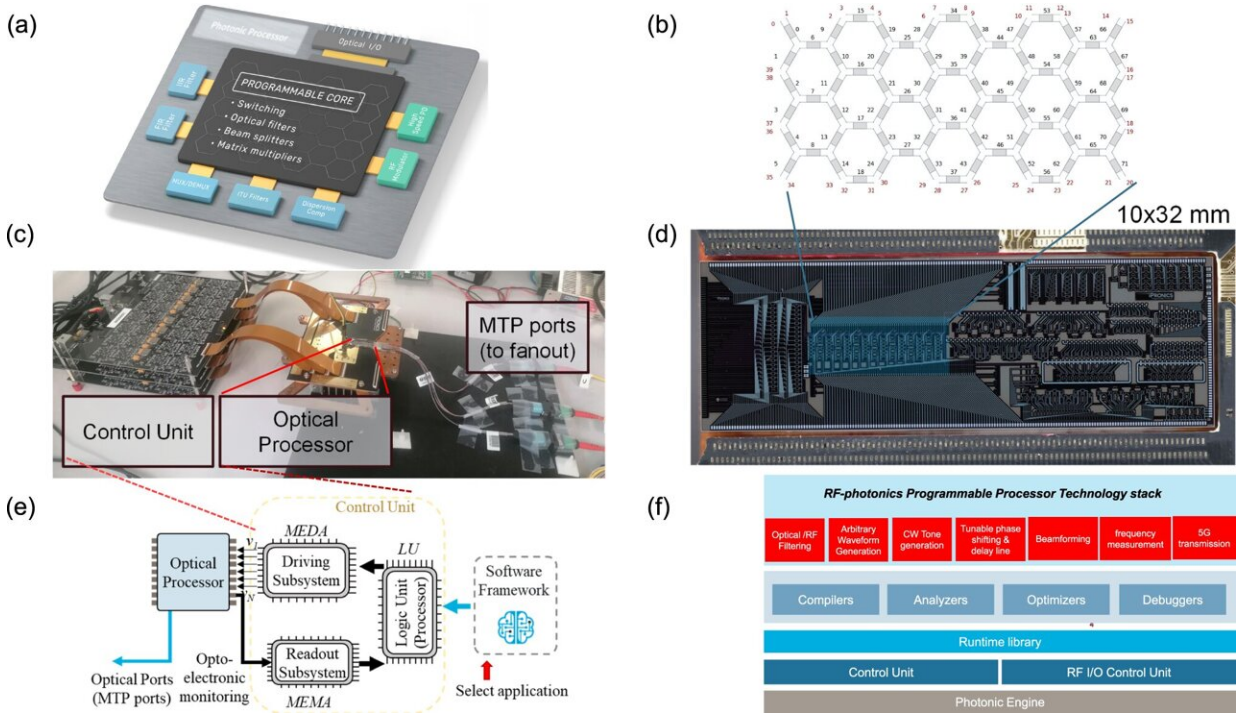
Research team manufactures the first universal, programmable and multifunctional photonic chip

April 15 2024



The photonic processor elements and layers. **a** Optical layer of the processor with the core, I/Os, and high-performance blocks, **b** schematic of the waveguide mesh core, **c** assembled chip with control unit and access fibers, **d** picture of the chip with the highlighted region of the reconfigurable core, **e** interconnection diagram between optical system, control unit and software layer, **f** Software layer stack employed in this work. Credit: *Nature Communications* (2024). DOI: 10.1038/s41467-024-45888-7

A team from the Photonics Research Laboratory (PRL)-iTEAM of the Universitat Politècnica de València and the company iPRONICS have designed and manufactured a revolutionary chip for the telecommunications sector, data centers and infrastructure associated with artificial intelligence computing systems. It is the first universal, programmable, and multifunctional photonic chip worldwide.

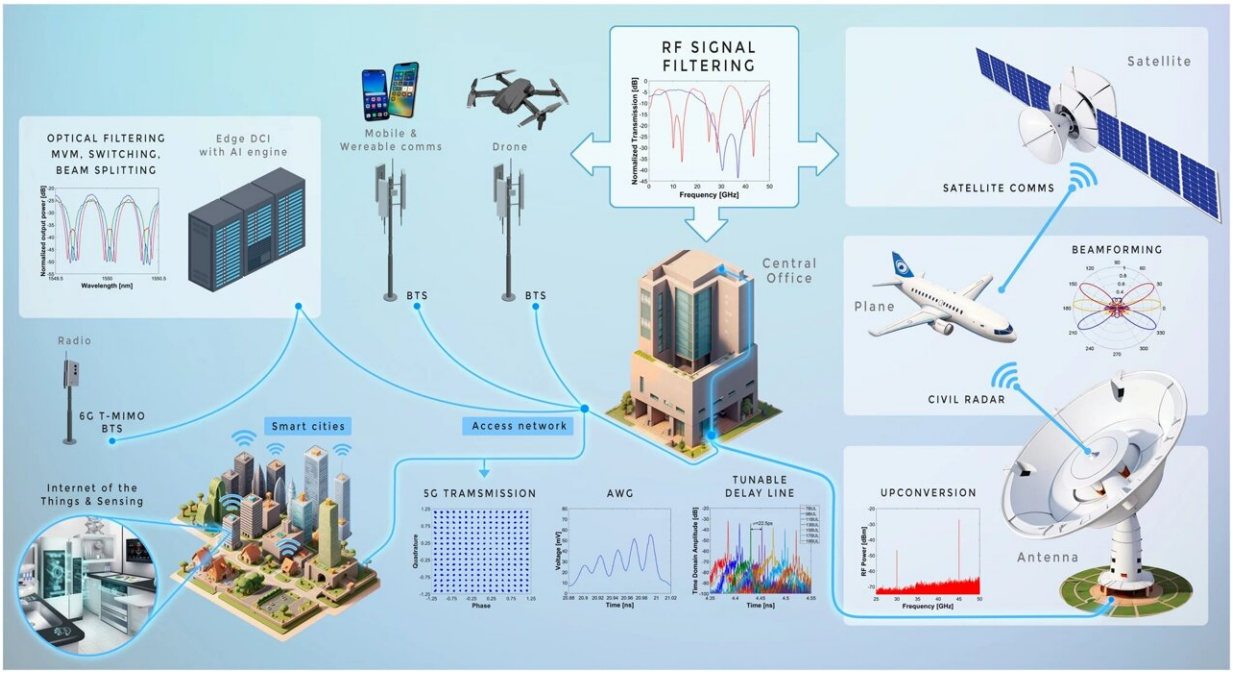
It will benefit 5G communications, data centers, quantum computing, artificial intelligence, satellites, drones, and autonomous driving, among many other applications.

The development of this chip is the main result of the European project UMWP-Chip, led by researcher José Capmany. The work has been published in *Nature Communications*.

The chip devised and manufactured by the UPV and iPRONICS team allows on-demand programming and interconnecting of wireless and photonic segments of communication networks, avoiding the generation of bottlenecks that can limit both the capacity and bandwidth available.

"It is the first chip in the world with these characteristics. It can implement the twelve basic functionalities required by these systems and can be programmed on demand, thus increasing the efficiency of the circuit," explains Capmany.

The UPV professor explains that applications such as 5G or autonomous cars require a higher frequency, making it necessary to reduce the size of the antennas and the associated circuits. In this case, the PRL-iTEAM from UPV has managed to make the converter behind the antenna, an interface chip, as tiny and compact as possible and ready to support current and expected future frequency bands.



(BTS base station, CS central station, DC data center, AI artificial intelligence, AWG arbitrary waveform generation, IoT Internet of things, MIMO multiple input multiple outputs). Credit: *Nature Communications* (2024). DOI: 10.1038/s41467-024-45888-7

This chip has already been integrated into an iPRONICS product, the Smartlight, and Vodafone has already used it in testing.

"For us, the development of this chip is a crucial step because it has allowed the validation of our developments applied to a growing problem, the efficient management of data flows in data centers and networks for artificial intelligence computing systems. Our next goal is to scale the chip to meet the needs of this market segment," said Daniel Pérez-López, co-founder and CTO of iPronics.

More information: Daniel Pérez-López et al, General-purpose programmable photonic processor for advanced radiofrequency applications, *Nature Communications* (2024). DOI: 10.1038/s41467-024-45888-7

Provided by Universitat Politècnica de València