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GridSuite and PowSyBl:

an Open Source approach to develop advanced tools for grid analysis and simulation of power systems

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1 Context

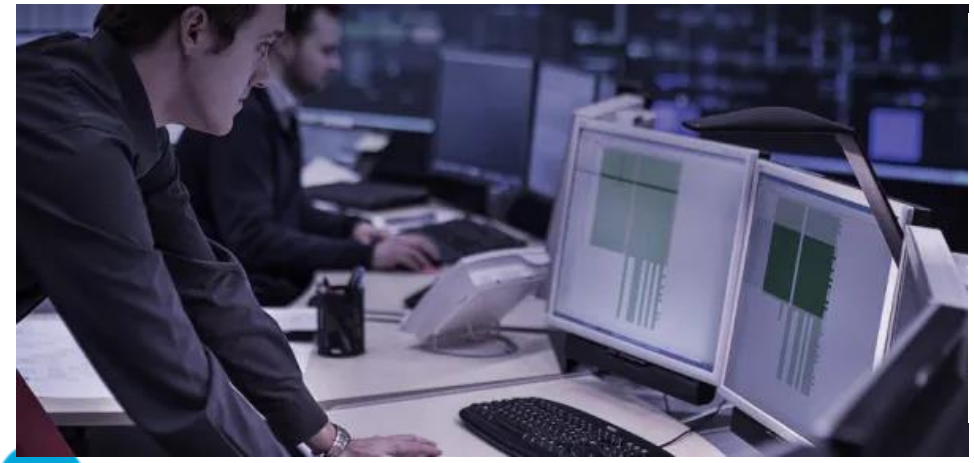
RTE’s missions

RTE is:

- The French TSO (transmission system operator): has the responsability to operate safely the French electrical Grid (20kV – 400 kV) and provide electricity access 24/7
- Assets owner: responsible of its assets renewal policy (billions of euros of investments)
- Responsible to adapt the structure of the grid for the energy transition:
  - Increase interconnections capacities (ex: DC link between France and Ireland)
  - Adapt the grid to the new energy mix: (ex: Build a network to accommodate marine energy sources)

Many challenges in a fast-changing world

- The future holds numerous challenges:
  - helping to achieve the Green Deal's carbon-neutrality target by 2050 by continuing to integrate an increasing amount of renewable energy;
  - supporting the integration of electric vehicles into the power system;
  - supporting decentralised power generation.
- In order to successfully complete the energy transition in accordance with the EU's objectives, transmission systems must continuously come up with novel solutions.
  - RTE must adapt its tools to be compliant with evolving grid codes
  - RTE is actively involved in research programmes seeking to develop technological innovations.



Power system tools must adapt quickly

- Today's need is not to build a tool to answer present's needs but to build a tool that is flexible enough to integrate quickly and efficiently tomorrow's needs.
- Do we have a precise vision of functionalities that will be required in 5 years? **No**
- How do we get back control of our future? **Open source!**

LF ENERGY
POWSYBL

GridSuite

2 PowSyBl

LF ENERGY

POWSYBL

A software ecosystem dedicated to power grid transmission

- PowSyBl: a set a low-level software components used as a foundation for building power system applications
  - Power Grid Modeling
    - Convenient and rich API to build and update Grid models for study purposes
    - Visualization of grid network and grid substation
  - Grid data format conversion
    - Standard data format (CIM, UCTE)
    - Commercial tool (PSS/E, PowerFactory) for interoperability
    - Academic data format (IEEE, Matpower)
  - Analysis functions:
    - Power flow calculation
    - Security analysis
    - Sensitivity analysis
    - Short circuit calculation
    - Dynamic (time domain) simulation
  - Mostly Java (17) code, no complex framework, as light as possible.

3 GridSuite

GridSuite

A software ecosystem dedicated to power grid transmission

- GridSuite: an application built on top of PowSyBl and used for all power grid studies
  - From real time studies (security analysis) to long term grid planning (studies to connect new renewable generation).
  - In production environment at RTE since end of 2023 for a few early users.
  - Target: 400 users end of 2025 with 24/7 support
  - 20+ developers
  - 100% open-source technical stack with a modern and scalable architecture:
    - Around 40 Micro services, Java, Spring Boot, REST API, RabbitMQ based messaging, PostGreSQL, Elastic search
    - Orchestrated by a k8s cluster
    - Web frontend: ReactJS , DeckGL (WebGL) for high performance grid geographical view.

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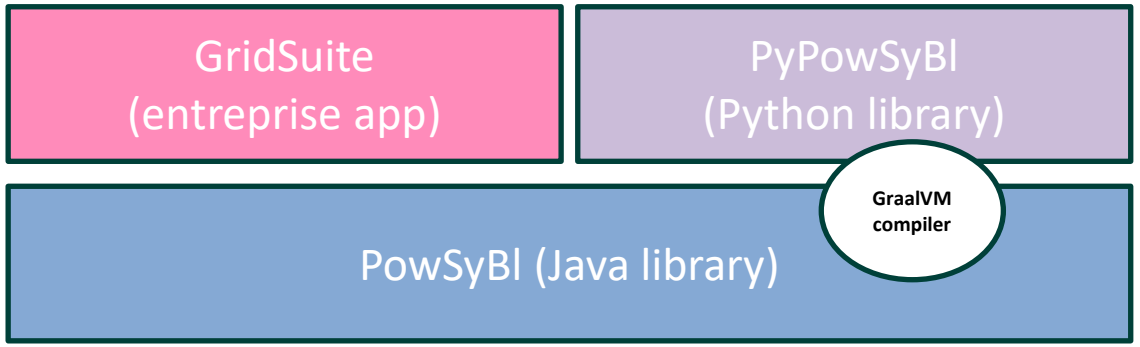
Industrial use and experimental use: is it PowSyBl?

An architecture to meet both entreprise and research needs

- Technical stack mismatch between
  - **Classical entreprise application**: technical stack based on Java ecosystem (Spring, Quarkus, etc)
  - **Research / data science community**: mainly on Python ecosystem.
- How to reconcile these 2 needs and continue to share same building blocks for all our users ?
  - Java to native code compilation using GraalVM (https://www.graalvm.org/) to build a C library from all PowSybl Jars
  - Python extension module based on PowSyBl C library



5 Vital minimum information (because 15 min is way too short for this subject!)

Where is it ?

- Useful links
  - https://github.com/powsybl
  - https://github.com/gridsuite
  - PowSyBl LFE: https://lfenergy.org/projects/powsybl/
  - PowSyBl documentation https://www.powsybl.org/
  - PyPowSyBl documentation https://pypowsybl.readthedocs.io/en/stable/
  - GridSuite architecture: https://github.com/gridsuite/documentation
  - Slacks for questions/support powsybl.slack.com and gridsuite.slack.com
  - GridSuite Online demo !! https://demo.gridsuite.org (GH account for login)
  - GridSuite demo Youtube Video: https://www.youtube.com/watch?v=1AmiEldTtqw

GridSuite demo?