Financiado por la Unión Europea
NextGenerationEU

MINISTERIO DE ASUNTOS ECONÓMICOS Y TRANSFORMACIÓN DIGITAL

Plan de Recuperación, Transformación y Resiliencia

E1. Project Plan

Project: MAP-6G

PROGRAMA DE UNIVERSALIZACIÓN DE INFRAESTRUCTURAS DIGITALES PARA LA COHESIÓN

UNICO I+D 5G 2021

Fecha: 31/08/2022

Versión: 1.0

1. Deliverable information

Description: Revision of the project vision, considering first results generated within the project, other relevant scientific, technological or market developments, including scenario and use case definitions, requirements, KPI and evaluation criteria.

Due date: 31/08/2022

Responsible: IMDEA Networks

Partners involved: IMDEA Networks

2. Project plan

The commercial deployment and subscription of the fifth generation (5G) is taking shape worldwide, and the vision of the evolution of 5G into the sixth generation (6G) is now being discussed. Already there is a strong expectation that communication systems beyond 5G will not just be a simple upgrade of 5G, hence several ideas such as integrating communications, sensing, and computing capabilities into future communication systems have been proposed.

Though these ideas are at an early stage of conceptualization, one thing that is known for sure is that beyond 5G wireless communication systems will expand towards even higher frequencies, I.e., mmWave and THz spectrum bands to mainly satisfy the high data rate demands.

The higher frequencies will not only significantly improve network performance but will also enable several orders of magnitude of high localization accuracy and lower latency than prior technologies.

Though 6G mobile networks will go far beyond the use cases that can be covered by 5G, and so will be the threat of privacy.

Hence*, the overall vision of MAP-6G is to integrate communication with big data analytics for applications such as localization, with privacy-preserving solutions by design, which will help us achieve the goals outlined in activities A3,* A4, A5, and A8*.*

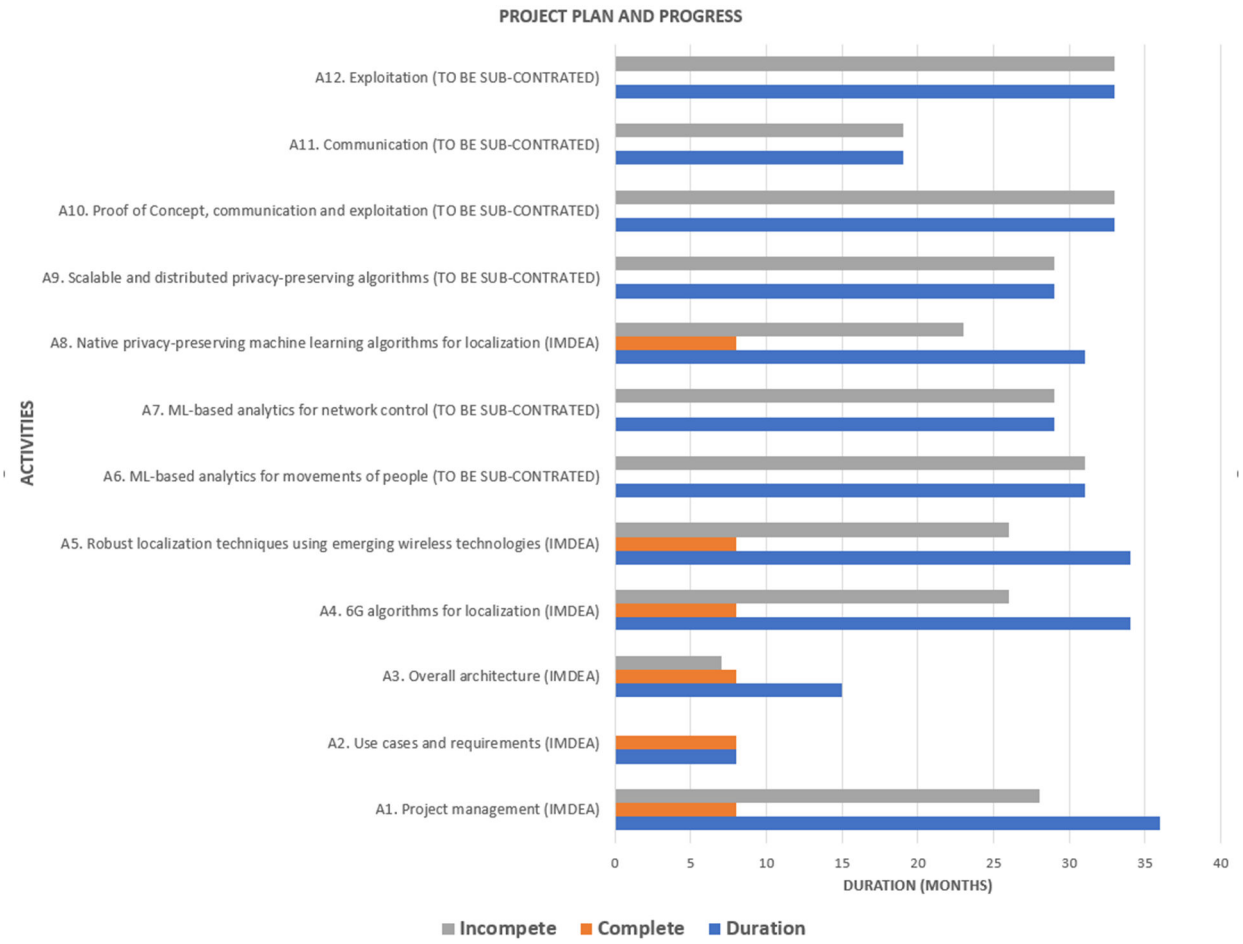

Figure 1: Project plan and status of the work packages activities as of August 2022

Regarding the project plan, in Figure 1, we show the status of the different activities that have been planned in the project. As it has been illustrated, some activities have started, and others are yet to start, while others are to be sub-contracted. In the following section, non-technical and technical plans of the project are discussed.

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2.1. Non-technical aspects,

The project begins by setting up project management tasks like creating mailing lists and shared folders, scheduling regular project meetings, and preparing tenders for sub-contracting activities. These activities are based on the inputs of activity A1.

Tenders are to be advertised to sub-contract activities A6, A7, A9, A10, A11, and A12 as per the project proposal, and industry sub-contractors are to be recruited via a highly competitive process.

Later, a kick-off meeting for the project will be organised to kick-start the collaboration with the sub-contractors

2.2. Technical aspects,

The project will begin by investigating the potential and opportunities of state of art systems as inputs to activities A2 and A8 and designing the testbed reference architecture for localization and machine learning based analytics, as inputs to activities A4, A5, and A8. The planned work is crucial for learning technologies used in the spectrum while preserving privacy of users, but also in learning the methodologies which can be applied in the context of emerging 6G architectures including concepts such as O-RAN and federated learning. Here we present our planned activities:

a) Examining the current spectrum sensing systems

Considering that 6G networks will need to operate alongside existing other RAN technologies such as 4G/5G and Wi-Fi networks, as well as incorporate intelligence in spectrum utilization, there is a need to investigate the potential and opportunities of state of art spectrum sensing systems.

We observe that the present techniques for labelling spectrum data do not operate in real-time, which may not meet the demands of 6G. In addition, spectrum sensing systems are inefficient in categorizing the entire spectrum range in terms of storage and computation, and they also fail to distinguish between different RAN technologies that use the same modulation scheme.

We plan to perform a comprehensive assessment of measurements obtained from a spectrum crowdsensing systems. The evaluation will comprise of several considerations, such as uplink data magnitude, real-time assistance, compression algorithm, computational expenses, spectrum utilization, storage prerequisites, latency, and classification precision.

In addition, we plan to develop a framework that achieves an average classification accuracy of up to 94%, and a maximum latency of under 4 seconds when integrated into the backend of a significant crowdsensing network. Further, we plan to propose a deep learning framework that enables intelligent classification of wireless RAN technologies in spectrum crowdsensing systems.

b) Building a 5G/6G OperAirInterface testbed for experimentations

Regarding research on 5G technology, despite multiple 5G specification releases following Release 16, there is a scarcity of 5G experimentation as the majority of studies depend on simulations. To support our experimental work and validate theoretical findings, we plan to construct a comprehensive 5G testbed utilizing open-source solutions, specifically OpenAirInterface. This testbed will be equipped to conduct localization measurements between the 5G base station and User Equipment (UEs) and will incorporate high-performance hardware such as the Ettus N310 USRPs and high-clock frequency servers. OpenAirInterface is the most advanced open-source software available for cellular networks and will be used to configure the testbed. We will save the reference signals and channel estimations for online analysis and machine learning-based analytics.

To implement the activities (4, 5, 8) in Figure 1, the plan is to use our 5G testbed as a contributor to the data that will be used in designing and testing of 6G algorithms for localization, implementing robust localization techniques using emerging wireless technologies, creating native privacy-preserving machine learning

algorithms for localization.

3. Subcontracting plan

Report on the bidding process for MAP-6G.

The Ministry of Economy and Digital Transformation published the model specifications for the tenders corresponding to the UNICO subprojects in March 2022. The first template included some mistakes that were fixed in the following months, so we couldn't complete the bidding documents for MAP-6G until the end of June.

Tender announcement: The date of publication of the contract notice has been fixed in various sources:

- Portal de la Contratación de la Comunidad de Madrid: July 5, 2022.
- Diario Oficial de la Unión Europea: July 8, 2022.
- Boletín Oficial de la Comunidad de Madrid: July 15, 2022.

Lots offered: 4 for RISC-6G.

Approval: The estimated date of approval of the award by the Delegate Commission (Region of Madrid) and the Secretaría de Estado de Telecomunicaciones is in October 2022.

Assignment and Commencement of Tasks: The award is expected for October or November 2022, and the corresponding tasks are expected to start in late 2022 or early 2023.

Work report delivery dates: Despite the delay in the bidding process, the delivery dates of the work reports of the subcontracted companies are maintained in order to continue with the project deliverables plan without changes.

In conclusion, the bidding process for MAP-6G is expected to progress as planned, with the awarding of the lots in October or November 2022, and the start of the corresponding tasks by the end of 2022 or beginning of 2023. Despite the delays in the process, it is expected that the delivery dates of the work reports of the subcontracted companies will be met.