Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
RESTART

RESTART

Overview of RESTART program and experimental labs

Antonio Capone

Scientific Coordinator

Email: antonio.capone@polimi.it

Finanziato dall'Unione europea NextGenerationEU

Ministero dell'Università e della Ricerca

Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA

RESTART

RESEARCH and Innovation on Future Telecommunications Systems and Networks

Proponent: University of Rome Tor Vergata

Hub: Fondazione RESTART

Spokes: 8

Grant: 116M€

Duration: 2023-2025

Italian National Recovery and Resilience Plan (NRRP), Mission 4

Program Partners

27
Program partners

TOR VERGATA UNIVERSITÀ DEGLI STUDI DI ROMA
Consiglio Nazionale delle Ricerche
Politecnico di Bari
POLITECNICO MILANO 1863
Politecnico di Torino
Sant'Anna Scuola Universitaria Superiore Pisa
ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA
Università di Catania
UNIVERSITÀ DEGLI STUDI FIRENZE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II
UNIVERSITÀ DEGLI STUDI DI PADOVA
Università degli Studi Mediterranea di Reggio Calabria
SAPIENZA UNIVERSITÀ DI ROMA
cnit consorzio nazionale interuniversitario per le telecomunicazioni
FUB Fondazione Ugo Bordoni Ricerca e Innovazione
open fiber
TIM
vodafone
WINDTRE
ERICSSON
prysmian The planet's pathways
Italtel
LEONARDO
TELESPAZIO una società LEONARDO e THALES
Hewlett Packard Enterprise
Tiesse

Cascade Calls Partners

89
CC Partners

adant · applicon · artémat · Dr WOLF · FASTWEB · Fondazione Guglielmo Marconi · LOGO GRAMMA · MATICMIND

Meetecho · MUV · NEXTWORKS · Revelis · SensorID · SKOPÍA · Sma-RTy

telebit · Università degli Studi dell'Aquila · DISIM · Università degli Studi della Campania Luigi Vanvitelli · Università degli Studi di Cagliari · Università degli Studi di Ferrara · Università di Genova

Università degli Studi di Messina · Università degli Studi di Milano Bicocca · UNIMORE · Università degli Studi di Napoli Parthenope · Università degli Studi di Palermo · Università di Parma · Università di Pavia · Università di Pisa

Università di Torino · Università di Trento · Università degli Studi Suor Orsola Benincasa · Università della Calabria · Università Politecnica delle Marche · Xenia Network Solutions

Spokes

8
Spokes

SPOKE1
Pervasive and Photonic Network Technologies and Infrastructures
Consiglio Nazionale delle Ricerche

SPOKE2
Integration of Networks and Services
Politecnico di Bari

SPOKE3
Wireless Networks and Technologies
POLITECNICO MILANO 1863

SPOKE4
Programmable Networks for Future Services and Media
Politecnico di Torino

SPOKE5
Industrial and Digital Transition Networks
ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA

SPOKE6
Innovative Architectures and Extreme Environments
Università di Catania

SPOKE7
Green and Smart Environments
Università degli Studi di Napoli Federico II

SPOKE8
Intelligent and Autonomous Systems
TOR VERGATA Università degli Studi di Roma

Missions

7 missions

1 **Research** Telecommunications of the Future

2 **Laboratories, Proofs of Concept and Demonstrators**

3 **Innovation and Technology Transfer**

4 **Support to Start-ups and Spin-offs**

5 **Education and Training Activities**

6 **PhD Programs**

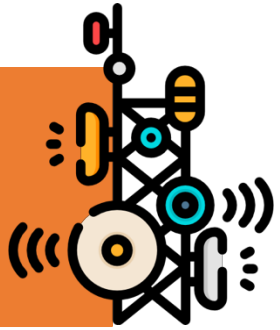
7 **Communication, Standardization and Open Source Solutions**

Research projects

32
Research projects

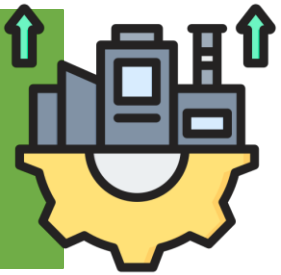
Vision of telecommunications evolution

Technologies



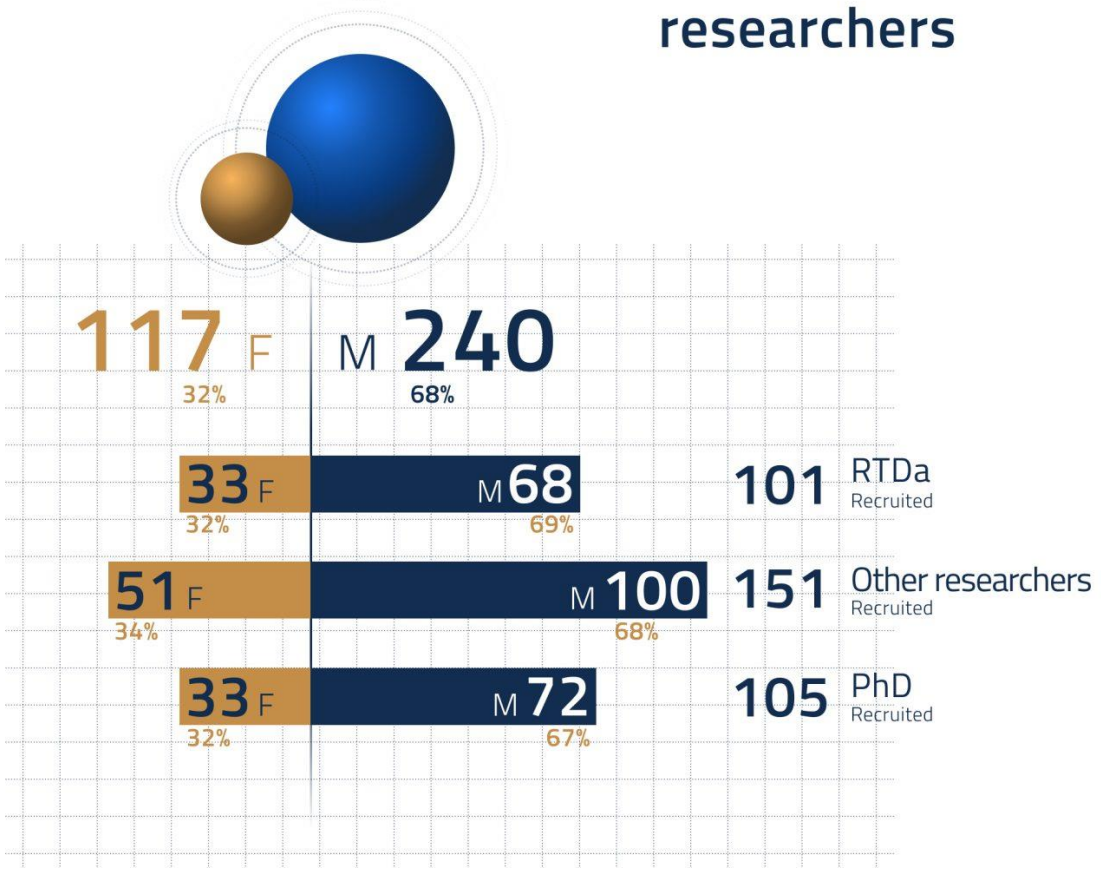
System approaches

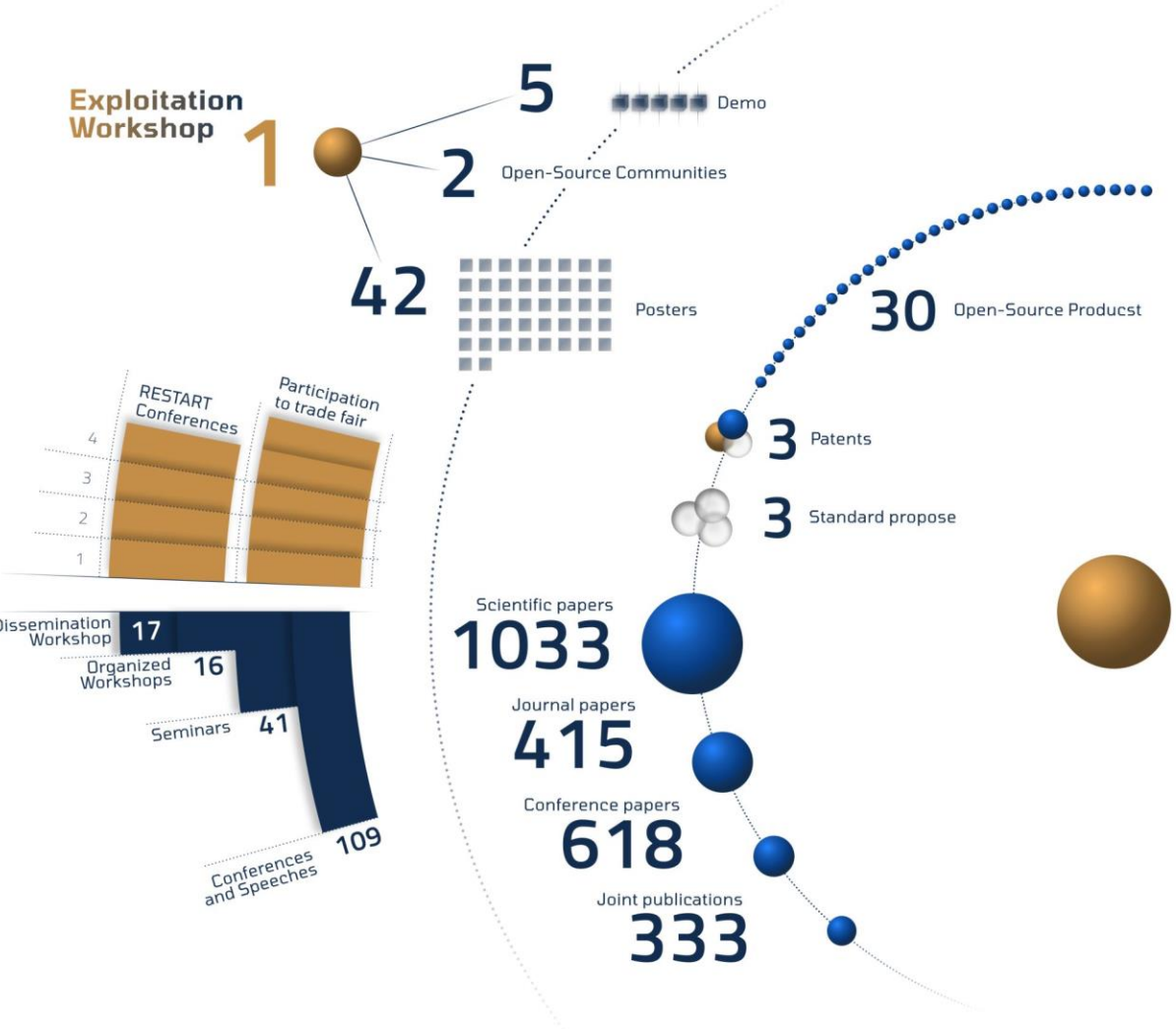
Application domains

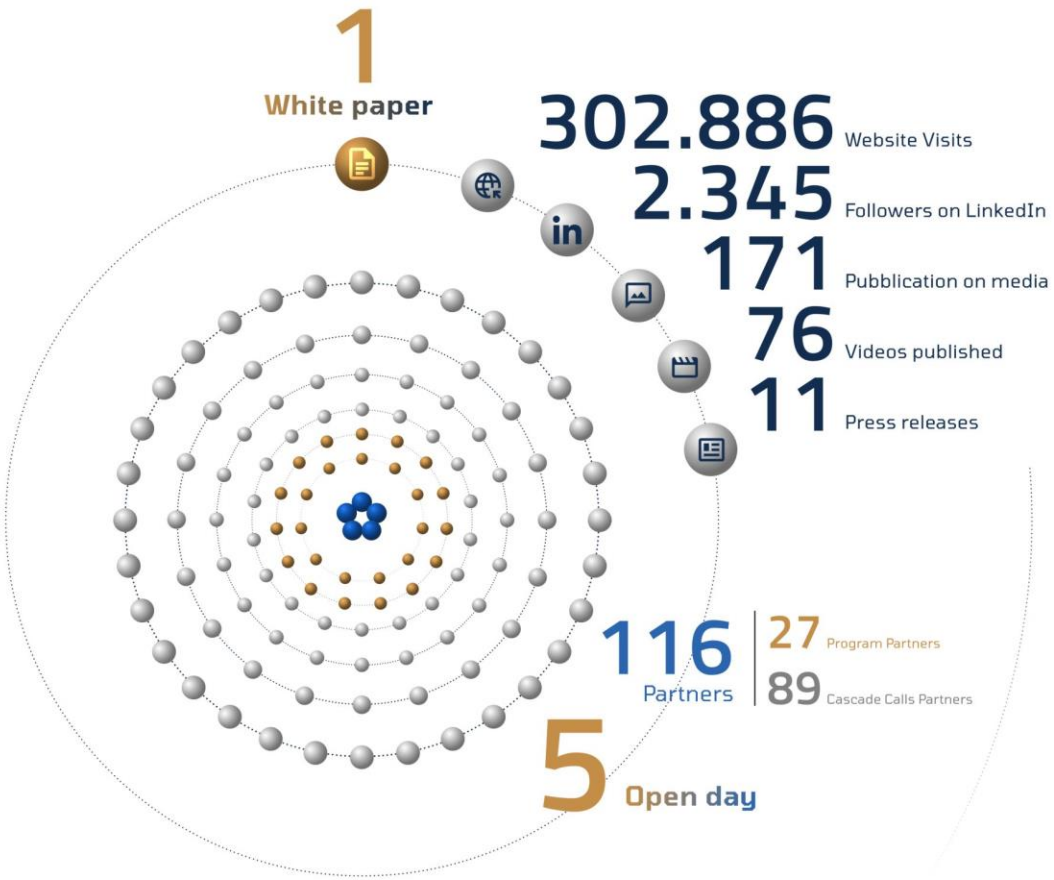


Grand Challenges

↙ Recruited researchers




Exploitation Workshop 1
5 Demo
2 Open-Source Communities
42 Posters
30 Open-Source Producst
3 Patents
3 Standard propose
Scientific papers 1033
Journal papers 415
Conference papers 618
Joint publications 333
RESTART Conferences
Participation to trade fair
4
3
2
1
Dissemination Workshop 17
Organized Workshops 16
Seminars 41
Conferences and Speeches 109


1 White paper
302.886 Website Visits
2.345 Followers on LinkedIn
171 Pubblication on media
76 Videos published
11 Press releases
116 Partners
27 Program Partners
89 Cascade Calls Partners
5 Open day

RESTART Laboratories

Affiliated laboratories

PESCO	POLIFAB Politecnico di Milano, MI
ITA-NTN NET4FUTURE ARCADIA	PHOTONIC DEVICES LAB Politecnico di Milano, MI
6GWINET	S2N S2N National Laboratory, GE
RIGOLETTO HePIC	INPHOTEC CNR, PI

13
Laboratories
As of today

20
Projects
Involved

RESTART Laboratories

PHOTONET Scuola Superiore Sant'Anna, PI	RIGOLETTO HePIC	SPOKE 1
SLICES CNIT, PI	PESCO	
iNTN-NS Politecnico di Bari, BA	ITA-NTN NET4FUTURE ARCADIA	SPOKE 2
WISYNET Politecnico di Milano, MI	6GWINET	SPOKE 3
PROGNOSE Politecnico di Torino, TO	SUPER FUN-MEDIA LEGGERO	SPOKE 4
IDTN Università di Bologna, BO	RIGOLETTO IN MOSS MoVeOver	SPOKE 5
MC2 Università di Catania, CT	COHERENT AQUASMART	SPOKE 6
FABRISS Università di Napoli Federico II, NA	SRE ISACAGE	SPOKE 7
ARTEN Università di Roma Tor Vergata, RO	NETWIN MOSS WITS ARCADIA LIASON	SPOKE 8

PHONET

Optical network/systems/devices photonet lab

Scuola Superiore Sant'Anna, Pisa

43.721082379229955, 10.402796625657558

3

Technologies under development

To connect value chain of photonics, by designing, prototyping and demonstrating PoC for an innovative end-to-end optical transport network

RESTART Projects involved

SPOKE 01

S4 RIGOLETTO

HePIC F7

Optical Network/Systems/ Devices Lab

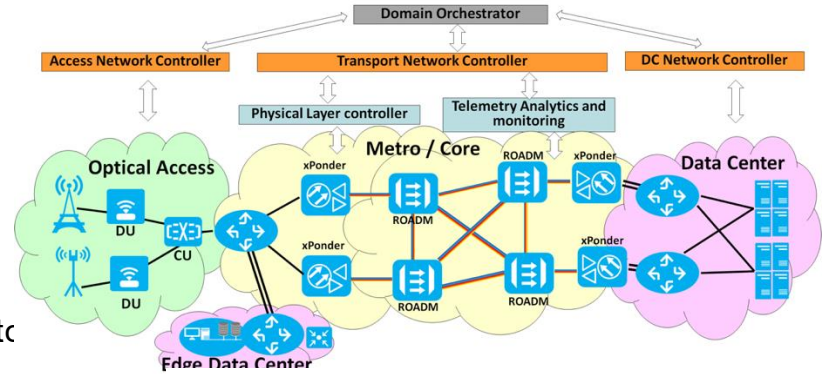
Responsible people: Piero Castoldi, Marc Sorel, Scuola Superiore Sant'Anna

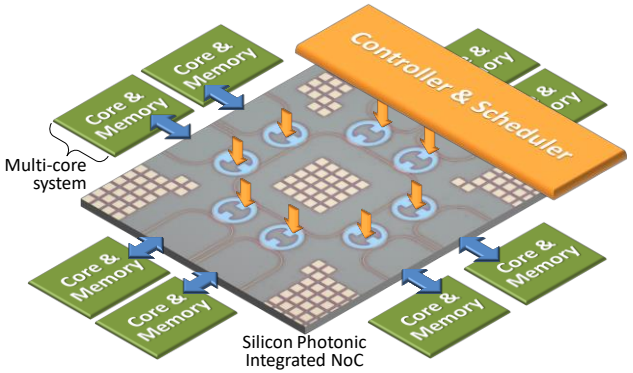
Involved technologies:

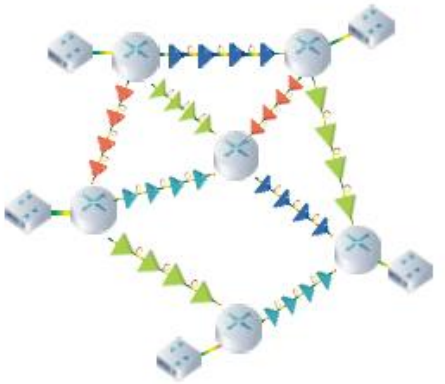
- Photonic integrated devices
- Optical systems
- Disaggregated Optical networks

Innovation

- Complete suite for disaggregated optical networks validation
- Complete validation cycle for PIC from design to characterization
- Zero touch optical network validation







SLICES

Scientific Large Scale Infrastructure for Computing Experimental Studies

Consorzio nazionale interuniversitario per le telecomunicazioni

43.71941884475859, 10.423870667986334

3

Technologies under development

To enable pervasive Internet post-5G experimentation in the cloud/edge continuum at a European scale

RESTART Projects involved

SPOKE 01

S8 PESCO

Scientific Large Scale Infrastructure for Computing/Communication Experimental Studies

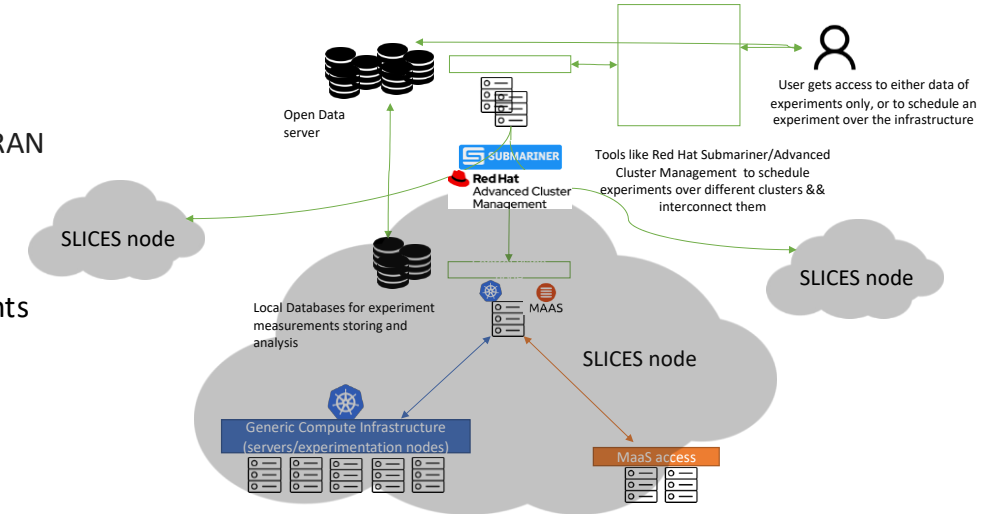
Responsible people: Andrea Passarella, CNR

Involved technologies:

- Post-5G disaggregated core, edge and RAN
- Resource-limited edge devices
- Quantum node

Innovation

- Disaggregated post-5G open components
- Decentralised edge-based technologies
- Quantum Internet protocols



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iTNT-NTS

Integrated Terrestrial and Non Terrestrial Networks & Services

Politecnico di Bari

41.10913314620737, 16.87898576785592

4

Technologies under development

To bridge the future through the integration of Terrestrial and Non-Terrestrial Networks and Services

RESTART Projects involved

SPOKE 2

S14 NET4FUTURE

S12 ITA-NTN

ARCADIA F17

Experimental Lab of Integrated Terrestrial and Non Terrestrial Networks & Services

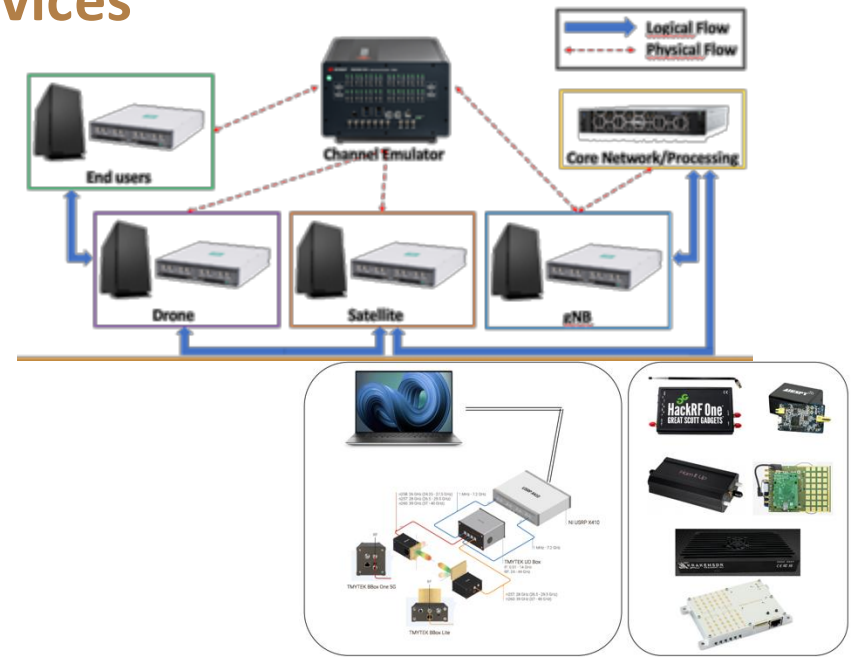
Responsible people: Luigi Alfredo Grieco, Giuseppe Piro, PoliBA

Involved technologies:

- Internet of Drones (IoD)
- Non-Terrestrial Networks (NTN)
- Integrated Terrestrial/Non-Terrestrial Networks (T/NTN)
- 5G and Beyond

Innovation

- Innovative design and analysis of future wireless communication systems, based on the integration of Terrestrial and Non-Terrestrial Networks (T/NTN)
- Development of new standards for 6G and satellite-based communication systems
- Provision of enhanced experimental facilities in the South of Italy, with mid- and long-term vision for other future funding sources



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RESTART

WISYNET

Wireless Systems and Network Technologies

Politecnico di Milano

45.47902004114133, 9.22734815059342

2

Technologies under development

To design mmWave and Sub-THz devices for 6G networks, while investigating biological effects and developing AI-optimized radio architectures

RESTART Projects involved

SPOKE 3

S6 6GWINET

Wireless Systems and Network Technologies

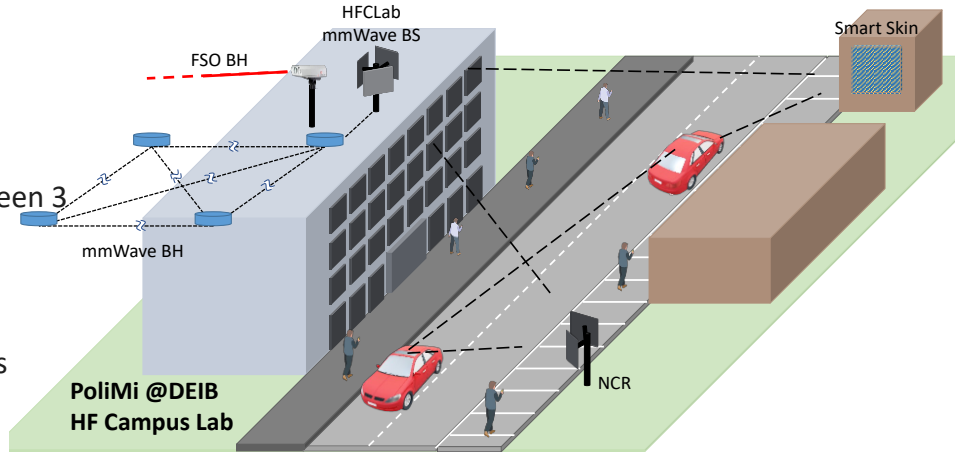
Responsible people: Umberto Spagnolini, Antonio Capone, PoliMI

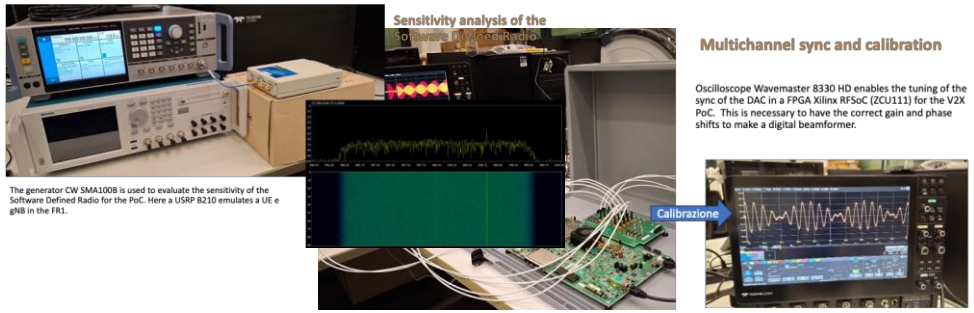
Involved technologies:

- Real 5G network (HFCLab)
- Measurements instruments operating between 3 and 110 GHz.
- Radio and optical systems

Innovation

- Open and virtualized Radio Access Networks operating at mmWave
- Lab for characterization of wireless devices operating between 3 and 110 GHz
- Lab for E.M. biological studies.
- New Tx-Rx at Very High Frequency





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PROGNOSE

Programmable Networks and Future Services

Politecnico di Torino

45.0634798792398, 7.662354894249298

4

Technologies under development

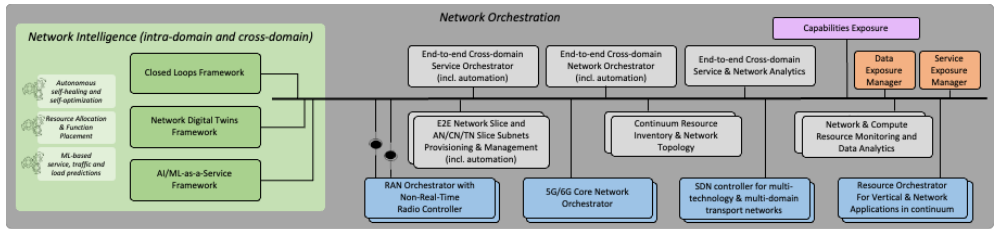
To forge Future Networks and Applications: Seamless Adaptation, Empathetic Interactions in Tomorrow's Virtual Realms

RESTART Projects involved

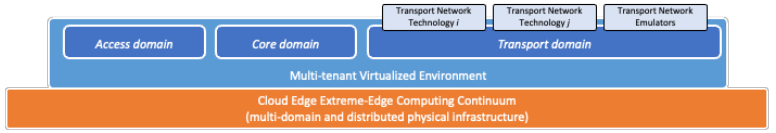
SPOKE 4

- S2 SUPER
- S7 FUNMEDIA
- LEGGERO F2

Forging Future Networks and Applications: Seamless Adaptation, Empathetic Interactions in Tomorrow's Virtual Realms



Responsible people: Carla Fulvio Risso, Carla Fabiana Chiasserini, Enrico Magli, PoliTO

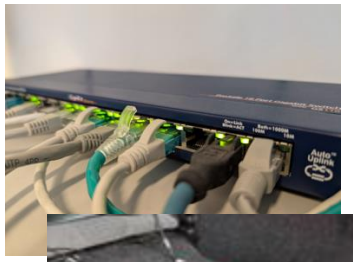


Involved technologies:

- Open Radio Access Network (O-RAN)
- eBPF
- Openflow
- Programming Protocol-independent Packet Processors (P4)

Innovation

- In-line packet processing
- Software-defined networking (SDN)
- Open, virtualized, disaggregated, programmable RANs
- Zero-touch self-optimizing autonomous networks



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IDTN

Industrial and Digital Transition Networks

Università di Bologna

44.502100596242336, 11.36487597886205

5

Technologies under development

To investigate advanced technologies for industrial networks, with experimental testing in outdoor industrial contexts involving UAVs and AGVs

RESTART Projects involved

SPOKE 5

S4	RIGOLETTO	MOSS	F9
S9	IN	MOVEOVER	F15

Industrial and Digital Transition Networks

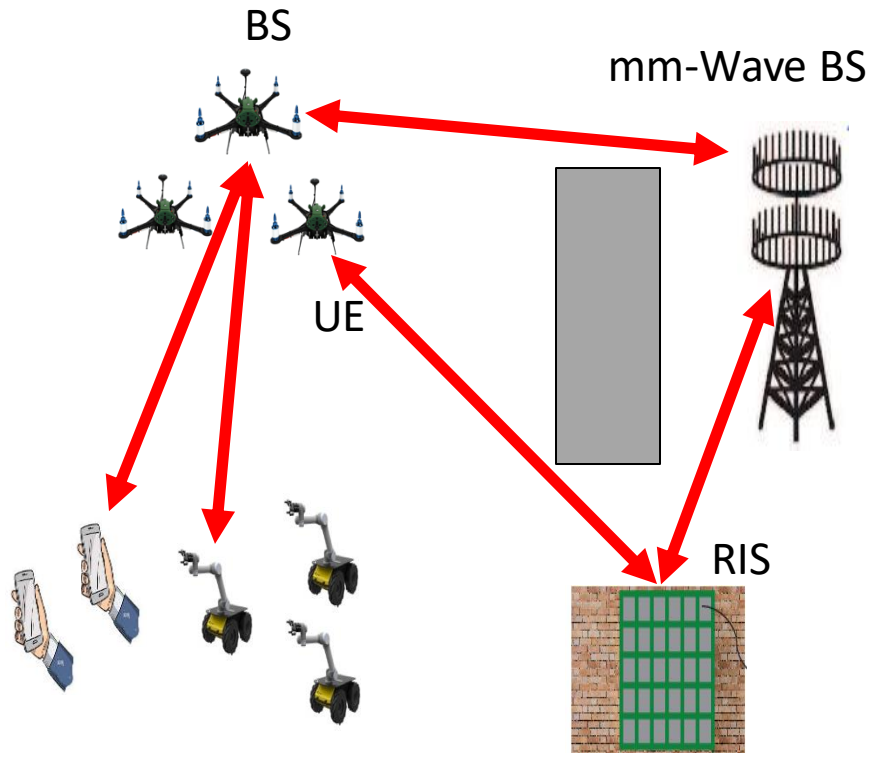
Responsible people: Alessandro Vanelli-Coralli, Chiara Buratti, University of Bologna

Involved technologies:

- 5G/6G for Industrial networks
- Sub-THz communications
- Wireless Power Transfer at microwaves
- Reflective and Reconfigurable Intelligent Surface

Innovation

- Testing outdoor Industrial context, including UAVs and AGVs
- Experimental characterization of Sub-THz communications
- New strategies for Wireless Power transmissions
- Testing Reflective and Reconfigurable Intelligent Surfaces



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MC2

Mission Critical Communications

Università di Catania

37.503683830879396, 15.086551740700251

5

Technologies under development

To go beyond conventional networking, for holistic and mission-critical communications

RESTART Projects involved

SPOKE 6

S1 COHERENT

AQUASMARTT F16

Mission Critical Communications Laboratory

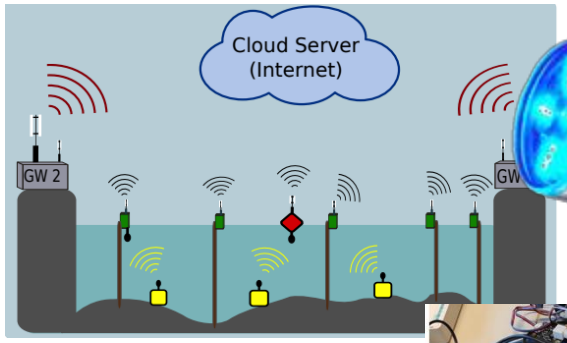
Responsible people: Sergio Palazzo
Università di Catania

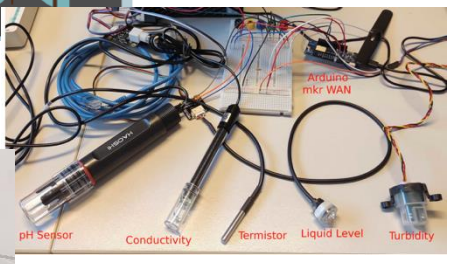
Involved technologies:

- LPWAN (LoRa/LoRaWAN technologies)
- 5G and 6G communications technologies
- Digital Twins for networking
- V2X and UAV-based networks
- Acoustic underwater communications

Innovation

- Develop and test innovative architectures integrating heterogeneous network segments and technologies
- Develop hybrid terrestrial/underwater communication systems
- Design and develop a multi-layer underwater communication system employing heterogeneous devices using a SDR approach
- Integrate the underwater technologies with LPWAN technologies to extend the underwater network transmission range





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FABBRISS

Fabrication of RIS and Sensors for the Telecommunications of the Future

Università di Napoli Federico II

40.84679632210277, 14.25801059037176

2

Technologies under development

To create Smart and Green Environments for the Telecommunications of the Future

RESTART Projects involved

SPOKE 7

S12 SRE

S13 ISACAGE

FABRISS: FAB-SENSE and FAB-RIS

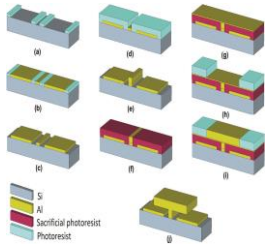
Responsible people: Daniele Riccio di Napoli Federico II

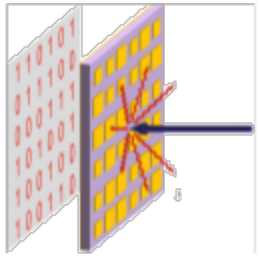
Involved technologies:

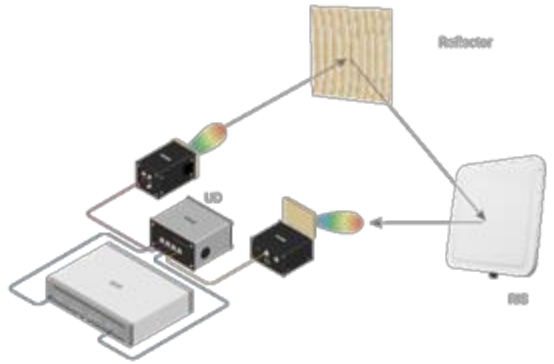
- Joint Comm. and Sensing:
  - Software Defined Radio (SDR) devices
  - Antennas and radio frequency components
  - High-performance computing systems
  - MATLAB/Simulink, LabView
- Smart Propagation Environments
  - Magnetron sputtering deposition
  - Maskless lithography (@UNINANO)
  - Dry and wet etching (@UNINANO)
  - DC and HF testing systems

Innovation

- Cost-effective fast-prototyping
- Complete validation via experimentation







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ARTEN

Artificial intelligence at all communications layers

Università di Roma Tor Vergata

41.85157395443431, 12.629268754399074

4

Technologies under development

To enhance signal coverage, deploy IoT devices for animal monitoring and RF interference in various contexts

RESTART Projects involved

SPOKE 8

S3	NETWIN

MOSS	F9
WITS	F13
ARCADIA	F17
LIAISON	F18

Artificial intelligence applied to Telecommunications networks

Responsible people: Luca Chiaraviglio, University of Rome Tor Vergata

Involved technologies:

- Cloud Infrastructure for AI Tasks
- Bare metal server for HPC ML Tasks
- Fully Programmable SDR Devices
- Private 5G Network for Experimental Activities (Core + RAN at 3.5 GHz)
- I/Q receiver for ELINT sensing & monitoring
- Benchtop analyzer for intelligent signal analysis

Innovation

- Cloud Infrastructure for Distributed AI Tasks
- HPC Server for Local AI Tasks
- Programmable Devices for Testing of Core and Radio 5G Functionalities
- IoT Energy Harvesting Nodes for testing and deployment of IoT services in rural environments
- Measurement devices for high fidelity RF monitoring & RF sensing








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RESTART

Affiliated Laboratories

5
Technologies under development

S2N
S2N National Laboratory, GE

Enabling Cutting-Edge Experimental Research on Green and Secure Next Generation Mobile Networks

INPHOTEC
CNR, PI

A fabrication and packaging facility for prototyping

POLIFAB
Politecnico di Milano, MI

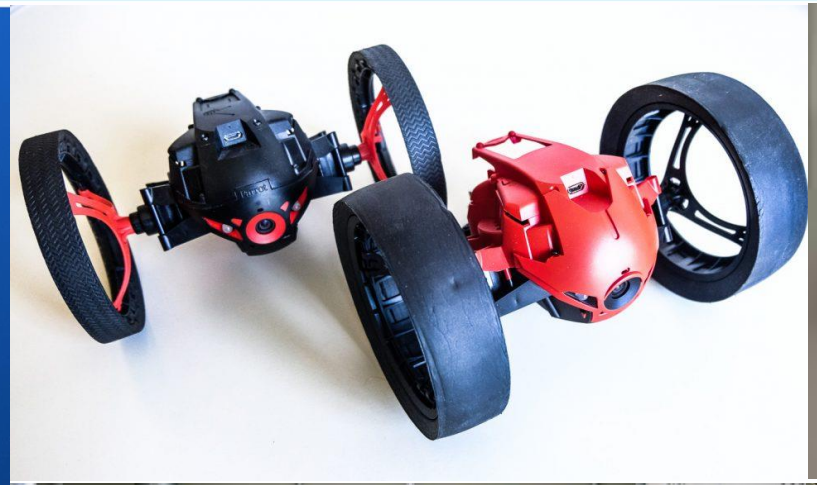
Micro and nano fabrication facility of Politecnico di Milano

PHOTONIC DEVICES LAB
Politecnico di Milano, MI

Characterization and testing of photonic devices

3
Industrial Partners

2
RESTART Projects involved



Thanks!