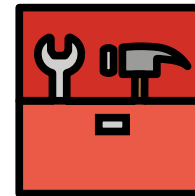
Accessible

- [GitLab](#)
- [PyPI](#)
- [Zenodo](#)



Interoperable

- [API](#)
- [Workflow tools](#)
- [CSV](#)
- [YAML](#)



(Re-)usable

- [Apache 2.0](#)
- [REUSE](#)
- [Wiki](#)
- [Javadoc](#)
- [Win/Mac/Linux](#)
- [Scalable \(H\)PC](#)

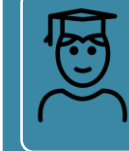
Icons by [OpenMoji](#), [CC BY-SA 4.0](#)

Key Indicators



Users

- 24 confirmed external user
- 9 external contributions



PhD candidates

- 7 internal
- 6 external



Visibility

- 25k views on Wikipedia
- 16k views on openmod



Software

- 32 releases
- 27k downloads

AMIRIS

Community Support



Post any question about AMIRIS at the [openMod Forum](#).



Send us an [email](#).



Discuss AMIRIS issues at our [Open Forum](#), every Friday 10 o'clock CET.



Raise issues and feel free to [contribute](#).

Imprint



Topic: Electricity market simulations with the open agent-based model AMIRIS

Date: 2025-02-02

Author: Christoph Schimeczek

Institute: German Aerospace Center
Institut of Networked Energy Systems

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