



What is 6G-SHINE?

The 6G Short range extreme communication Inside Entities (6G-SHINE) project aims at pioneering the main technology components for wireless in-X subnetworks, short range low power radio cells and o be installed in entities like robots, production modules, vehicles, and classrooms to provide very localised high-performance connectivity.

In-X subnetworks are located at the very end of the 6G `network of networks and are expected to offload the broad wireless network infrastructure from the most demanding services in terms of data rate, or latency and reliability. They should be able to operate standalone -at least for the most critical services- while benefitting from connection with the broader network, which can improve radio resource management, traffic steering, management of traffic and computational resources.

6G-SHINE will propose a set of disruptive technology components ranging from the physical layer to system architectures, whose performance will be verified via simulations and – for selected components – via laboratory demonstration platforms. Such technology components will constitute a portfolio of solutions for the pre-standardization of 6G.

Project objectives

- Define relevant application scenarios, use cases and architectures for in-X subnetworks, and analyse related performance requirements.
- Characterize the radio propagation channel in the short-range scenarios and frequency bands of interest.
- Design new physical layer (PHY) enablers for scalable requirements in terms of latency, reliability or throughput, tailored to devices with constrained computational capabilities by leveraging the opportunities offered by short-range subnetworks.
- Develop new effective medium access control (MAC) solutions for efficient multiplexing of diverse traffic types in a subnetwork, including deterministic traffic.
- Develop cost-effective centralised, distributed or hybrid radio resource management techniques (considering both legitimate and malicious interferers) in hyper-dense dynamic subnetwork deployments.
- Develop new methods for integrating subnetworks in the 6G architecture and efficient orchestration of radio and computational resources among subnetworks and broader network.
- Validate the most promising technology components via proof-of-concepts in laboratory facilities.
- Create a large portfolio of technology components for pre-standardization, scientific publications at internationally recognised conferences or journals, organisation of workshops in connection with high-profile conferences, and submitted IPRs.

Visit [6G-SHINE website](#)

Dissemination activities



On June 1, Prof. Davide Dardari (CNIT) gave a keynote speech on “Holographic radio: When electromagnetism meets signal processing” at the International Conference on Communications (ICC 2023), Rome, within the Workshop on Holographic MIMO.



Frank Burkhardt was interviewed in a short video by Martel Innovate promoting the recently started SNS project.

Find the video here: [6G SNS JU Phase 1 - Projects overview](#)



Presentation at Global 5G Evolution

On July 11, 2023, Gilberto Berardinelli gave a short talk on in-X subnetworks at XCHANGING IDEAS #39 virtual conference, organised by Global 5G evolution.

Find the full video of the event here

6G Short range extreme communication IN Entities (6G-SHINE)

Motivation

6G is expected to take the form of a 'network of networks'. It will integrate subnetworks with diverse characteristics in terms of coverage, operational purpose, and spectrum, including cellular, non-terrestrial, drone, campus and private networks.

In-X subnetworks are located at the very end of the 6G 'network of networks' to support highly localized and high-performance connectivity. For example, in-vehicle wireless subnetworks may replace the wired infrastructure for the anti-lock braking system (ABS), motor control and advanced driver-assisted systems (ADAS); in-robot subnetworks can wirelessly support fast closed loop control, e.g. force control; in-classrooms subnetworks can be used for extended reality (XR) applications for educational purposes. These use cases may be demanding extremely high data rates, or low latencies and high reliability – especially for life-critical applications.

Workplan

The 6G-SHINE project plans to pioneer the main technology components for wireless in-X subnetworks and prepare their adoption to the future 6G standards. In this respect, the project plans to:

- Define relevant application scenarios, use cases and architectures for in-X subnetworks, and analyze related performance requirements.
- Characterize the radio propagation channel in the short-range scenarios and frequency bands of interest, considering 0.1 GHz, mmWave and sub-THz spectrum regions.
- Design new physical layer (PHY) and medium access control (MAC) enablers for scalable requirements in terms of latency, reliability or data rate, leveraging the opportunities offered by short

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Budget
5.46 Mio. € over all, funding of 4.59 Mio. € by the European Union

Project Duration
01.03.2023 to 31.08.2025
(30 months)

Website
<http://www.6gshine.eu>

Horizon Europe Grant Agreement No. 101095738. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or SNS IT. Neither the European Union nor the granting authority can be held responsible for them.

Find the leaflet
here



European cross-sector research
will push the boundaries for short
range communication

First press release (March
21 2023)



European
School
of Antennas
and Propagation

2023



technology research directions, and how these can be mapped to standardization.

It was also a great opportunity for the new the Smart Networks and Services Joint Undertaking (SNS-JU) projects to present their plans and exchange ideas regarding standardization roadmaps.

Information exchange was mutually beneficial, as research community could learn about standardization opportunities, as well as guidance opportunity on when, where and how to get involved in standardization; while standardization community could learn on the latest technology research trends and make early connections with relevant projects.

Most of the granted SNS projects had the opportunity of presenting their standardization plans in dedicated sessions. Gilberto Berardinelli presented the 6G-SHINE vision and its potential impact towards standardization in a session dedicated to stream B of the SNS work programme, together with representatives from the following projects: 6G-TANDEM, 6G-NTN, CENTRIC, ETHER, SUPERIOT, TERRAMETA and TIMES.

Gilberto explained how 6G-SHINE work is mainly targeting 6G pre-standardization, though the project consortium does not exclude the possibility of providing input already to 3GPP Release 19. Targeted standardization groups are 3GPP, ETSI, IEEE; as well as industry fora like 5G-ACIA and 5G-AA.

Technological outcomes of 6G-SHINE with potential long term standardization impact include:

- Use case and requirements for subnetworks
- Short range radio channel models
- Beam-based short range communication with constrained devices
- Jamming-robust PHY design
- RIS-enabled smart repeaters
- Network-coded cooperation
- Flexible/full duplexing with new signaling procedures
- In-X predictive scheduling
- MAC solutions for (new) unlicensed bands
- Centralized/distributed radio resource management
- Architectural components and signaling
- Data routing for collaborative subnetworks

6G-SHINE will rely on industrial partners in the consortium to bring the technological outcomes in the aforementioned standardization bodies.



6G-SHINE at EuCNC & 6G Summit

The 2023 EuCNC & 6G Summit took place in Gothenburg, Sweden, on June 6-9. The conference brought together research and industry representatives, to discuss the latest research results and ongoing projects. Also, 2023 EuCNC & 6G Summit offered an exhibition with more than 70 exhibitors, showcasing example of coming technologies, in a 6G perspective. The conference also featured numerous exciting keynotes, panels, sessions, workshops, and tutorials.

Frank Burkhardt and Gilberto Berardinelli have presented the 6G-SHINE project in a poster session on June 7. Also, a leaflet of the project was released for the conference.

Find the digital version of the leaflet here: [6G-SHINE leaflet](#)

6G-SHINE project

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Co-funded by
The European Union

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