

RTE DEPLOYS LF ENERGY SEAPATH FOR VIRTUAL PROTECTION AUTOMATION AND CONTROL



LF ENERGY SEAPATH

OVERVIEW

RTE, the French transmission system operator, has successfully implemented SEAPATH as the virtualization environment for its new generation of Protection, Automation, and Control (PAC) systems, known as R#SPACE. This fully digital, IEC 61850-based multi-vendor PACS leverages SEAPATH to enable high-availability and real-time virtualization in substations. Since the end of 2023, the first substation using SEAPATH has been operating seamlessly, with a roadmap targeting 100 deployments by 2030.

CHALLENGES

To modernize its substation infrastructure, RTE needed a scalable, interoperable, and cost-efficient virtualization platform for PAC systems. The key challenges included:

- Ensuring real-time processing and high availability in a virtualized environment.
- Achieving vendor independence and an open, cooperative ecosystem.
- Reducing hardware dependencies while maintaining strict operational requirements

THE SOLUTION

RTE chose SEAPATH, an open source project from LF Energy, as the foundation for its PAC virtualization efforts. SEAPATH provides:

- A real-time and high-availability hypervisor suitable for critical substation environments.
- An Infrastructure-as-Code (IaC) approach for automated deployment and scalability.
- A vendor-agnostic and open-source ecosystem for collaborative development.

The first set of substation functions virtualized under SEAPATH include:

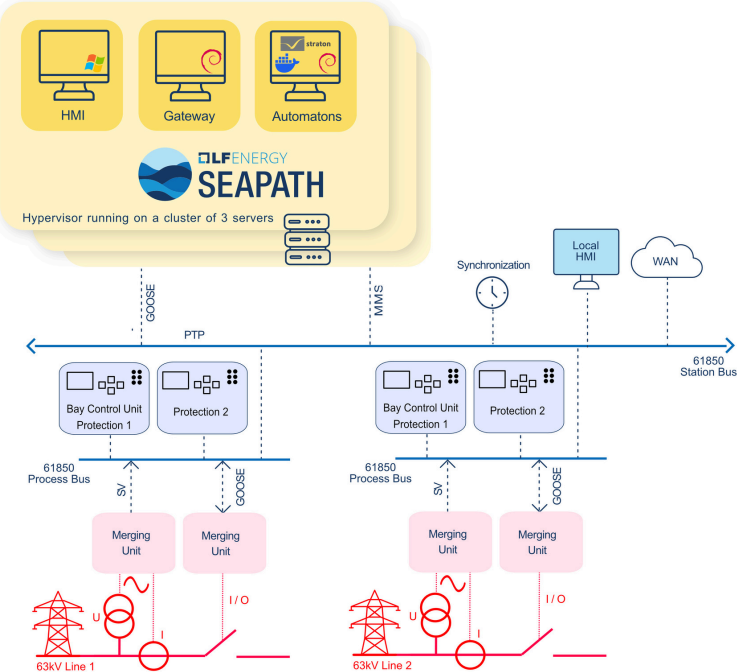
- HMI (Human-Machine Interface): Local operations and maintenance.
- Gateway: Telecontrol and supervision.
- Substation-Level Automation: Functions such as alarming, voltage regulation, and overload management, developed by RTE using Straton tools and running in Docker containers. Some require a strict cycle time of ~ 10ms.

RESULTS

The initial deployment of SEAPATH in a 63kV substation has demonstrated successful operation since late 2023 with multiple PAC functions virtualized. One additional substation was added in 2024 and three more are planned in 2025. The long-term goal is to have 100 substations (up to 400kV) by 2030 fully leveraging SEAPATH for PAC virtualization. This exercise has provided enhanced scalability, cost efficiency, and interoperability, proving the feasibility of open source virtualization in power systems.

NEXT STEPS

RTE is committed to the continued adoption and enhancement of SEAPATH. Future plans include industrial deployment acceleration across additional substations, and expansion of virtualized functions to include protection systems. RTE will also continue ongoing R&D initiatives to refine and optimize PAC virtualization in collaboration with the LF Energy community in order to further develop SEAPATH for wider energy industry adoption.



Learn more about [LF Energy SEAPATH](#).