AI-Enhanced Fiber-Wireless Optical 6G Network in Support for Connected Mobility

6G-EWOC Newsletter

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Network Architecture:
The Road Towards Connected Mobility

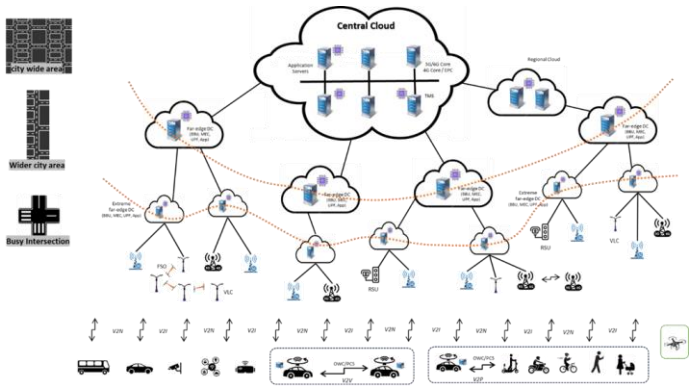
by *Eleni Theodoropoulou* and *George Lyberopoulos,* OTE

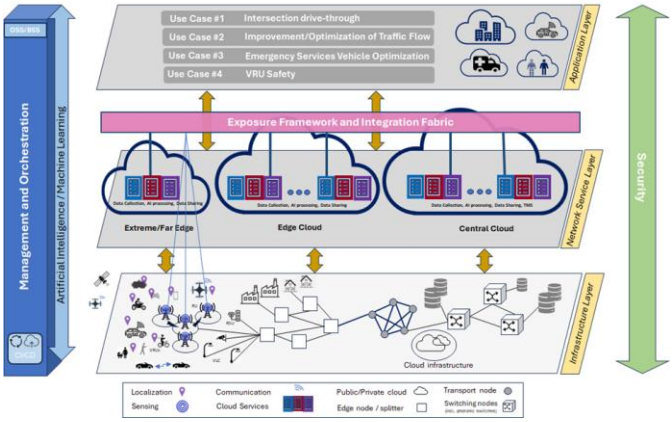
The 6G-EWOC project envisions transforming urban transportation by considerably enhancing the situational awareness of fully-autonomous vehicles and ensuring emergency vehicles' prioritization and a more efficient road utilization. This necessitates…

- real-time communication among all the "connected" road participants and road infrastructure,
- collective gathering, (intelligent) processing and sharing of sensory / other information to create a comprehensive 3D representation of the surrounding environment,
- a traffic management system capable of adapting the flows dynamically based on the current traffic conditions

To fulfil the above, we will utilize a plethora of enabling technologies as part of the 6G-EWOC architecture:

(a) Advanced, "connected" LiDARs/RaDARs,
(b) Joint comms and sensing and SLAM functionalities,
(c) Optical wireless communication for V2V, V2I and I2I free-space communication,
(d) high-capacity, flexible, SDN-based optical/photonic switching for the fronthaul, based on PIC and ASIC technologies,
(e) AI methods to generate 3D maps by processing large volumes of sensor data in real-time (at the edge network),
(f) AI-assisted control and orchestration of optical network resources for optimal allocation under any (vehicular and network) traffic conditions





From Fiber to Fiber:
How Fi-Wi-Fi Extends Optical High-Capacity Networks

6G-EWOC attended the ECOC 2024 conference to present its novel approach to bridge gaps in its high-capacity fiber infrastructure through its Infrastructure-to-Infrastructure (I2I) optical wireless communication mode.
In this top-scored paper, we demonstrate the efficient coupling between two single-mode fibers, as thin as a human hair, over a distance of 63 meters. We do so by utilizing a beamformer that is inspired by a simple photonic lantern.
For more details, check out the paper preprint on our project webpage.

The 6G-EWOC project has received funding from the Smart Networks and Services Joint Undertaking (SNS JU) under the EU's Horizon Europe research and innovation programme under Grant Agreement No. 101139182. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Smart Networks and Services Joint Undertaking. Neither the European Union nor the granting authority can be held responsible for them.

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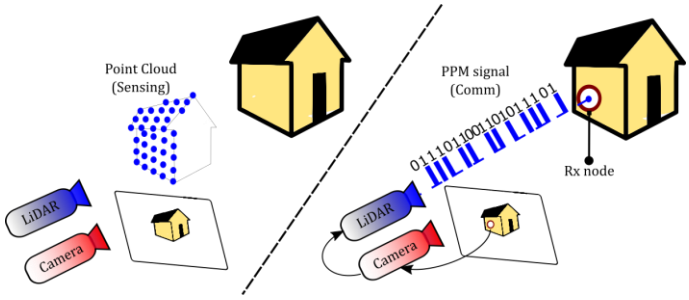
Enabling Technology:
Connected LiDAR (Joint Comms And Sensing)

by *Pablo García*, Beamagine

Light Detection And Ranging (LiDAR) devices use light beams to measure the distance to a target. Hence, they sense geometry and provide 3D images known as Point Clouds with higher spatial resolution than RaDAR sensors. Consequently, LiDAR devices are becoming key sensors for Autonomous Vehicles (AV) and perception applications based on combining multiple sensors and devices. However, using multiple devices implies an increase in hardware costs and system complexity. Thus, integrating capabilities in a unique device is crucial for improving AV's efficiency. In this newsletter, we feature the development of a novel LiDAR device for Joint Communication And Sensing (JCAS) applications as one of the enablers in the 6G-EWOC architecture.

The goal is to integrate optical communication capabilities to Beamagine's LiDAR devices, which use Micro-Electro-Mechanical Systems (MEMS) mirrors to steer the light beam. Hence, the connected LiDAR will be capable of establishing a Free-Space Optical (FSO) communication link with the 6G-EWOC fronthaul to send information via Pulse Position Modulation (PPM).



Connected LiDAR concept. LiDAR is (left) sensing and (right) communicating.

In 6G-EWOC, Beamagine will collaborate with UPC and Magna to develop this innovative connected LiDAR solution for JCAS applications using the synergies between LiDAR and RaDAR devices – with the ambition of becoming an essential device for future AVs. Our target is to demonstrate the feasibility of our JCAS-enabled LiDAR and outperform current reference performances that are limited to <1.45 Mbit/s within a 100 m range.

Stay tuned for the first publications towards this ambitious goal.

Our Recent Publications

F. Honz, and B. Schrenk, *"Fiber-Based Focal Plane Array Beamformer as Air Interface of an Alignment-Tolerant Optical Fi-Wi-Fi Bridge,"* in Proc. Europ. Conf. Opt. Comm. (ECOC'24), Frankfurt, Germany, Sep. 2024, W1D.2

Meet the 6G-EWOC Team

We are delighted to present further project results at two more fall conferences. Take the opportunity to meet us at

- *IEEE Future Networks World Forum (FNWF) Dubai, 15th – 17th of October*
- *IEEE Int. Workshop on Computer Aided Modeling and Design of Communication Links and Networks (CAMAD) Athens, 21st – 23rd of October*
- *Smart City Expo World Congress, Barcelona, 5th – 7th of November*

Get in Touch

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