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PIANO NAZIONALE
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UNIVERSITÀ
DEGLI STUDI
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FORESEEN PRIN-PNRR 2022

Kickoff meeting

Presentazione unità
Università degli Studi di Milano





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Unit members

Christian Quadri

*Assistant Professor
@ Connets Lab*

Unit leader

Alessia Galdeman

PhD Student
@ Connets Lab





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Connets Lab

Connets Lab is the *Communication Network And Network Science Laboratory of UNIMI*

Research activities on **Communication Network**

- 5G/6G - Edge services resource provisioning and allocation
- 5G/6G - Edge service live-cycle management (monitoring & control)
- C-V2X - Network service for automotive (Vehicle platooning & Tele-operated driving)

Research activities on **Network Science**

- Machine Learning on Graph (Node/Edge/Graph attributes regression & classification)
- Temporal Multilayer Graph (Anomaly detection on temporal motifs)





Connets Lab - On going research activities on Communication Network

Joint computing, communication energy-aware task offloading in edge

- **Distributed and online** offloading decision (*Multi-agent Reinforcement Learning*)
- **Computing and communication** resource allocation
- **Minimization/optimization of energy consumption** (computation & communication)

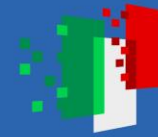
Multi-Radio Access Technology AI-assisted Vehicle platooning

- Reliable platooning with on-board optimal RAT selection (5G & 802.11p)
- **AI-assisted decision process**
- Experimental evaluation using **full-fledge simulation environment** (e.g., OMNeT++)

5G-Edge Assisted Tele-operated Driving

- Performance evaluation of Tele-operated Driving service in a broad set of scenarios
- **Modeling and creation of simulation scenarios**
- Experimental evaluation using **sophisticated simulation environment** (OMNeT++ & CARLA)





Edge-Assisted Platooning

Goal: Control of platoon through edge computing and 5G network

- Platoon stability
- Splitting & Merging maneuvers
- 5G network QoS requirements (bandwidth, latency, ...)

Methods and tools:

- Network and vehicular simulators
- 5G & ETSI MEC standards

Main contributions:

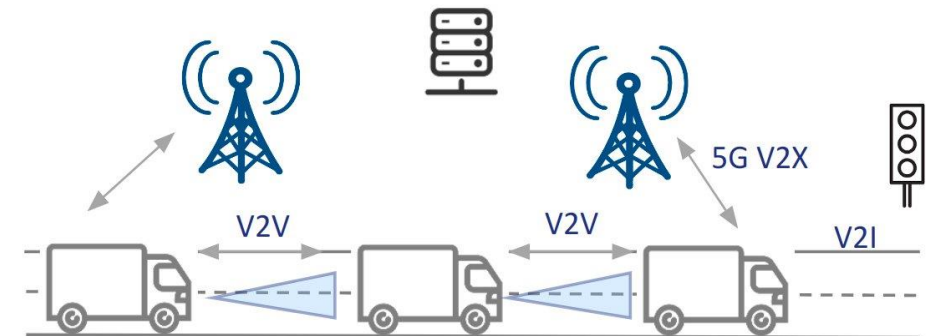
- Feasibility of the edge approach and preliminary QoS requirements definition
- Edge-assisted Multi-platoon architecture
- Definition of Utility Function for optimal multi-platoon configuration

Elsevier ComCom 2022 *Edge-based platoon control*

ACM MSWiM 2020 *Platooning on the edge*

MedComNet 2021 *From Plato to platoons*

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Tele-operated Driving on 5G

Goal: Feasibility study of remote driving through 5G network

Methods and tools:

- Network and vehicular simulators
- 5G RAN and Core standards

Main contributions:

- Simulation framework combining OMNeT++ and CARLA released to the community
- Preliminary performance evaluation considering different 5G RAN configurations

IEEE VNC 2023 *Simulation of Tele-Operated Driving over 5G Using CARLA and OMNeT++*

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Platooning Co-simulation

Goal: Design and implement co-simulation framework for platooning

Methods and tools:

- Network and vehicular simulators
- Co-simulation using FMI standard
- 5G & ETSI MEC standards

Main contributions:

- Co-Simulation of Cyber-Physical System of platooning V2V and Edge
- We have shown the benefits of a co-simulation design w.r.t. a monolithic one
- Modular and standard framework design and implementation

Elsevier ComCom 2023

Co-simulated digital twin on the network edge: A vehicle platoon

IEEE WoWMoM 2022 (TWINNETS) *Co-simulated Digital Twin on the Network Edge: the case of platooning*



FORESEEN methodology

