

Cronos as the World's No. 2 Electricity Provider Supports Continuing Safe Operation of Nuclear Power Plants

2nd Gen Intel® Xeon® Scalable processors help EDF manage existing power facilities while predicting future needs and engineering new resources to help them be CO2 neutral by 2050

Solution Summary:

- BullSequana X supercomputer built by Atos
- 81,600 cores of 2nd Gen Intel® Xeon® Platinum 8260 processor
- Theoretical peak of 7.1 petaFLOPS
- Ranked 67 on November 2020 Top500 list



Executive Summary

Headquartered in Paris, France, [Électricité de France \(EDF\)](#) is the second largest electric utility in the world. It has over 120 gigawatts of generating capacity—90 percent free of CO2 emissions—much of it from its 58 nuclear power plants. EDF designs, builds, and manages various types of power facilities, including nuclear, off-shore wind, hydro, and solar. EDF engineers use High Performance Computing (HPC) for design of new generating facilities, to understand and predict customers' power consumption, and for safety and regulatory compliance through system and component simulations. Needing ever higher resolution simulations and to support emerging artificial intelligence (AI) studies, EDF upgrades their supercomputing resources every few years. Their latest deployment, called Cronos, was built on 2nd Gen Intel® Xeon® 8260 processors.

Challenge

“When it comes to our facilities, our number one concern is safety,” stated Alain Martin, Head of Scientific Information Systems at EDF. “Many things are difficult or complex to measure within a nuclear power facility, so we simulate evolution of various components using computation. These include components of the Reactor Pressure Vessel (RPV), steam generator, primary pump, among others. The higher the resolution of these simulations, the more detail we understand about the components' condition, operational efficiency, and reliability—all key factors to ensure safety.”

HPC is a critical resource at EDF. In addition to running simulations to support compliance with nuclear regulatory requirements, HPC also helps engineers understand risks of other types of power plants, such as solar, off-shore wind, and hydro. For example, using HPC for predictive maintenance and component end of life tracking helps keep facilities running optimally. And, simulations are used during design, engineering, and construction of various power generating facilities.

“We use many types of open source and proprietary codes for studies in mechanics, hydraulics, neutronics, physics, and Multiphysics,” added Cyril Baudry, Scientific Information Systems Architect at EDF. “We know these codes very well, such as Computational Fluid Dynamics (CFD). They are parallelized and highly scalable codes able to process large datasets. Over the decades that we have operated facilities, we continually expand our datasets every year, demanding more and more computing resources to process them in reasonable time and gain insight from them.”



HPC simulations support compliance with nuclear regulatory requirements.

These datasets also provide a foundation for building machine learning models they can run on more powerful clusters with AI support.

EDF's Gaia cluster, designed around Intel Xeon Gold 6140 processors, was installed in 2018. EDF upgrades systems on a cadence of about every three years. In late 2020, they began deployment of Cronos, an HPC cluster with 7.1 petaFLOPS performance (theoretical peak).

Solution

Cronos was built for traditional simulation and modeling of various scientific codes plus to support emerging machine learning use cases. The BullSequana X supercomputer was built by Atos using 2nd Gen Intel Xeon Platinum 8260 processors with 24 cores, 326 TB of memory, and InfiniBand HDR fabric. Cronos ranked 67 on the November 2020 TOP500 list and [ranked 97 on the June 2021 Top500 list](#).

"We run many parallel workloads, so more cores give us more capacity to run simulations," explained Baudry.

The high-performance workloads they run have been bound by memory bandwidth and performance-limited by processor clock frequency. The 2nd Gen Intel Xeon Platinum 8260 processor gives them more memory channels and higher memory bandwidth compared to previous generation Intel Xeon Scalable processors. They also benefit from the fewer cores that run as fast as 3.9 GHz in turbo mode compared to other processor SKUs.

Result

Cronos went into production in Q1 of 2021 with only a few users who are optimizing their codes and running simulations. One of the emerging uses cases, however, is machine learning.

"We are just beginning to explore machine learning workloads," concluded Baudry. "We are exploring AI to use for predictive maintenance, electrical consumption planning, cybersecurity, social media analysis, to name just a few. It is a new area for us."

Simulating and predicting future energy needs, analyzing nuclear power plant component evolution, and managing new energy sources requires HPC on a large scale. Cronos gives EDF the computing resources needed to continue to validate the safety of nuclear facilities, design new power generating resources, and leverage the power that AI and machine learning can bring to scientific insight and business efficiency and leadership.

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—Cyril Baudry, Scientific Information Systems Architect at EDF

Solution Summary

EDF is the second-largest electrical power provider in the world. They are responsible for engineering, constructing, and operating nuclear, hydro, solar, and off-shore power generating facilities. To continue to plan and prepare for the future while ensuring the safety and reliability of current production systems, EDF relies on ever-increasing HPC capabilities. Their most recent acquisition, Cronos, built on 2nd Gen Intel Xeon Platinum 8260 processors gives them the needed resources for new insights and continuing operations for several years to come.

Where to Get More Information

[Learn more about EDF.](#)

Explore the capabilities of the [2nd Generation Intel Xeon Scalable processors](#) with integrated Intel Deep Learning Boost capabilities for accelerated AI inferencing.

Solution Ingredients

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HPC helps engineers understand the risk of alternative energy solutions, such as wind power plants.



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