UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

# [ MOBILE TECHNOLOGIES ]

# RESEARCH, DEVELOPMENT & INNOVATION AT THE UNIVERSITAT POLITÈCNICA DE CATALUNYA - BARCELONATECH (UPC)

The Universitat Politècnica de Catalunya - BarcelonaTech (UPC) specialises in the fields of engineering, architecture, science, and technology, including technologies applied to connectivity and to mobile technologies. In this field, the main focus areas are:

- Advanced connectivity and 6G
- Artificial Intelligence of Things (AIoT) and distributed connectivity
- Security and network resilience
- Energy efficiency
- Intelligent computing and cognitive systems
- Satellite communications
- Infrastructures and laboratories
- Quantum computing

As a result of the UPC's recognised research track record in its areas of specialisation, we can offer a wide range of services:

- R&D technology transfer projects
- Consortia for national and Horizon Europe projects
- Patents
- Technology assessment
- Specialised facilities

The UPC is a leading university in Spain in volume of research and technology transfer to companies, and has become one of the major hubs of knowledge in Southern Europe.

# ADVANCED CONNECTIVITY AND 6G

- Management with generative AI. Autonomous network orchestration through large-scale language models (LLMs) and intent-based networks.
- Deterministic networks. Design of multi-agent control planes based on AI to guarantee communications with near-zero latency and Ultra-High Reliability in geographically distributed networks.
- Fibre-Radio convergence: development of infrastructures integrating programmable optical fronthaul and wireless access in millimetre bands (FR2, 26 GHz) for connected mobility.
- Open infrastructures. Laboratories and testbeds based on open architectures (O-RAN) and open-source software.
- Multi-element antennas with technology based on beamforming.
- Management of interference in communications and in information processing.
- Signal protocol models to improve the efficiency of handover mechanisms through software-defined networks (SDN).
- Graphene and wireless microantennas that can operate in the terahertz band.

# ARTIFICIAL INTELLIGENCE OF THINGS (AIoT) AND DISTRIBUTED CONNECTIVITY

- Aerial and Non-Terrestrial IoT (NTN). Use of drones (UAVs) as flying base stations and intelligent relays to integrate the Internet of Everything into cellular and satellite networks.
- Marine and underwater IoT. Development of autonomous underwater node networks with bidirectional acoustic communication and embedded AI for environmental monitoring.
- Data improvement in IoT. Machine learning to optimise data quality in low-cost sensor networks, improving measurement accuracy.
- IoT mesh networks with low-power radios.
- Data modulation of wifi devices for communications with non-wifi devices.

TECNOLOGÍAS

## SECURITY AND NETWORK RESILIENCE

- Design of advanced, modular and open security systems in multi-domain environments in 6G ecosystems.
- Cybersecurity in the cloud continuum environment.
- Proactive security and digital twins.
- Algorithms for the detection of cyber-physical attacks.
- Intrusion detection system (IDS) and intrusion prevention system (IPS).
- More efficient and secure hardware security systems for memory devices (memristors).


## ENERGY EFFICIENCY

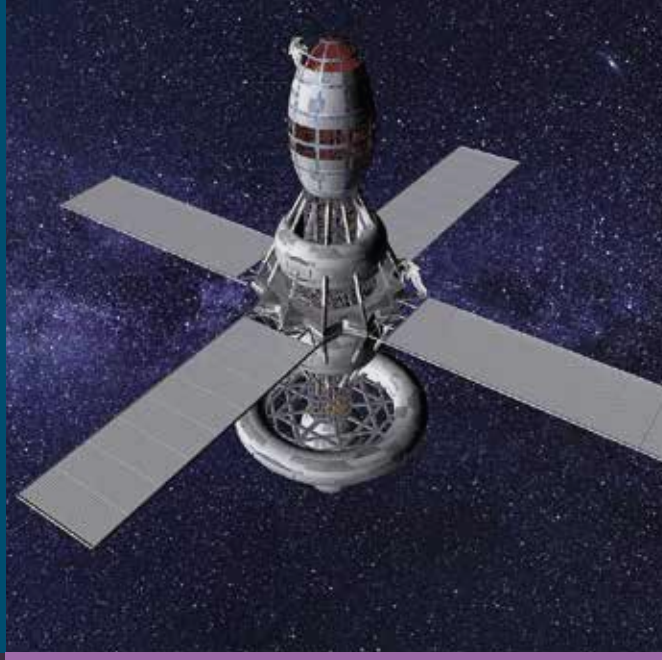
- Algorithms for energy optimisation for 5G networks.
- Low-cost radiofrequency links with low energy consumption.
- Faster and lower energy consumption processors for artificial intelligence and autonomous learning.
- Systems for evaluating and improving energy efficiency and performance associated with AI.

## INTELLIGENT COMPUTING AND COGNITIVE SYSTEMS

- Cloud/Edge/Fog Continuum: Management of computational resources from the device (edge) to the cloud to reduce latencies.
- Automated Regulatory Compliance: AI-based frameworks for regulatory compliance and digital certification (Compliance Digital Passport) in regulated data spaces.
- Efficient processors for intelligent computing systems capable of carrying out cognitive functions.
- Advanced management and control of systems for 5G networks.
- Optimisation of massive communications with multiple inputs and multiple outputs (MIMO).
- Autonomous adaptation in wireless networks.

## SATELLITE COMMUNICATIONS

- Instant, precise and reliable positioning methods based on GNSS signals.
- Development and integration of payloads based on GNSS-Reflectometry (GNSS-R) for nanosatellites.
- Development and integration of communication subsystems for nanosatellites and their links (satellites and ground station).
- Environmental testing and test of nanosatellites and subsystems through cleanroom facilities, thermal-vacuum chamber and vibration systems.

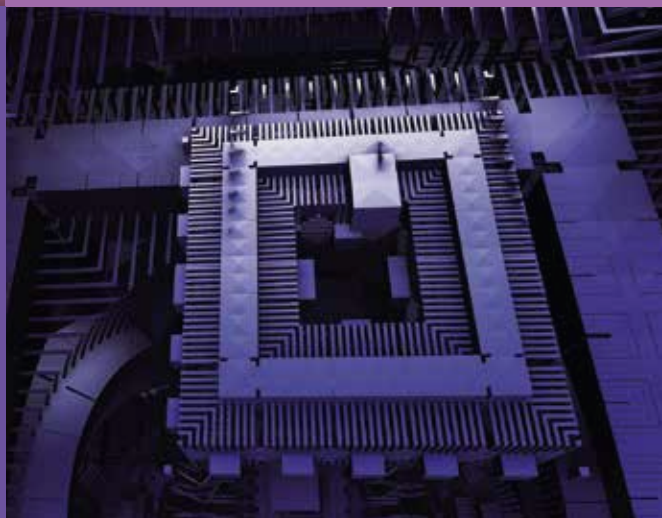


## INFRASTRUCTURES AND LABORATORIES

- 6G LABNET UPC: Infrastructure for the experimentation and validation of technologies and services using next-generation networks in a real-world environment spanning more than 30 km.
- UPCxels: An open, multi-sector data space for creating value from information.
- OBSEA: Submarine scientific, cabled and multiparametric laboratory for real-time marine observation.

## QUANTUM COMPUTING

- Development and integration of Quantum Key Distribution (QKD)
- Services in 6G satellite networks.
- Post-quantum cryptography.
- Architectures for quantum processors



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