Orange's Padus Lab to Showcase Next-Generation Prefab Solutions for Telecom Equipment Hosting

A Vertiv Case Study

Background

The continued convergence of IT and telecommunications has a massive impact on the everyday lifestyles of people across the globe. New generations of connected Internet of Things (IoT) devices now allow people to control their homes from smartphones, work remotely from almost any location, and collaborate in real-time using video conferencing tools that drive both business, education, and scientific research.

Today, telecommunications is a multi-trillion-dollar industry. Because of the nature of their business, major global telecom players like France's Orange S.A., are faced with a unique social responsibility. They are tasked not only with providing the technology that enables the world to communicate, but they must also directly address important issues such as communications access inequalities and the global warming-induced climate emergency.

With a base of 263 million customers across 26 countries, Orange recognises that its corporate responsibilities go far beyond generating profits. In fact, its recently released Engage 2025 strategic plan is heavily focused on social and environmental accountability, as well as on technological innovation.

As part of the Engage 2025 plan, Orange has committed to achieving net-zero carbon emissions by 2040. This goal will require Orange to reduce carbon emissions by 30% (compared to 2015), and to source 50% of its energy from renewables (compared to 26% in 2019).

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- Dominique Bodéré, ITN Energy Optimisation & Ecoefficiency Project Manager, Orange

Challenge

Develop an edge computing solution that will support distributed telecom environments while producing net-zero carbon emissions.

Solution

Prefabricated modular data centre includes:

- Vertiv™ NetSure™ 400V HVDC power system and battery cabinets
- Vertiv™ Knurr DCM™ server racks
- Vertiv™ Liebert® DCD heat exchangers
- Vertiv™ Liebert® HPC-S freecooling chiller
- Vertiv™ Liebert® PCW chilled water perimeter unit
- Vertiv™ Liebert® HPW wall-mounted air conditioning unit

Results

- Rapid two-day installation period
- Edge computing site suitable as a replicable standard for multiple geographies
- Collaboration of business, technology, and academic experts to drive innovation
- A technical education site available for both employees and the local community
- A design that enables drastic energy consumption reductions

Converting Theory into Practice

The Green IT Network (ITN) program, an offshoot of Engage 2025, will help to achieve Orange's 2040 goal by improving energy efficiency and reducing energy expenditures across Orange data centres and networks. In order to convert network energy efficiency into practice, Dominique Bodéré, ITN Energy Optimisation & Ecoefficiency Project Manager at Orange, and his management team launched an innovative initiative called the Padus Lab.

"The name itself is indicative of the purpose of this initiative," D. Bodéré said. "'Padus' means sustainable in the local Breton language. Our work within the lab is focused on developing green solutions that boost energy efficiency and reduce carbon emissions, and on innovation since the lab functions as a collaborative test bed for new technologies."

For Orange, the Padus Lab concept breaks new ground in multiple areas. First, the facility itself is a prefabricated data centre, built, designed and tested by Vertiv, in Zagreb, Croatia, and then transported to Lannion, France. This area of France, known as the "Tregor Valley" is a telecommunications industry hub, and Lannion is where the actual Orange energy efficiency research and development is taking place.

Second, some of the technologies tested will be truly groundbreaking and include server immersion, liquid cooling, a Vertiv™ NetSure™ 400V HVDC power system, energy storage, a Vertiv™ Liebert® HPC-S freecooling chiller system, and even green hydrogen energy generation.

"The Padus Lab will assess new means of producing, storing, and managing energy in ways that are as green as possible, and also serve as an edge computing model for deploying future Orange networks across the globe," D. Bodéré said.

One of the motivations for creating the laboratory is to enable the measurement and optimisation of 5G energy consumption, virtualisation, and future networks beyond 5G.

An Ecosystem of Partners Led by Vertiv

In order to achieve such aggressive goals, Dominique Bodéré and his team are turning to an ecosystem of key partners that include technology infrastructure providers like Vertiv, standards organisations such as open interface, IT server providers, and local universities.

"The prefab lab that Vertiv is jointly providing embraces open interface platform standards and will help us monitor all elements across the technology chain including IT, networking, power, and temperature control equipment," D. Bodéré said. "We will use modeling to simulate all possible environmental conditions and limit the number of actual tests we will need to perform in different countries as this edge technology gets distributed across geographies."

With its Padus Lab, Orange is promoting collaboration among experts from the same fields for the benefit of all parties involved. Manufacturers are able to put their innovative technologies to the test under real-life conditions. And Orange, acting as an integrator, then generates technical specifications that are adapted to the manufacturers' needs.

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The relationship between Orange and Vertiv is multidimensional and goes well beyond Vertiv serving as a long-standing technology supplier. Vertiv and Orange are investing equally in the project, and Vertiv's global footprint allows for full support in the European, Middle Eastern and African countries where Orange conducts business.

"In responding to our specifications, Vertiv received the highest grade among the global technology providers we considered, excelling from a technology, performance, and value perspective," D. Bodéré explained.

For starters, Vertiv provided the prefabricated module that houses the Padus Lab, as well as Vertiv™ Liebert® DCD heat exchangers that provide rear-door rack cooling, a Vertiv™ NetSure™ 400V HVDC power station with lithium-ion battery banks for energy storage, Vertiv™ Knurr DCM™ server racks, a Vertiv™ Liebert® PCW chilled water perimeter unit, a Vertiv™ Liebert® HPC-S freecooling chiller, and a Vertiv™ Liebert® HPW wall-mounted air conditioning unit.

Inside the Vertiv prefabricated module

Challenge

Innovative Approaches Needed to Address Edge Computing

In developing its technical requirements for the Padus Lab, and its future global edge computing network, Orange was looking for guidance on how to best support its mobile phone base stations across regions with widely differing climates. In considering its existing portfolio of building assets, Orange knew it faced a number of challenges for meeting future needs:

- **Suitable facilities** – Since a core Orange business requirement was the ability to support edge computing, Orange knew that use of existing facilities would not be practical. Edge computing addresses the issue of data latency by locating compute power physically close to the creation point of the data. For this reason, Orange needed a modular solution that could house and support compute power across its distributed networks of telecom cell towers. The solution needed to precisely meet the needs of each territory, while taking advantage of external climatic conditions to limit its environmental impact in terms of power consumption.
- **Advanced remote monitoring requirements** – Since the availability of on-site experts to support the edge computing systems housed within the module would be severely limited, Orange needed a system capable of remotely monitoring not only server performance, but also the cooling, power, and security systems in place to support the implementation.
- **Energy efficient operations** – Since the edge computing solution would need to house networking equipment, as well as the servers necessary for the operation, these mixed technology sites would pose new challenges in terms of energy efficiency, especially because Orange is laser-focused on reducing its carbon footprint. For this reason, Orange knew it had to invest in the most efficient data centre power and cooling technologies.

Solution

Pushing the Envelope on Energy-Saving Technologies

In order to address these issues, Orange began to consult with Vertiv regarding the necessary building blocks for crafting a viable, future-proof solution. With lower energy consumption as a critical goal, the joint team proposed a number of solutions for engineering a strong Padus Lab proof-of-concept:

- **Prefabrication** – As integrated solutions, prefabricated modules include rack, row, aisle, and complete data centre options that are flexible in design and based on proven configurations. Such solutions can be applied across a wide variety of edge sites and allow for easier implementation, management, and replication. In the case of Orange, Vertiv proposed a 110-square metre (approximately 1,200 square feet) solution that was built in its manufacturing site in Zagreb, Croatia, and then transported to Orange's research and development site in Lannion, France.
- **Cooling** – Cooling can represent up to 40% of a data centre's total energy consumption. For this reason, Orange is exploring a number of innovative technologies, such as freecooling (a practice where the outside air is used to directly cool the IT room or data centre), liquid cooling (direct cooling solutions that expose server components, such as processors, to liquid to cool them more efficiently) and server immersion (when servers are submerged in a thermally conductive dielectric liquid or coolant, and heat is removed by circulating liquid around hot components and through cool heat exchangers) as possible solutions. Vertiv has also contributed fanless Vertiv Liebert DCD air-water heat exchangers that install as the rear door of server equipment racks. Far less energy is consumed when the source of the cooling is located in close proximity to the heat source. The Vertiv Liebert PCW chilled water perimeter unit also contributes to minimising running costs for the entire cooling system through its internal design and enhanced technology.

- **Energy storage** – Lithium-ion battery banks will be integrated and tested both with outside solar panels and possible green hydrogen generation to provide on-site energy generation and storage for stable energy supply to the edge computing modules.
- **400-volt HVDC power** – Higher energy efficiency is possible with a 400-volt HVDC power distribution system because it eliminates two power conversion steps and enables single end-to-end voltage throughout the data centre. This helps in managing operating expenses and lowering carbon dioxide emissions.

Results

Collaboration Is Key for a More Energy Efficient Future

Although the work at Orange's Padus Lab is just beginning to get underway, early results have been encouraging. For instance, the deployment of the Vertiv prefabricated modules delivered to the Orange Lannion campus took only two days to install. The fast delivery of a pre-built data centre, with instantly available power and cooling capacity, now makes it possible to ship such modules to remote locations without having to fly in and assemble an army of experts for traditional build-out purposes. The "plug and play" nature of the prefabricated modules greatly helps to accelerate the building, installation, and servicing phases of the project.

"The prefabricated modularity allows us to adapt to the different needs of the countries that we service in Europe, Africa, and the Middle East," D. Bodéré said. "We are looking at modular energy envelopes for these sites so that we can localise and provide the appropriate functionality within the container. In Africa, for instance, we will deal with outside temperatures of 40 degrees Celsius (104 F), while in Poland, we are closer to zero degrees Celsius (32 F). That will require a solution that is flexible, yet energy efficient."

The Padus Lab is also being instrumented with sensors that serve as thermal readers and energy probes. The team collects temperature and energy consumption data from remote servers and power and cooling infrastructure. For Orange to be able to integrate this data with in-house software, opening of application programming interfaces is essential. The goal is to centrally monitor a set of multi-vendor equipment. Ultimately, artificial intelligence will be used to drive monitoring so that equipment behavioral trends can be identified and energy use optimised.

The lab is also being made available as an educational site for both Orange employees and members of the local community who wish to learn more about the advanced technologies being developed.

"We are focused on supporting our goal of net-zero carbon by 2040," D. Bodéré said. "By working and collaborating with partners like Vertiv, who share a commitment and passion for curbing the harmful effects of global warming, we feel we will have the necessary ingredients to succeed."

Vertiv™ NetSure™ 400V DC power solution

Vertiv™ Netsure™ 400V Key Features:

- High power density and small footprint
- Safe and reliable with alarms for insulation failure and grounding faults
- Local monitoring and control via 7-inch touchscreen color display
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Watch our Padus Lab project video to learn more or browse our telecom industry page to find the right infrastructure solutions for your next project.

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