

## 3 6G networks and edge computing

### Abstract

6G networks are expected to converge towards highly distributed communication networks natively embedding (edge) computing and storage resources, which will serve diverse applications with demanding QoS requirements, such as ultra-low latency and ultra-high reliability. The functions integrated in 6G networks will include distributed computing, network and devices resource optimisation, advanced integration of heterogeneous wireless technologies. This makes 6G networks much more than “efficient communication pipes”, calling for novel approaches to design them.

### Topic 3.1: Network slicing and edge resource orchestration in 6G systems

We are looking for a post-doc researcher working on the design of end-to-end management and orchestration approaches for B5G/6G systems that can serve a massive number of extremely heterogeneous and dynamic network slices that cross multiple technological domains (i.e., device, RAN, core, edge, and cloud) in highly dynamic and uncertain environments. A special emphasis will be dedicated to use cases where applications require the collection and cooperative processing of multiple real-time data streams from dispersed IoT devices. The main tasks will include: (i) design and performance evaluation of AI/ML-driven energy-efficient network and orchestration algorithms for B5G/6G networks; (ii) design of protocols and APIs to integrate the proposed approaches in the ETSI reference architecture for orchestration, network and service management (MANO, NFV, ZSM, etc.), (iii) publication of high-quality scientific articles in international conferences and journals, and (iv) participation in technical meetings for R&D international projects, with travels in EU countries.

### Topic 3.2: Cooperative Ubiquitous Opportunistic Charging with Intelligent Battery Aging Mitigation

Battery aging (the loss of battery's capacity and internal resistance growth) is an emerging challenge for portable devices carried by mobile users. Due to the fact that newer consumer electronic devices are becoming more feature-rich and resource demanding, they are subjected to more charge-discharge cycles compared to their older counterparts; a pattern which increases their battery aging, and enables them to require higher power and more expensive and bigger batteries. Individualized battery aging mitigation and user profiling, which do not take into account neither other users in the networked population nor emerging energy sharing technologies like peer-to-peer wireless power transfer, are not uncovering the full potential of intelligent charging. We are looking for a post-doc to work on the algorithmic design and performance evaluation of large-scale ubiquitous (wireless and/or wired) charging intelligence protocols in order to cooperatively mitigate battery aging, radically optimize energy redistributions, and unorthodoxically increase user quality of experience.

### Topic 3.3: ServerlessOnEdge 2.0: reliable, faster, & better FaaS at the edge

*Topic type: Research assistant (graduate) or post-doc for 1 year*

[ServerlessOnEdge](#) is an ongoing research effort that aims at realising serverless computing in edge networks, compatible with the [ETSI MEC](#) reference architecture for edge computing. The function invocations are transported by HTTP/2 connections using [Google's gRPC](#). A preliminary support of [HTTP/3+QUIC](#) using Facebook [mvfst](#) () and [proxygen](#) has been added recently, but it does not allow

function invocations to be mapped to independent streams nor support client roaming. We are looking for a graduate student or a post-doc who will be working on overcoming these shortcomings by extending the QUIC support in ServerlessOnEdge: this will increase the reliability with unstable client connectivity, reduce function invocation tail latencies, and enhance service continuity. Two grants have been awarded for this research activity: IIT Innovation Grant 2021, [Facebook Research Award 2021](#) in the area of "Internet and web services". The research activities will contribute to the developments within the Horizon Europe EDGELESS project.

## Candidate profile

Ideal candidates should have or about to obtain a MSc degree (for the PhD level) or PhD degree (for the Post-doc level) in Computer Science, Computer Engineering, Communications Engineering, Mathematics, or closely related disciplines, and a proven track record of excellent University grades (PhD level) or of publications in relevant top-tier conferences and journals (Post-doc level). Preferably, the topic of the MSc/PhD thesis should be in one of the relevant research areas

- Topic 3.1: network virtualization (NFV), 5G-based network slicing, SDN-based networking, applied AI/ML for ICT
- Topic 3.2: Theoretical modeling, network-wide algorithmic design, intelligent computing, simulations, real-device experimentation
- Topic 3.3: network protocol implementation, cloud-native architectures, C++ programming

Good written and spoken communication skills in English are required.

## Contacts

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