Ericsson and CTTC partner for researching and addressing the challenges of massive network slicing for advanced 5G and 6G networks

Ericsson and CTTC (Centre Tecnològic de Telecommunications de Catalunya) will partner on long-term research projects focused on crucial aspects of 5G evolution, as part of the UNICO I+D program launched by the Spanish Ministry of Economy and Digital Transformation and backed by NextGeneration EU. Through a tight collaboration articulated in two large and complementary research projects, 6G-DAWN and 6G-BLUR, Ericsson and CTTC shall jointly address major technological challenges behind the implementation and scaling of Massive Network Slicing.

Focused research and innovation to enable Communication Service Providers (CSPs) to dramatically stretch and scale their Network Slicing capabilities to provide tailored connectivity services to hundreds and then thousands of large, mid-sized, and small enterprises, are essential for catalyzing the **transition from the early network slicing deployments of today to the massive network slicing scenarios ahead of us**.

For that reason, in the 6G-DAWN and 6G-BLUR projects, Ericsson and CTTC zero in on scenarios of massive network slicing for non-public networks (NPNs) connected to public networks. The research will investigate how to best manage the network complexity that will come from a public network (operated by CSPs) which may need to run multiple heterogeneous end-to-end network slices to support NPNs.

This joint research initiative of CTTC and Ericsson, carried out in the framework of the 6G-DAWN and 6G-BLUR projects, aims at leveraging and evolving 5G standards for securing both **interoperability and economies of scale of innovative solutions for enabling massive network slicing.** The project seeks to develop significant enhancements in four key areas of technology: flexibility; sustainability; zero-touch automation and resiliency of advanced 5G networks, now and through their evolution to 6G.

First, a high degree of flexibility for the distribution of network and computing resources is envisioned and encouraged to secure both **a best fit of network performance levels to the demands of the subscribers and an optimal utilization of network resources** for making massive network slicing a sustainable business. A range of alternative scenarios for optimally distributing 5G network functions and leveraging edge computing across interconnected 5G public networks and non-public networks shall be evaluated.

Secondly, the fast expansion of 5G infrastructures and services calls for **innovative solutions for minimizing the consumption of energy and improving overall sustainability** across the full network from the 5G network core through the edge and the RAN and the user equipment. Beyond the intrinsic enhancements that 5G technology brings over previous mobile network standards in the aspect of energy efficiency, this initiative looks into further end-to-end approaches for specific applicability to 5G non-public network environments, leveraging 3GPP standards such as those covering PNI-NPN architectural patterns as well as major technology trends like Deep Learning.

Thirdly, embracing **Zero-Touch automation approaches shall be crucial for reducing the lead times for launching new NPN services**. The ambition for this cooperative research project is that a 5G NPN equipped with Zero-Touch capabilities will automatically connect and adapt to the public network and edge environment and will self-configure for meeting expected performance levels – all of it happening at NPN start-up time. In support of this ambition, network Digital Twin technologies shall be leveraged and evolved.

Finally, safeguarding **end-to-end network resiliency** is of utmost relevance to all stakeholders in the addressed NPN scenarios, including CSPs and enterprise businesses/users. At all segments across the 5G/6G chain, at all moments, and for all types of conditions, advanced 5G networks shall be equipped with automated and proactive mechanisms to **detect, predict, and prevent situations of potential network service unavailability or degradation.** Advanced Machine Learning algorithms shall be heavily leveraged for this purpose, with a focus on the timely detection of anomalies that might lead to compromised critical KPIs of resiliency and integrity of the network.

One of the fundamental goals of the UNICO I+D program is to create a long-lasting 5G/6G Spanish innovation ecosystem. For this reason, along this joint research journey of CTTC and Ericsson, several challenges, trade-offs, constraints, and innovative approaches shall be looked into. It will drive the specification and validation of a set of robust design and architectural principles as well as delivering first technical implementations through high-impact Proofs of Concept (PoCs). All outcomes will be shared with the Spanish and European 5G and 6G research and industry ecosystem, as enabler of the envisioned long-lasting industry-academia ecosystem creation.

Manuel Lorenzo, Head of Technology and Innovation at Ericsson Spain, says: "The increased adoption of 5G by innovative services, becoming the technology of choice supporting more and more diverse use cases, business needs and user segments, is a global trend we are witnessing. 5G is becoming a widely used and spread technology with the potential to connect every person, business and machine in every corner of the world. Going forward, the expected demand for growth and scale of advanced 5G deployments calls, in its turn, for new research and innovation in end-to-end aspects of the architectural evolution of 5G to 6G. That is why Ericsson and CTTC are jointly addressing challenges for advanced 5G networks related to flexibility, sustainability, zero-touch automation and resiliency, within the 6G-BLUR

and 6G-DAWN projects sponsored by the Spanish Ministry of Economy and Digital Transformation".

Josep Mangues-Bafalluy, Head of the Services as networkS (SaS) research unit of CTTC, and co-Principal Investigator of the 6G-BLUR and 6G-DAWN projects, says: "The 6G-DAWN and 6G-BLUR projects fully embed the spirit of the UNICO I+D program in the sense that we see it as the seed for the creation of an advanced 5G and 6G industry-academia ecosystem through the leadership of Spanish R&D research groups, in this case through a collaboration between the Ericsson and CTTC groups. There is a successful past track record of collaboration between Ericsson and CTTC and this only comes to strengthen the relationship in topics that have a high potential in transforming the way mobile networks are handled at scale, including network slicing, NPN integration, energy efficiency, and zero-touch network automation through the application of a variety of artificial intelligence techniques. Through the project outcomes, we are working together to have a long-lasting impact in the research and industrial 5G and 6G communities."

Network Slicing as a key enabler of new services in Non-Public Networks (NPN):

5G standards revolutionized the role of mobile networks with the introduction of network slicing capabilities. Network slicing makes it possible to, over common and standard mobile network technology infrastructure, create a set of distinct and specialized connectivity services - called network slices – which can be delivered to different users.

Now we are seeing an increase globally in 5G network deployments, with these new networks expected to reach more and more varied types of businesses, users, and devices. This will come with a broad range of heterogeneous needs and demands on the network. This is especially the case for the envisaged scenario of proliferation of virtual 5G private network services - called non-public networks (NPN) in 3GPP terminology - that rely on 5G public networks and pervasive application of network slicing. Network slicing is the key enabler in these non-public networks that will ensure tailored network services, optimized resource allocation, and enhanced security for diverse use cases and business needs.

As 5G network deployments evolve, CSPs who operate the networks will have to dramatically expand their network slicing capabilities to provide these vital tools and services to thousands of enterprises of all sizes – the size and complexity of the requirements here lead to the term massive network slicing. New paradigms will have to emerge for overcoming and managing the intrinsic complexity of massive network slicing in such a fast-growing market which analyst organization IDC estimates will expand at CAGR of 35.7%, from 2022 to 2026.

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The Centre Tecnològic de Telecomunicacions de Catalunya (CTTC) is a non-profit R&D center established by the Government of Catalonia in 2001. Fundamental and applied research, as well as technology transfer activities mainly focus on communication technologies, service and communication infrastructure, and geomatics. The CTTC offers an extensive portfolio of (i) research and innovation services (incl. R&D&i contracts, technology alliances, standards

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