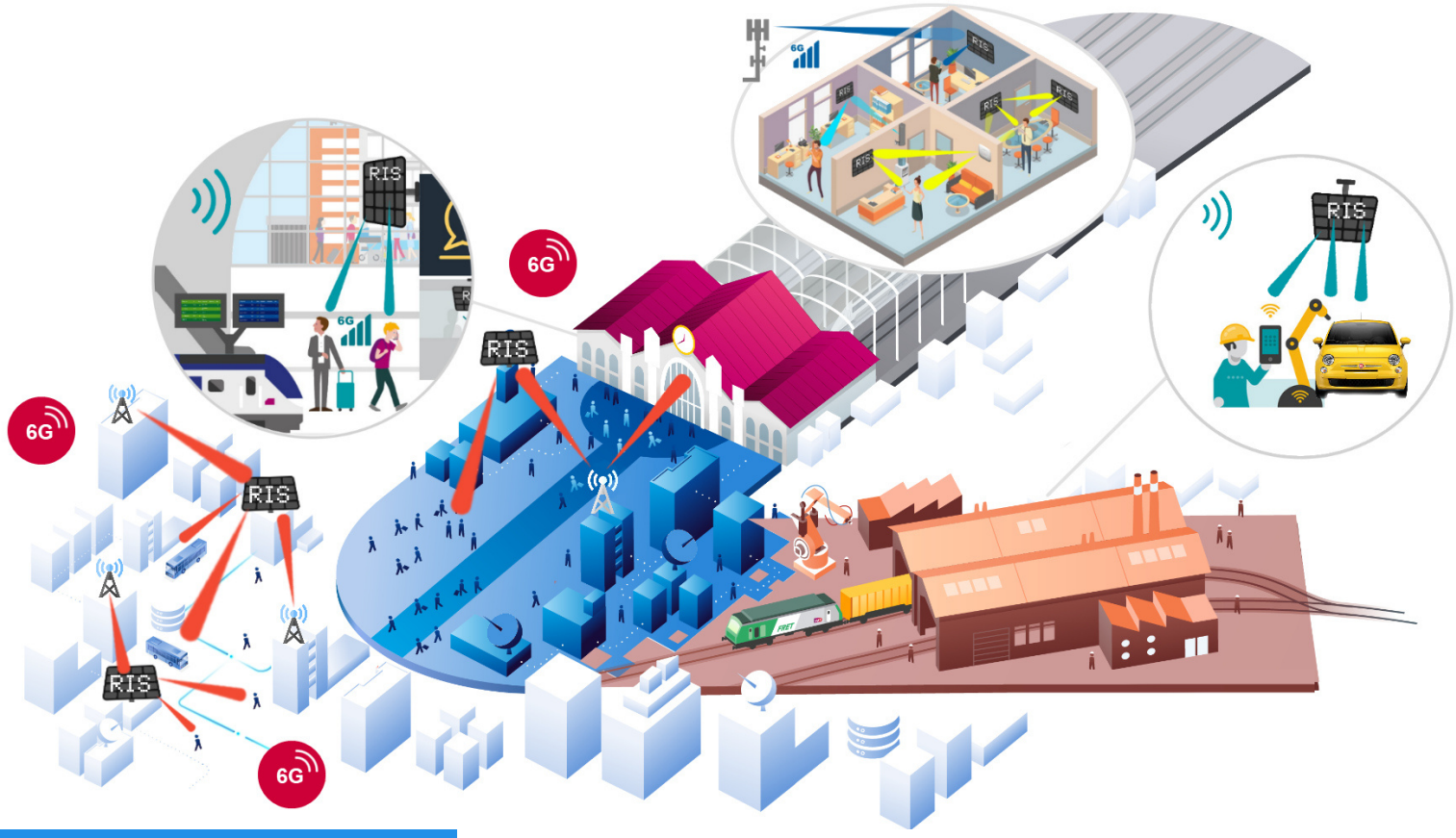
NEWSLETTER #02

JULY 2022

RISE-6G



PROJECT UPDATES IN NUMBERS

18
Deliverables

5
Plenary meetings

103
Publications

54
Dissemination actions

HALF-TERM TECHNICAL UPDATES

We are excited to announce that in June 2022 RISE-6G concluded the half term of its lifespan and operation!

The collective work of the partners has resulted in various technical contributions, each aligned toward the common defined objectives of the consortium, moving the idea of Reconfigurable Intelligent and Sustainable Environments (RISE) a step closer to its realisation. The technical advancements brought in the field of Reconfigurable Intelligent Surfaces (RISs) have been orchestrated under the technical Work Packages (WPs) of the project.

This Newsletter provides an update on the progress, outcomes, and advancements achieved by the active WPs. The issue presents an outline of the submitted deliverables from WP2 through WP6, along with their aim and scope. WP7 kickstarted recently with the complete definition of the project's field trials.

RISE-6G

https://rise-6g.eu/

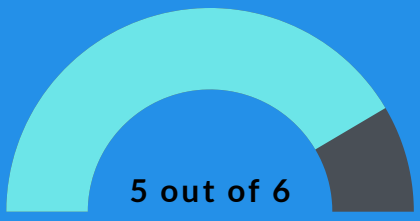
WORK PACKAGE 2

Goals

Investigate high relevance Beyond-5G (B5G) scenarios and use cases where the RIS technology can be successfully exploited.

Identify and define relevant performance metrics and target KPIs.

Perform closed-loop analysis jointly with the technical WPs in order to find the most suitable network architectures and deployment strategies which better exploit the RIS technology.



5 out of 6 deliverables completed

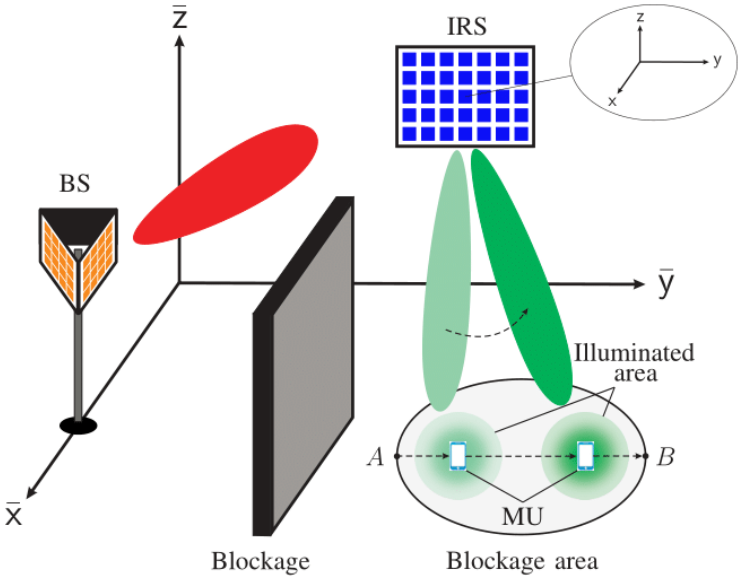
Scenarios, Use Cases and KPIs

Deliverables 2.1 and 2.3: ***"Reference system, scenarios and use cases analysis: final results" (initial & final results)***

- An analysis and characterisation of the reference scenarios has been carried out focusing on the technical challenges and requirements, as well as achievable performances.
- The use cases detailed have been explored within the project timeframe with the end goal of field-trial demonstrations.

Deliverables 2.2 and 2.4: ***"Metrics and KPIs for RISE wireless systems analysis" (initial & final Results)***

- Traditional and beyond-SoTA performance metrics and KPIs have been identified and proposed for utilisation from the WPs.
- The following central concepts have been introduced:
  - **Area of Influence:** An area of significant improvement of wireless connectivity boosted/enabled by the RIS technology.
  - **Bandwidth of Influence:** The frequency bandwidth in which any wave hitting the RIS gets reflected.



Deliverable 2.5: ***"RISE network architectures and deployment strategies analysis: First results"***

- Architectures of networks, environments, and RIS deployment strategies have been identified and designed.
- The deliverable serves as a harmonisation point between the intermediate contributions by the other technical WPs.

LEAD BENEFICIARY

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on behalf of

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WORK PACKAGE 3

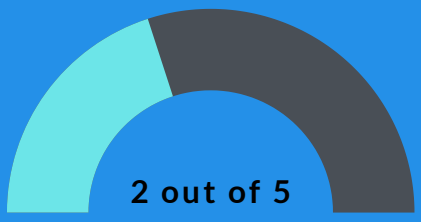
RIS Modelling, Design, and Characterisation

Goals

Propose an end-to-end electromagnetic model of the RIS unit elements and signal propagation using equivalent models and full-wave electromagnetic simulations.

Design, prototype, and characterise RIS hardware to cover different frequency bands within communication and localisation applications.

Sound real life RIS-empowered environments to develop realistic scenarios; where channel measurement will be performed in static and dynamic multipath conditions.



2 out of 5 deliverables completed

LEAD BENEFICIARY

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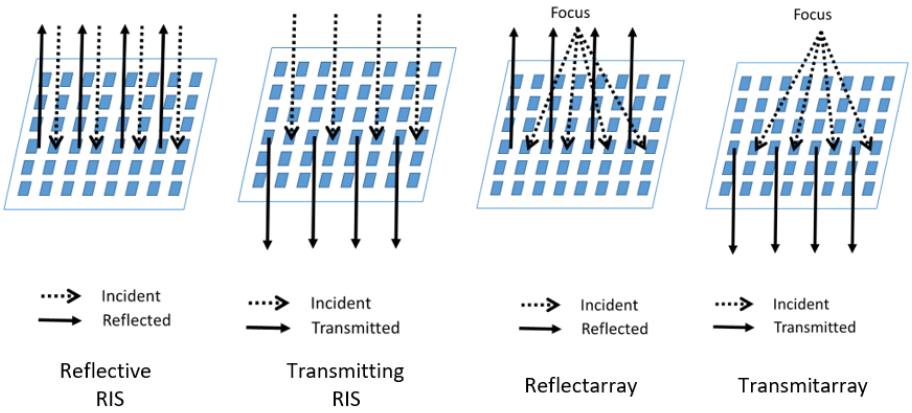
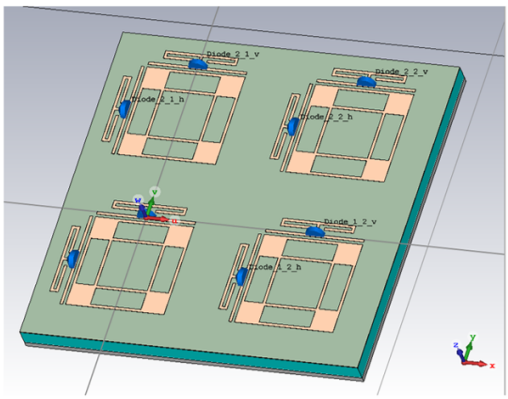
Deliverable 3.1: *"Preliminary RIS model and measurement campaigns"*

- An electromagnetic RIS/unit-cell model has been proposed.
- The "reconfigurable" channel has been modelled.
- Design and prototype proposals have been developed for metasurfaces in a large frequency range.
- A system level abstraction has been provided as well as a characterisation of the control logic.

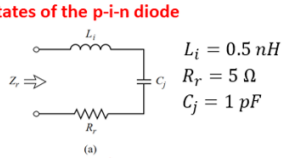


Deliverable 3.2: *"RIS designs, and first prototypes characterisation"*

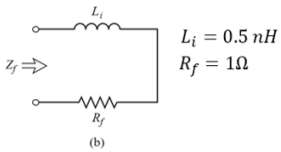
- A focus has been given on the main technology challenges related to the design and prototyping in a large frequency range.
- Reports on the principal methodologies for characterisation of metasurfaces and control operations have been prepared.
- The RIS design has been based on different core technologies from simple p-i-n diodes to more complex MEMS or varactors.



Equivalent circuits for the ON and OFF States of the p-i-n diode



OFF – Reverse bias state



ON – Forward bias state

WORK PACKAGE 4

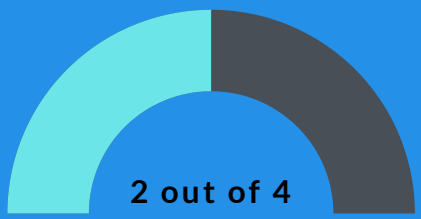
Goals

Propose network architectures and deployment strategies including RIS control signaling for enhanced connectivity.

Explore the fundamentals of communications for RIS-empowered systems.

Develop protocols and methods for RIS control and resource allocation to support high reliability, coverage, and low-latency.

Establish joint resource allocation and offloading strategies to unlock seamless, reliable, distributed, and RIS-empowered edge computing services.



2 out of 4 deliverables completed

LEAD BENEFICIARY

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on behalf of

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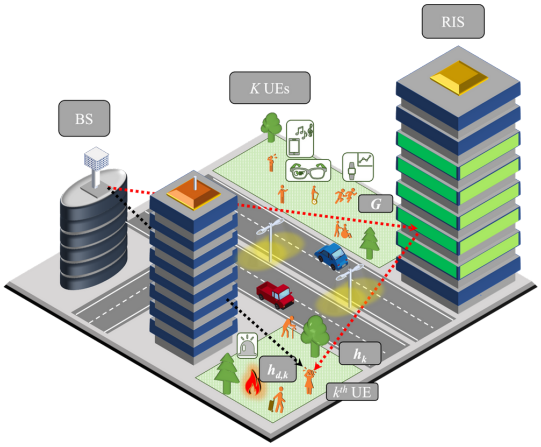
RIS for Enhanced Connectivity and Reliability

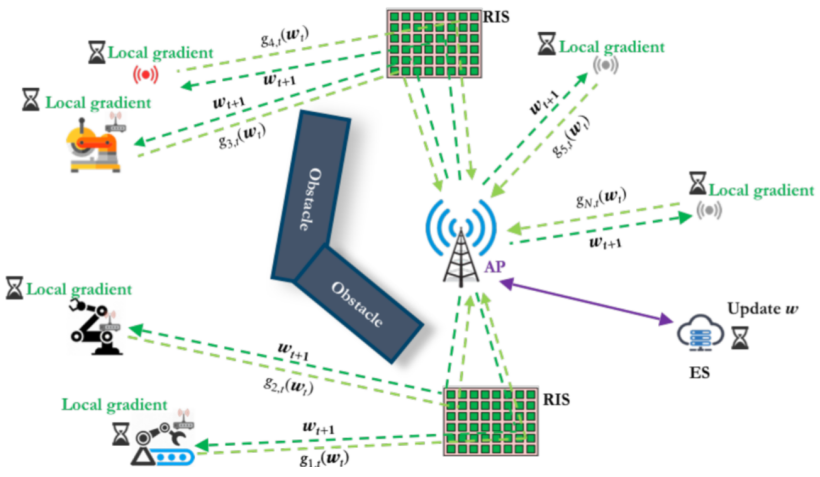
Deliverable 4.1: ***"Deployment and control strategies of RIS-based connectivity" (intermediary specifications)***

- Results have been presented that focus on different network architectures, KPIs, control, and signalling strategies.
- The best strategies for RIS deployment have been detailed, considering both autonomous operating and controlled surfaces.



Deliverable 4.1: ***"Multi-user techniques and connectivity of RIS-based communication and mobile edge computing" (intermediary specifications)***

- Specifications on performance limits in RIS environments have been reported, accounting for realistic channel models and control overheads.
- Algorithms have been developed for control signalling, channel estimation, and resource allocation.
- The effects of network resilience, energy efficiency, and joint communication and computation with latency-constrained edge services have been considered.



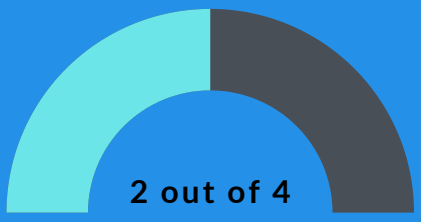
WORK PACKAGE 5

RIS for Enhanced Localisation and Sensing

Goals

Investigate and propose network architectures, signalling schemes, and RIS control protocols specifically designed for radio localisation and sensing.

Develop and evaluate novel estimation, localisation, and detection algorithms for RIS-aided localization and sensing applications.



LEAD BENEFICIARY

Prof. Henk Wymeersch

on behalf of

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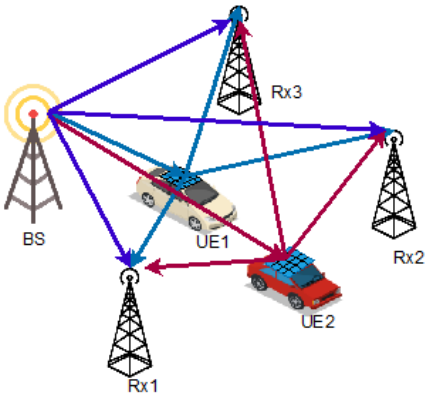
Deliverable 5.1: ***"Control for RIS-based localisation and sensing" (intermediary specifications)***

- Novel network architectures for localisation and sensing have been proposed.
- Different KPIs, architectural alternatives, RIS control strategies, and signalling have been covered.



Deliverable 5.2: ***"Algorithms for RIS-based localisation and sensing" (intermediary specifications)***

- Algorithms for estimation and detection in RIS-empowered environments have been developed and presented.
- The following problems have been trackled:
  - Estimation of location-dependent RIS-enabled multipath parameters.
  - Estimation of active UEs and passive objects.
  - RIS-enabled simultaneous localisation and mapping.
  - Spectrum sensing, Radio Frequency (RF) mapping and fingerprinting-based localisation.

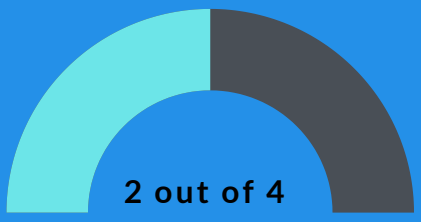
WORK PACKAGE 6

Goals

Develop new network architectures and deployment strategies with RIS for improved Energy Efficiency (EE), reduced Electro-Magnetic Field Exposure (EMFE) and enhanced Spectral Secrecy Efficiency (SSE).

Investigate sustainable RIS solutions designed for improved EE and SSE, as well as reduced EMFE.

Provide an assessment of the KPI values achieved in RISE networks.



2 out of 4 deliverables completed

LEAD BENEFICIARY

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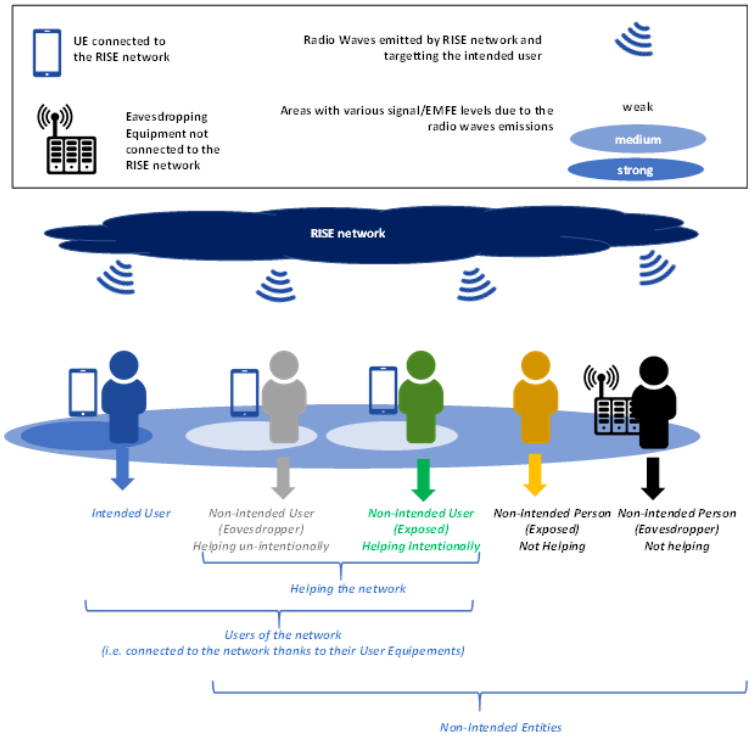
RIS for Enhanced Sustainability and Security

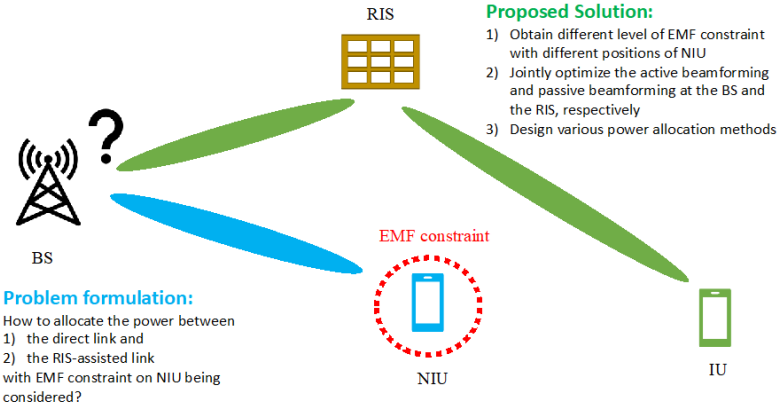
Deliverable 6.1: ***"Network architectures & deployment strategies with RIS for enhanced EE, EMFE, and SSE" (intermediary specifications)***

- Results have been provided for network architectures and deployment strategies for enhanced EE, EMFEU, and SSE metrics.
- The impact of the presented solutions for RIS-empowered environments for the relevant metrics of the WP has been examined.



Deliverable 6.2: ***"Sustainable RIS solutions design for EE, EMFE and SSE" (intermediary specifications)***

- PHY-MAC innovations and several architectural options have been designed to reach the target objectives.
- Innovative schemes have been proposed to optimise the trade-off between the different metrics.



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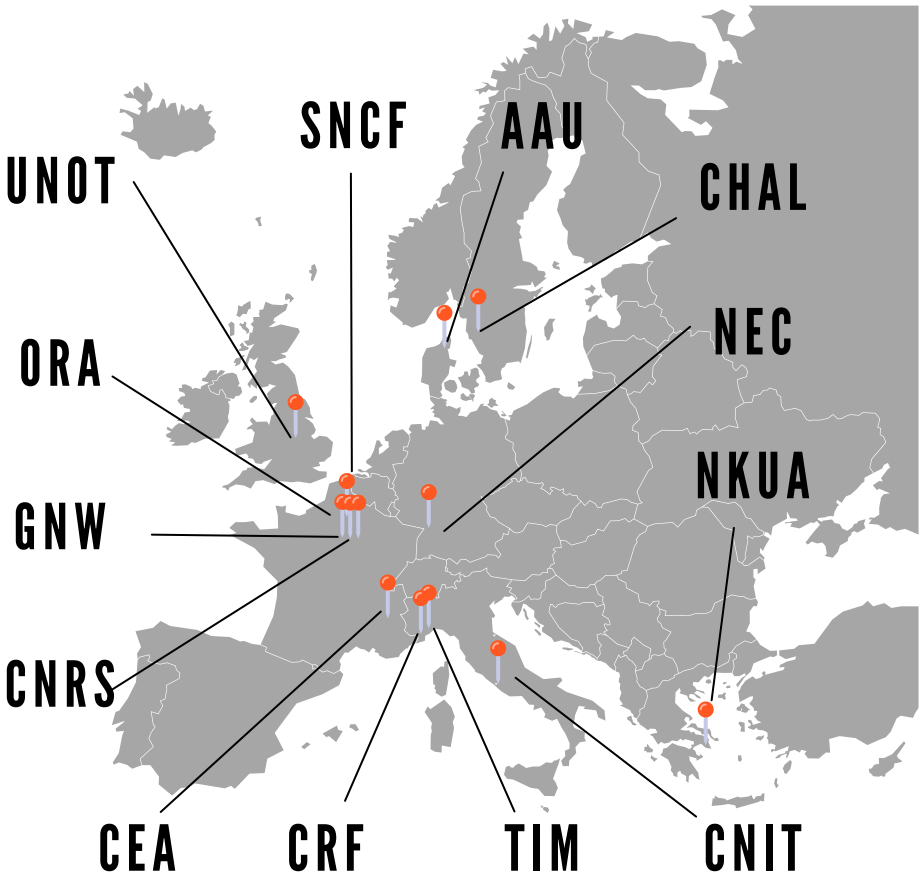

PROJECT PARTNERS

- COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES **(CEA)**
- NEC LABORATORIES EUROPE GMBH **(NEC)**
- ORANGE SA **(ORA)**
- *TELECOM ITALIA SPA* **(TIM)**
- GREENERWAVE **(GNW)**
- CHALMERS UNIVERSITY OF TECHNOLOGY **(CHAL)**
- AALBORG UNIVERSITET **(AAU)**
- CENTRO RICERCHE FIAT S.C.P.A. **(CRF)**
- NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS **(NKUA)**
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- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE **(CNRS)**
- UNIVERSITY OF NOTTINGHAM **(UNOT)**
- SOCIETE NATIONALE DES CHEMINS DE FER FRANCAIS **(SNCF)**

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