NEWSLETTER #1

CONVERGE-PROJECT.EU

CONVERGE
view-to-communicate and communicate-to-view

Co-funded by the European Union

CONVERGE project has received funding under the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101094831, including top-up funding by UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee.

Milestones & Highlights

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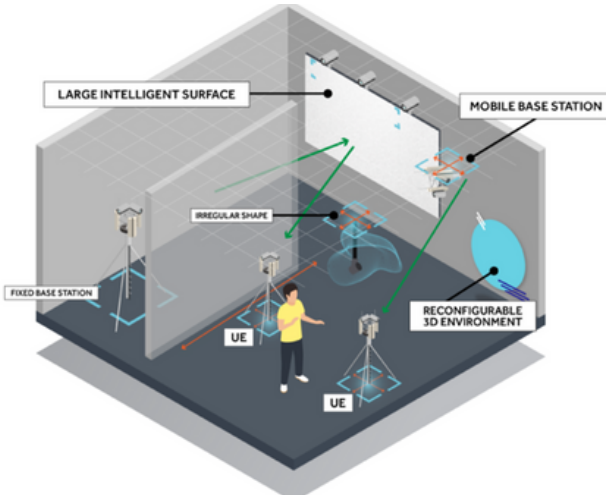
Project Overview

The CONVERGE project is uniting the previously separate fields of telecommunications and computer vision, spurred by new mm-wave communications. This fusion will exploit computer vision for wireless channel management and create detailed 3D maps for better localization and sensing. Conversely, radio sensing could make computer vision more reliable in challenging conditions. CONVERGE is creating a comprehensive set of tools that include vision-enhanced intelligent surfaces, base stations, simulators, modelers, and machine learning algorithms to process various data types. These innovations aim to boost the capabilities of European research infrastructures.

This is the first newsletter of CONVERGE, which from now on will be released every 6 months. We bring you some of the key achievements of the project in its first year, as well as a flavour of some of our plans going forward."



COONVERGE Chamber

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Kick-Off Meeting in Porto Portugal

The CONVERGE project kicked off on February 3, 2023, in Porto, aiming to develop a set of innovative tools to support research infrastructures.

The project CONVERGE – Telecommunications and Computer Vision Convergence Tools for Research Infrastructures, led by INESC TEC, aims to develop a set of innovative tools to support research infrastructures, over the next three years. In the future, research supported by these tools is expected to play a major role in the healthcare, industry, automotive, telecommunications and media sectors.

It is a new area of research that aims to generate knowledge from merging wireless communications, computer vision, sensing and machine learning. Concerning the CONVERGE project, Luís Pessoa, project coordinator, stated that "the goal is to develop a set of tools for research infrastructures that promote the creation of a new research area aligned with the see-to-communicate and communicate-to-see paradigm".

Through the combination of data generated by radiofrequency (RF) communications systems and video cameras, it will be possible "to obtain new datasets that will be made available openly to the scientific community, promoting the creation of new knowledge and new discoveries".
"Communications systems that operate in higher radio frequency bands will depend much more on the line-of-sight to operate. These systems will benefit from computer vision provided by video cameras to better predict the dynamics of the communications channel, like anticipating line-of-sight loss due to an obstacle, or helping build three-dimensional maps to improve mobile terminal position estimation". Moreover, the researcher mentioned that "computer vision applications may become more robust against challenges like occlusions or low light when supported by RF data".

This set of tools is unprecedented in the world; on the one hand, it will provide the scientific community with a series of exclusive and open data, and, on the other hand, it will improve the competitiveness of research infrastructures and the companies involved.

"The community, featuring thousands of users, will benefit from the results of CONVERGE over the next 10 years", said Manuel Ricardo, scientific coordinator of the project. Among the various expected results are the emergence of new areas of research, the development of new industrial applications capable of combining video information, sensing, radio and data traffic, and the improvement of the skills of employees, students and industrial users of research infrastructures, who will be trained to use the new set of tools.

Areas like healthcare, industry, the automotive sector, telecommunications and audio-visual content distribution services will be some of the main beneficiaries of the research supported by these tools, namely through the automatic assessment of patient posture and prosthesis alignment in physical rehabilitation (in the case of healthcare); better understanding of the factory floor (industry); improvement in the perception of the surrounding environment of the vehicle, as well as external conditions that may affect the quality of autonomous driving (concerning the automotive sector); the possibility of controlling the electromagnetic response of the environment, as well as high-precision location and sensing services of high-resolution 3D environment (telecommunications); and use of computer vision to help decrease computational complexity in the radio frequency modelling of objects and people (multimedia).

"Currently, only the COSMOS infrastructure (United States of America), a partner of the CONVERGE consortium, provides access to cameras as a way to enhance research that exploits the information captured by these equipment to better understand the surrounding environment, thus developing new paradigms and communications solutions", explained Luís Pessoa – emphasising that "these cameras do not have the same line of sight as the base stations, thus being unable to provide the complete repeatability and reproducibility that is sought in CONVERGE".

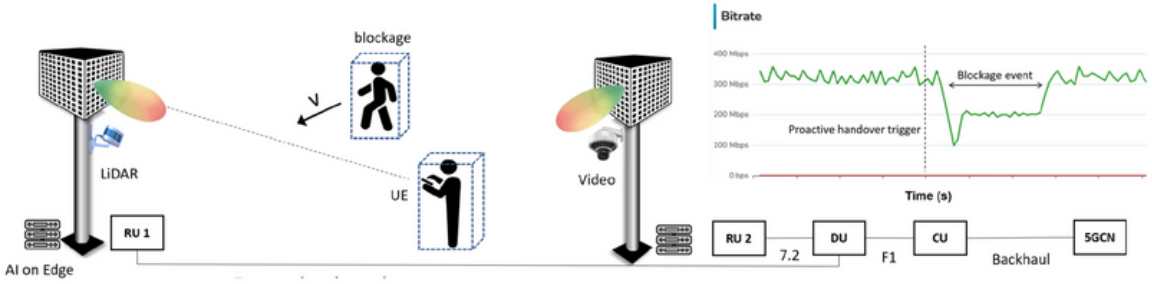
The CONVERGE project is coordinated by INESC TEC and features 15 more partners from six countries – Portugal, Finland, Spain, France, the United Kingdom, and the United States of America. The European Commission allocated €9M to fund the project.

Second Meeting in Sophia Antipoolis, France

The second in-person consortium meeting for the CONVERGE collaborative research project occurred on October 2nd and 3rd at the INRIA Lab in Sophia Antipolis, France. This gathering provided a comprehensive overview of the project's advancements, challenges, and future strategies. Led by Luis Pessoa of INESC TEC, the meeting delved into various aspects of project management, and essential discussions on technical aspects.

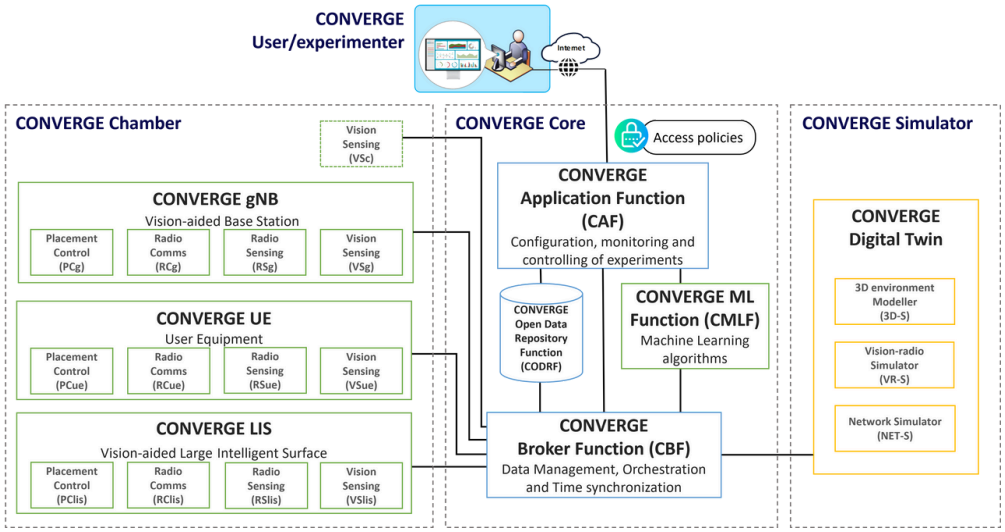
Use cases and high-level architecture specification (WP1)

WP1 has been initiated by identifying key use cases addressable by the project along five vertical markets: telecommunications, automotive, manufacturing, media, and health. It outlines the context, relevance, and applicable CONVERGE tools for each use case, alongside the specific challenges they address and the data types involved. For example, in telecommunications we have proposed a vision-aided proactive handover use case, where based on video cameras or LiDAR sensors deployed at 5G FR2 gNBs, a ML algorithm can predict mm-Wave signal blockage and trigger vison-aided proactive handover to another Radio Unit (RU).



CONVERGE vision-aided proactive handover use case.

WP1 defined the CONVERGE high-level architecture, consisting of three components: the CONVERGE Chamber for physical experiments, the CONVERGE Simulator for digital twin testing, and the CONVERGE Core for user interface, experiment control, storing datasets and ML model management. This setup facilitates both physical and virtual experiments, including equipment mobility, and ensures efficient interfacing and data management.



CONVERGE high-level architecture.

ICASSP2024 Workshop – Super-CLAM

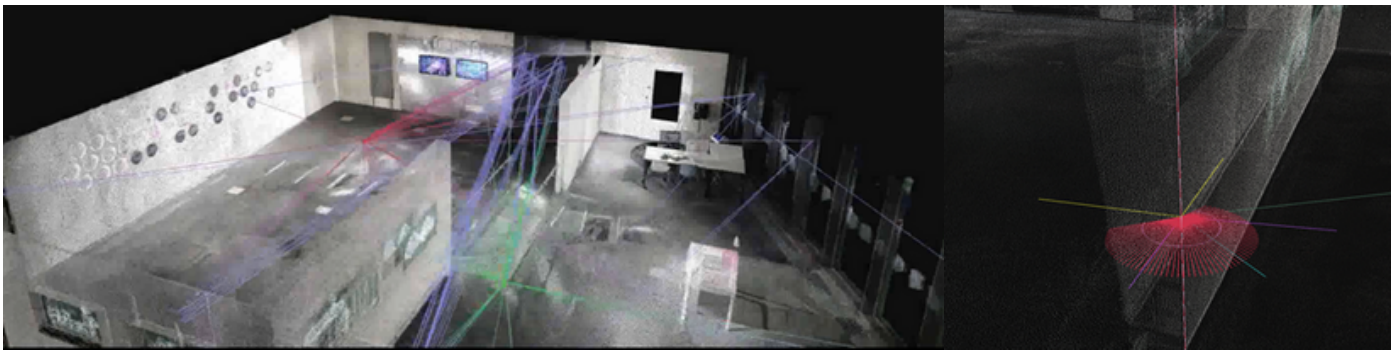
The Super-CLAM workshop, scheduled for Mon, 15 Apr, 08:30–12:00 (UTC +9) in South Korea, is organized by the EU projects CONVERGE and TERRAMETA. It covers topics related to integrated communications, localization, vision, and radio mapping.

Panel at IEEE GLOBECOM 2023

CONVERGE organized an industry panel entitled "Convergence of wireless communications and computer vision: a new paradigm created by the CONVERGE project," at the IEEE 2023 GLOBECOM in Kuala Lumpur, Malaysia, from 4th to 8th December 2023. The panel aimed at discussing new potential opportunities and challenges that can be anticipated by the usage of tools combining radio with computer vision, including potential contributions to science, standards, and industry verticals.

Innovations in Vision-Radio Simulation and 3D Modelling

Simulation of the propagation of radio waves in the mmWave range in multiple environmental conditions is becoming of vital importance. CONVERGE aims at facilitating a seamless transition between virtual and real tools by creating a "digital twin" of different experimental chambers. The simulator constructs a geometric 3D model, enriching it with electromagnetic characteristics that enable authentic simulations of both visual information and radio wave interactions. The novel vision-radio simulator leverages GPU-accelerated ray-tracing, aiming at granular computation of propagation paths and the accurate simulation of electromagnetic wave behaviours



CONVERGE will provide researchers with unparalleled tools for advanced planning of RIS-aided communications and sensing. The simulator acts as a virtual laboratory and a proving ground, facilitating a range of experiments that can overcome the limitation of physical chambers, ensuring that simulations for radio communications are precise replications of real-world conditions.

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