5G Enables Immersive Learning

A standalone 5G network and edge compute brings bi-directional holograms to Barcelona

During the pandemic, students became accustomed to attending lessons online. But video calls aren't generally as engaging as being taught in person.

To explore how remote learning could become more immersive and natural, the 5G Catalunya consortium employed a private standalone 5G network to enable two participants in a conference call to be depicted by live holograms. Cellnex Telecom, MasMovil, Aumenta Solutions and Lenovo ran the pilot of bidirectional holograms at the Cibernàrium, Barcelona Activa's training and technology dissemination centre at the MediaTIC building.

The pilot used depth cameras to capture volumetric models of the people and the environment to be broadcast over the network. Provided by Aumenta Solutions, this volumetric capture technology allowed a live 3D image of each speaker to be streamed in real-time across a private 5G network. With a standalone 5G network, the operator can dedicate specific connectivity resources to a specific application, such as a holographic video call.

"With this holographic solution, point-to-point volumetric representation marks a new way to see and understand things," says Javier Campos, CTO and CIO of Aumenta Solutions. "The most important thing is that 5G technology and this use case open up many

opportunities in other sectors, for example, remote medicine or care for people at risk of exclusion, or industry."

The pilot tested two scenarios. In one, the hologram was presented as a 3D projection (using a specialist device) and in the other, the hologram was displayed on a flat screen, but still conveyed a sense of depth.

The connectivity was provided by 5G small-cell indoor radio units installed by Cellnex. These units received the signal and transmitted it via fibre optics to the edge server (supplied by Lenovo) in a Cellnex data-centre cabinet near the MediaTIC building. Cellnex says this 5G architecture enabled "milliseconds latency and gigabits per second bandwidth" in both the uplink and downlink. Indeed, the pilot demonstrated that 5G, supported by edge computing, is sufficiently robust to support near real time bidirectional holograms between two locations, making for an immersive two-way video and audio communication experience.

"5G technology makes it possible to transmit large volumes of real-time data, which will enable us to experience immersive communication services, like connectivity through two-way holography, with a sense of presence and immediacy that will improve

the quality of interaction over other forms of distance teaching or learning," notes Ana Varela, 5G CAT pilot leader and Open Innovation Program Manager at Cellnex Telecom.

The demo at the Cibernàrium showed that "we don't need to wear glasses" to participate in a virtual lesson or meeting, adds Jose Antonio Aranda Legazpe, Product Strategy and Innovation Director at Cellnex Telecom. "The connectivity is robust enough to enable two holograms to meet at the same time."

As well as delivering remote teaching, this kind of bidirectional holographic technology could be used to enable remote medical consultations, making it easier for a doctor to gauge a patient's range of movement, for example. Live holograms could also be used to make remote business meetings more engaging and interactive.
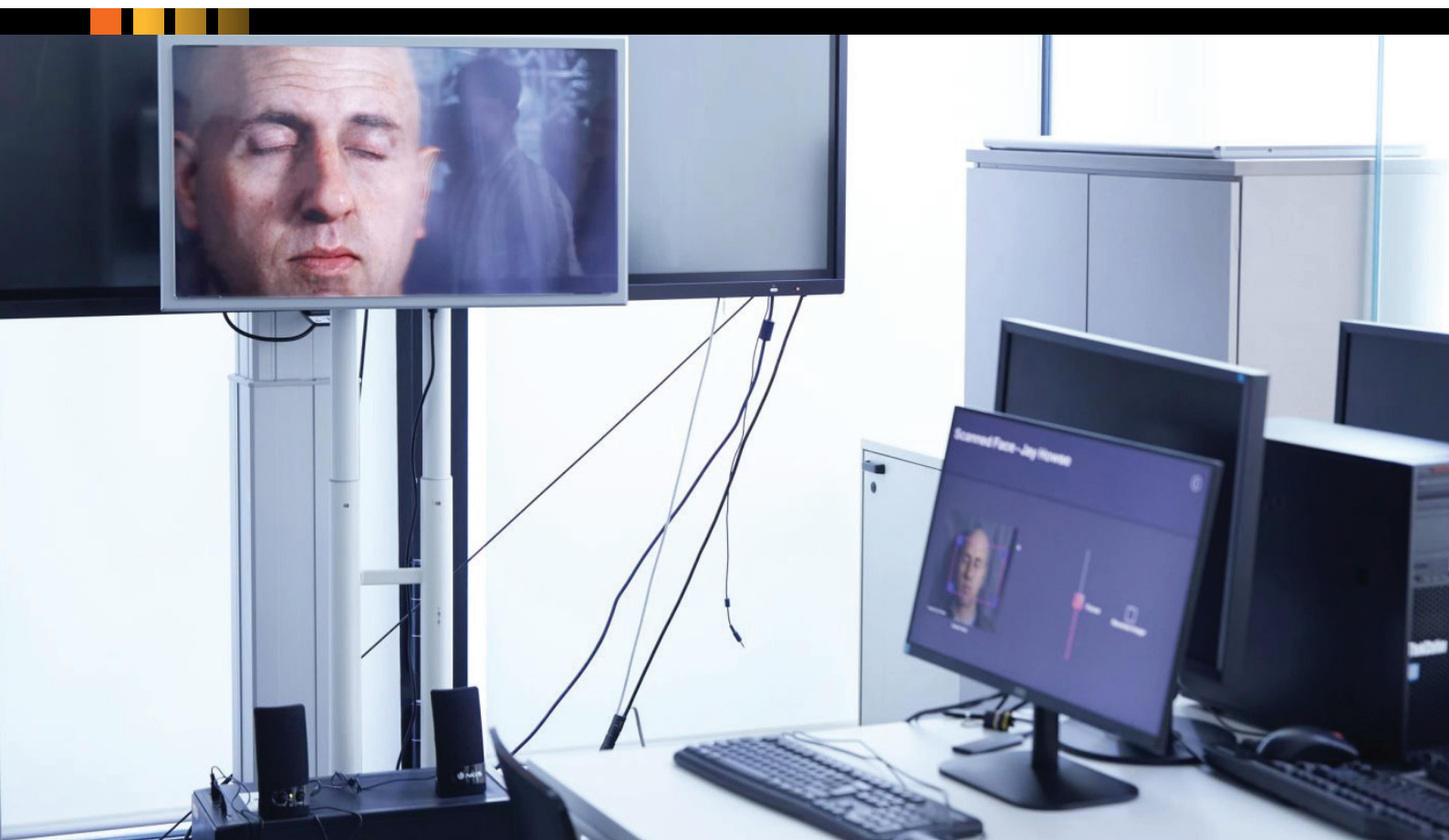
"Barcelona City Council's commitment to innovation and leadership in the technology sector has led us to this pioneering use of 5G technology and holograms to revolutionise training and open new business models for companies," says Sara Díaz, Director of Digital Talent at Barcelona Activa. "Barcelona is the third most important European city in terms of digital innovation and, thanks to these and other implementations, the city is cementing its leadership as a tech capital."

Exploring the versatility of standalone 5G

The advanced standalone 5G network being used for the 5G Catalunya project was designed and deployed by Cellnex, supported by Lenovo's edge computing solutions. The 5G standalone core enables the partners to harness the low latency and high throughput of a pure 5G architecture.
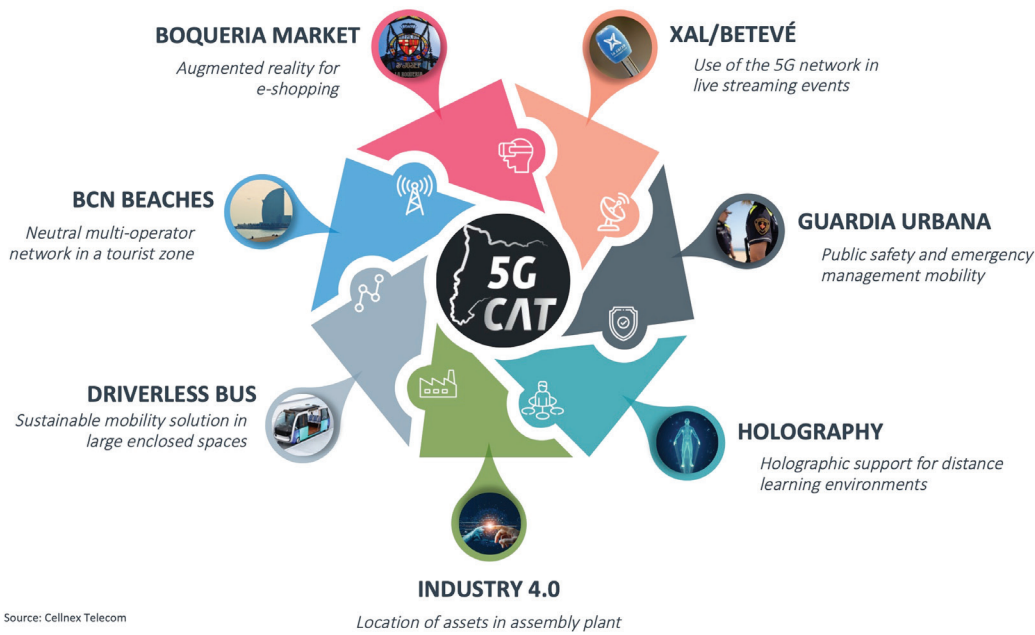
Cellnex is using the open RAN (radio access network) architecture in the seven base stations it has deployed in different locations across Barcelona to test different use cases (see graphic). The other use cases encompass automated transportation, augmented shopping, manufacturing applications, HD audio-visual transmission, security and emergency management and robust connectivity in tourist areas that see large numbers of seasonal visitors. Each of the base stations is supported by an edge data centre that is located close to the antenna to reduce latency.

Cellnex built the network specifically for the 5G Catalunya project, which is supported by Red.es (an entity attached to the Spanish Ministry of Economic Affairs and Digital Transformation). It involves a consortium of eight companies led by Cellnex and the Masmovil Group. Parlem Telecom, Aumenta Solutions, the engineering company Atos, the consultancy Nae,

5G Catalunya

5GCAT - Use Cases, Associated Technologies & Partners

Source: Cellnex Telecom

BOQUERIA MARKET
Augmented reality for
e-shopping

XAL/BETEVÉ
Use of the 5G network in
live streaming events

BCN BEACHES
Neutral multi-operator
network in a tourist zone

GUARDIA URBANA
Public safety and emergency
management mobility

DRIVERLESS BUS
Sustainable mobility solution in
large enclosed spaces

HOLOGRAPHY
Holographic support for distance
learning environments

INDUSTRY 4.0
Location of assets in assembly plant

---

the technology company Lenovo and the start-up Nearby Computing, a spin-off of the Barcelona Supercomputing Center, are also supporting the project, which is co-financed by the European Regional Development Fund.

Lara Rubianes, secretary of the 5G Pilot Monitoring Committee of the Red.es Digital Public Services Directorate, notes that "holographic support for distance learning environments is an example of the multiple real and sectorial applications of 5G [...] designing the use cases together with the end users, which was one of the objectives of the call, allows us to gauge how mature and appropriate these solutions are before we develop any future new services."

By proving the viability of a wide range of use cases, Cellnex is aiming to help mobile operators to make a return on their 5G investments. "5G pushes for a technology ramp up with high complexity and scale, which requires mobile operators to make high capex investments in new infrastructure," says Jose Antonio Aranda Legazpe. "Over the last few years, the ARPU (average revenue per user) has been decreasing, which aggravates mobile operators' pressure to find monetizing solutions."

One way to improve the economics of 5G is for multiple mobile operators to share infrastructure. Through a neutral host model, supporting infrastructure sharing of both active and passive infrastructure, Cellnex is looking to give operators the flexibility they need to support a wide range of 5G use cases.

In a speech in April 2022, Alberto Martínez Lacambra, General Director of Red.es, described 5G as "a technology with a transformative power that will mark a revolution and is an essential vector in the digitalisation drive envisaged in the Spanish Government's Recovery, Transformation and Resilience Plan and is one of the pillars of the Digital Spain 2025 strategy."

> Through a neutral host model, supporting infrastructure sharing, Cellnex is looking to give operators the flexibility they need to support a wide range of 5G use cases.

Jose Antonio Aranda Legazp - Product Strategy and Innovation Director at Cellnex Telecom

About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

For more information, please visit the GSMA corporate website at gsma.com

Follow the GSMA on Twitter: @GSMA.

About the GSMA Foundry

The GSMA Foundry is the go-to place for cross-industry collaboration and making positive change happen, supported by leading technology organisations and companies. By bringing together members and key industry players, engaging, and unifying the end-to-end connectivity ecosystem, the GSMA is solving real-world industry challenges.

Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. This enables the mobile industry's mission: to connect everyone and everything to a better future.

Find out more, or submit a new project idea, at gsma.com/Foundry

About Cellnex Telecom

The efficient deployment of next-generation connectivity is essential to drive technological innovation and accelerate inclusive economic growth. Cellnex Telecom is the independent wireless telecommunications and broadcasting infrastructures operator that enables operators to access Europe's most extensive network of advanced telecommunications infrastructures on a shared-use basis, helping to reduce access barriers for new operators and to improve services in the most remote areas.

Cellnex manages a portfolio than 138,000 sites –including forecast roll-outs up to 2030– in Spain, Italy, the Netherlands, France, Switzerland, the United Kingdom, Ireland, Portugal, Austria, Denmark, Sweden and Poland. 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 100 indices. It is also present in the main sustainability indices, such as Carbon Disclosure Project (CDP), Sustainalytics, FTSE4Good and MSCI.

https://www.cellnex.com/

About this case study