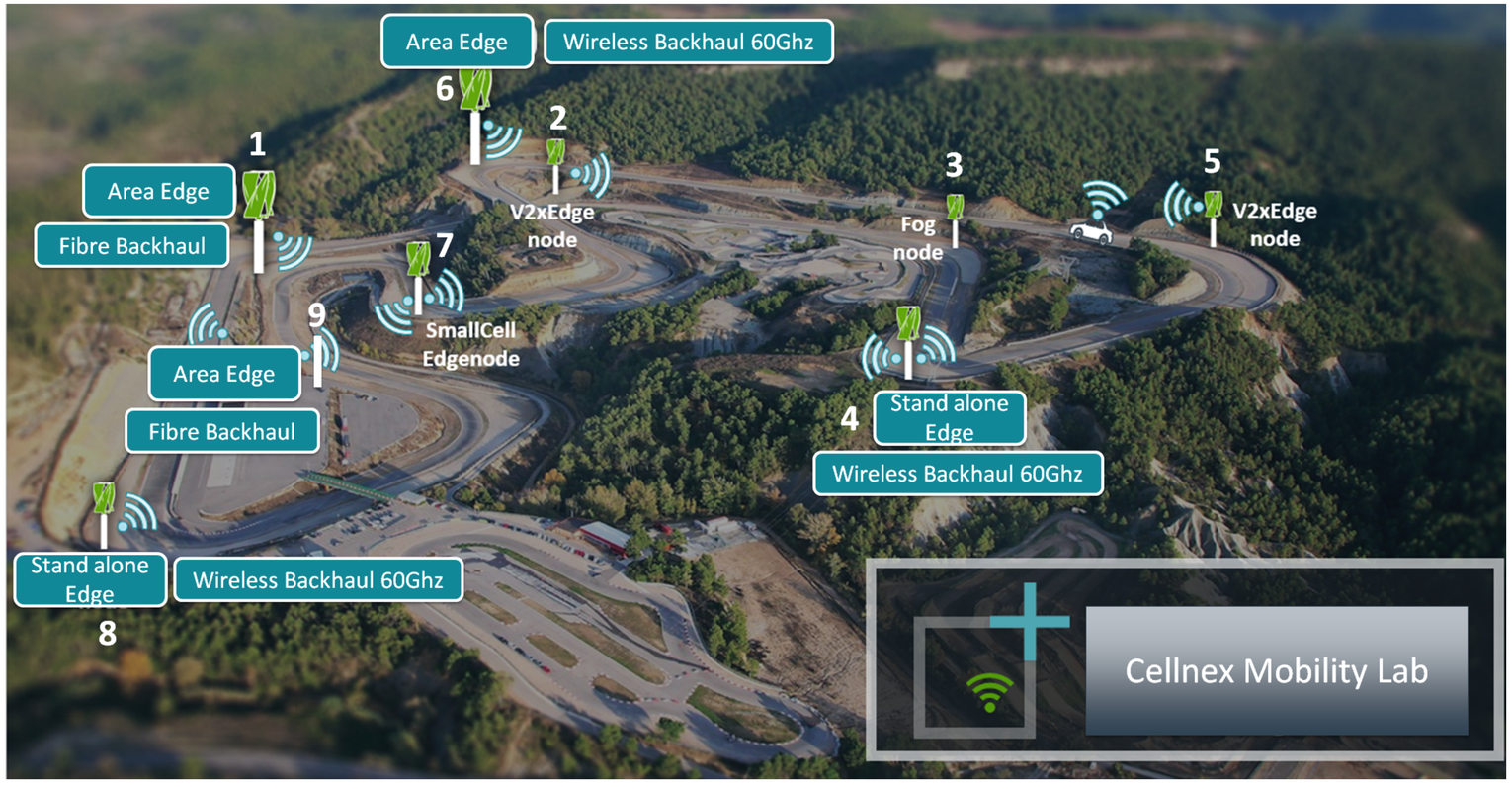
CELLNEX TELECOM

Optimizing the operation of sustainable communication sites.

Cellnex Telecom is Europe’s leading operator of wireless telecommunications with a portfolio that spans the continent. The Cellnex Mobility Lab is used to develop new sustainable, connected and autonomous mobility solutions related to 5G for vehicles, traffic management and smart road infrastructure.

The Mobility Lab represents an innovative area to test and develop new technology related to connectivity, specially designed for non-urban or semi-rural environments.

Lenovo



What are the benefits of edge computing?

Edge computing is an emerging paradigm where computing is performed at the “edge” of the network. It enables the co-existence of virtual network functions (VNFs) and Edge Applications in shared general-purpose compute platforms. This consolidation process results in converged network and services platforms that entirely transform the approach used to deploy network services and how end users access applications deployed at the edge of the network.

Edge computing allows for ultra-low latency response times and enhanced bandwidth availability in comparison to the conventional centralized computation models. There are also other compliance and cost benefits: for example where data is constrained to remain within a certain location or must be processed on-site because the cost of transport or transport time are prohibitive.

Applications that use the edge may include traditional network functions, connected self-driving cars, video surveillance, IoT analytics, video encoding, video analytics, speech analytics or retail services, among others.

About Cellnex:

Cellnex Telecom is Europe's leading operator of wireless telecommunications and broadcasting infrastructures with a portfolio of c.107,000 sites, 75,000 of them already in the portfolio and the rest in the process of closing or planned roll-outs up to 2028. Cellnex operates in Spain, Italy, Netherlands, France, Switzerland, the UK, Ireland, Portugal, Austria, Denmark and Sweden.

Cellnex's business is structured in four major areas: telecommunications infrastructure services; audiovisual broadcasting networks, security and emergency service networks and solutions for smart urban infrastructure and services management (Smart cities and the "Internet of Things" (IoT)). The company is listed on the continuous market of the Spanish stock exchange and is part of the selective IBEX 35 and EuroStoxx 600 indices. It is also part of the FTSE4GOOD, CDP (Carbon Disclosure Project), Sustainalytics and "Standard Ethics" sustainability indexes. Cellnex's reference shareholders include Edizione, GIC, ADIA, CriteriaCaixa, Blackrock, Wellington Management Group and Canada Pension Plan.

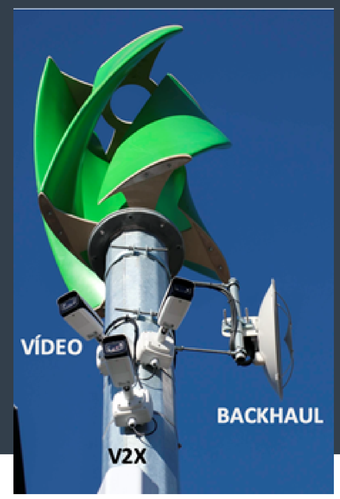
The Mobility Lab: Developing sustainable mobility solutions
The Cellnex Mobility Lab in Castellolí, near Barcelona (Spain), is focused on the development of vehicular use cases. The lab is the result of the digital transformation of Circuit Parcmotor Castellolí, which has been converted into an innovative technological center that supports experimental living-labs for smart mobility and connected/autonomous vehicles.

Mobility Lab develops 5G-based sustainable, connected and autonomous mobility solutions for vehicles, traffic management or road infrastructure. This represents an innovative area to test and develop new technological solutions and services advancing connectivity, especially in rural environments. The racetrack has been equipped with several self-sustaining sites to support the cellular Vehicle-to-Everything (c-V2X) wireless network that provides coverage to the whole circuit, allowing connectivity between vehicles, high-definition cameras for monitoring vehicles on the track and on-board units for transmitting telemetry, voice and video data.

The self-sustaining Green Edge sites are powered by renewable energy: in this case, solar and wind energy, that is generated on site. The communication towers are equipped with wind turbines and solar panels, as well as extended batteries to store the electricity that is generated. The towers are inter-connected using radio links and therefore, there is no need for power cables nor fiber links between them. One of the use cases under implementation is the automatic detection of car incidents (spinning, collisions, breakdown), where captured images are analyzed locally at the edge nodes and shared anonymously at the local node level. Something similar happens with sensor information, which is analyzed and shared at a local level too.

Each one of the Green Edge sites is enabled with a Lenovo ThinkSystem SE350 server, running Intel® Xeon® D processors, that continuously monitors its power consumption and the status of the battery and the level of energy generation. The rugged and compact Lenovo ThinkSystem SE350 is tailored specifically for the edge. It can be deployed practically anywhere as it does not require networking points or specialized power supplies, and can handle wide operating temperature ranges, dust, and vibration.

Both server models offer the physical and data security to protect against unauthorized access with a dedicated management port and the ability to detect hardware tampering and movement.

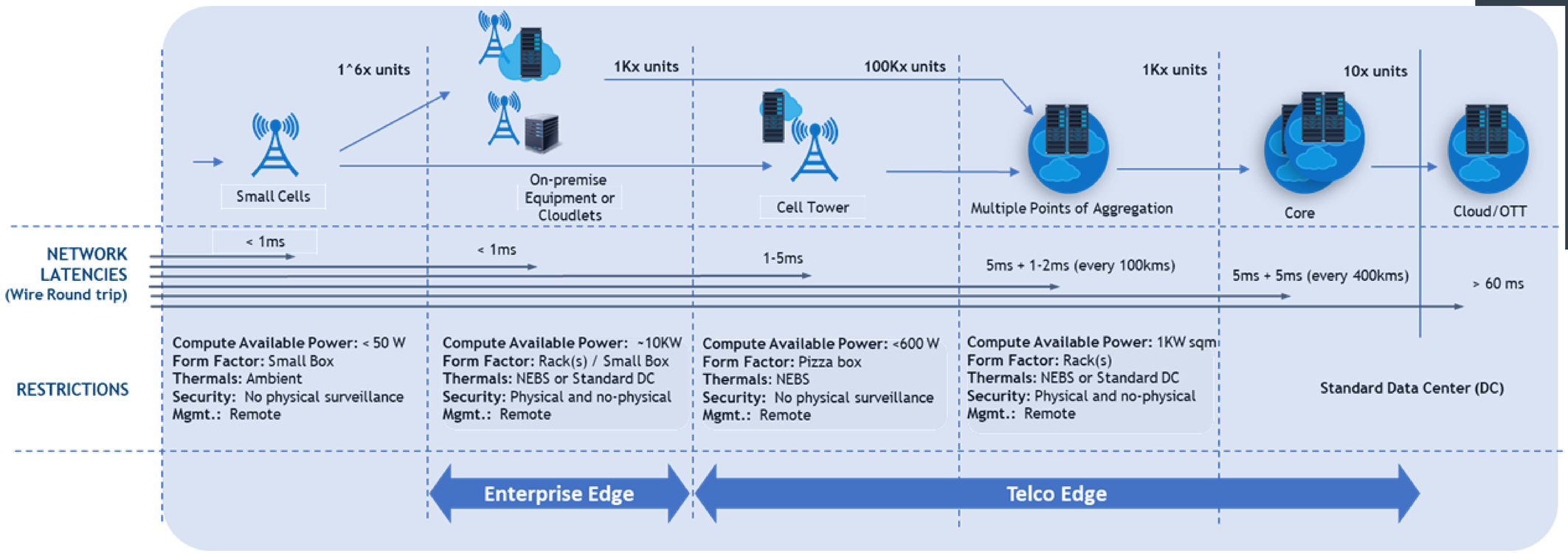


The backend of the Mobility Lab is equipped with a prototype Lenovo ThinkSystem SE650 which is a 2U-high modular system designed for applications that need significant processing power such as vRAN, multi-access edge computing (MEC), and NFV infrastructure (NFVI).

The whole infrastructure is operated using a combination of the orchestration features of Nearby One, the edge orchestration solution deployed by Nearby Computing, and the Lenovo Open Cloud Automation (LOC-A) software. With LOC-A, you can rapidly deploy, optimize, and manage cloud infrastructure on the ThinkSystem SE350 Edge Servers with support for Kubernetes, Red Hat OpenShift, OpenStack, and VMware Cloud Foundation.

Advanced AI techniques developed by Lenovo allow for precise forecasting of available energy levels in each Green Edge site. This information is used to enforce energy saving policies that can disconnect some of the server components or reduce operation frequency of other ones to reduce energy consumption and ensure service continuity. All this data is integrated into the operational engine of Nearby Computing's orchestration solution, that provides continuous service assurance and the enforcement of business level policies.

The Green Edge sites are enabled with cellular communications equipment to deliver c-V2X services, and the edge servers are responsible to host the applications running at the edge. At the control room of the lab, different network components are managed by Nearby Computing orchestration technology, including a packet core and an Open RAN controller.



Open Edge Architecture

In edge computing deployments, there are many technology aspects to consider including the servers and hardware components, end-to-end orchestration, networking standards and protocols, applications and virtualization, among others.

To address this challenge, Intel's Converged Edge Reference Architecture (CERA) can be used to speed up time to market for companies who want to deploy vertical-aligned service platforms that can support diverse workloads across media, inference, networking and IoT applications. The pre-validated reference blueprint aligns to a consistent architecture that can scale end-to-end across all edge locations.

1) CERA blueprints are based on open standards and interoperable components that allow seamless integration, testing and validation of technologies from diverse ecosystem vendors;

2) It brings commonality and reduces variance in architectures across different verticals such as Telecommunications, Internet of Things, Enterprise and Government, which traditionally have been implemented with their own vertical specific technologies

3) Based on a cloud-native architecture with open APIs, it leverages workload specific software toolkits such as OpenNESS, OpenVINO and Open Visual Cloud that make it easy to develop, test and deploy applications optimized and designed for edge;

4) Highly scalable and modular components that allow both reusability as well as customization to cater to specific edge use cases

Lenovo, Cellnex Telecom and NearbyComputing have closely worked with Intel to develop an open solution for Edge Computing that adheres to the CERA architecture, and that has been successfully deployed at the Cellnex Mobility Lab in Castellolí.

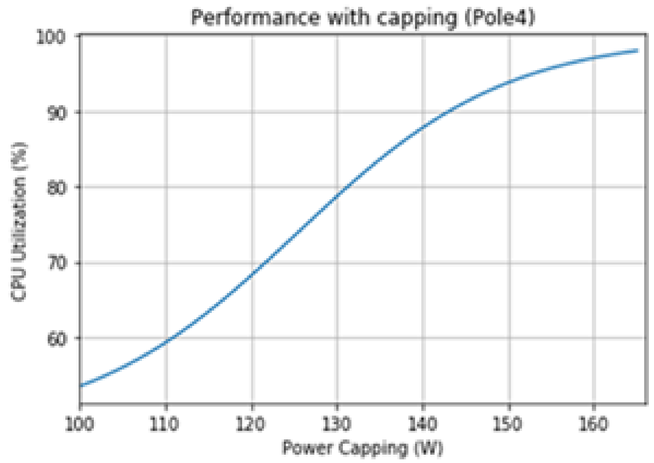
Results

The work demonstrated the feasibility of implementing a converged edge architecture, based on the principles of the CERA architecture. The unique combination of Lenovo Edge Servers and NearbyComputing's advanced orchestration engine allowed Cellnex Telecom to deploy an efficient and open management of the physical infrastructure, the VNFs and Edge applications in a completely sustainable c-V2X environment.

To automate the whole infrastructure operation, from node provisioning to service deployment and assurance, Nearby Computing deployed its Nearby One solution, that leveraged the energy policies enabled by Lenovo Edge servers, to operate the full infrastructure from a single pane of glass. The different VNFs and Edge applications hosted on-site delivered sustained and predictable performance thanks to the ability of Lenovo Edge servers to meet the demands of the most critical energy management situations. A combination of Intel® Xeon® Scalable processors and Intel® Xeon® D processors enabled a faster time to market by rapidly translating requirements into system architecture components, and by allowing services and network applications to run consolidated on the same stack.

The system was able to predict the energy demand over time based on power consumption models generated by Lenovo. These models were combined with the energy generation models, mainly influenced by the solar generation, to produce advanced predictions for the State of Charge (SOC) of the pole batteries. These predictions were fed into the Nearby One orchestrator to enforce a tailored power capping policy to keep the battery in a SOC above 90% by sunset time and minimize the workload of the ThinkSystem SE350 during the night to keep all services alive until sunrise.

The video analytics service, powered by the Intel's distribution of the OpenVINO™ toolkit, delivered with adaptive accuracy level, based on the power cap defined at each moment in time. Nearby One dynamically selected the AI model in use to achieve the maximum accuracy possible for the power cap in place.



The integrated solution, enabled by technologies from Lenovo, NearbyComputing and Intel, provides new business models for Cellnex Telecom to implement c-V2X services with high levels of service continuity and open modularity to host third party applications and VNFs. The automation mechanism introduced by Nearby One and LOC-A reduced the total cost of operations of the infrastructure, drastically decreasing the number of activities to be performed in the field.