PASSION

Photonic technologies for a programmable transmission and switching modular systems based on Scalable Spectrum/ space aggregation for future high capacity metrO Networks

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Instrument: RIA

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Web site:
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Budget:
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Project Partners:
Politecnico di Milano (POLIMI), IT (Coordinator)
Centre Tecnològic Telecomunicacions Catalunya (CTTC), ES
Technische Universiteit Eindhoven (TUE), NL
VTT Technical Research Centre of Finland Ltd, FIN
Vertilas GmbH (VERT), D
VLC Photonics S.L., ES
OpSys Technologies, IL
Effect Photonics BV (EFP), NL
SM Optics S.r.l. (SMO), IT
Telefónica Investigación y Desarrollo SA (TID), ES
European Photonics Industry Consortium (EPIC), FR
National Institute of Information and Communications Technology (NICT), J
Electronic and Telecommunications Research Institute (ETRI), KR

Vision & Aim

In the last decade we have observed a continuous development of the fibre optic networks for metropolitan applications. However, we are now facing a bottleneck in the transmission and the routing of data due to the dramatic increase in the users' number, in the content size, and caused by the convergence of mobile and datacom networks. Photonics is a key enabling technology for the evolution of the entire telecommunications infrastructure, but the technologies used so far for the metro network directly derive from the long-distance transport and they proved to be too expensive and power hungry.

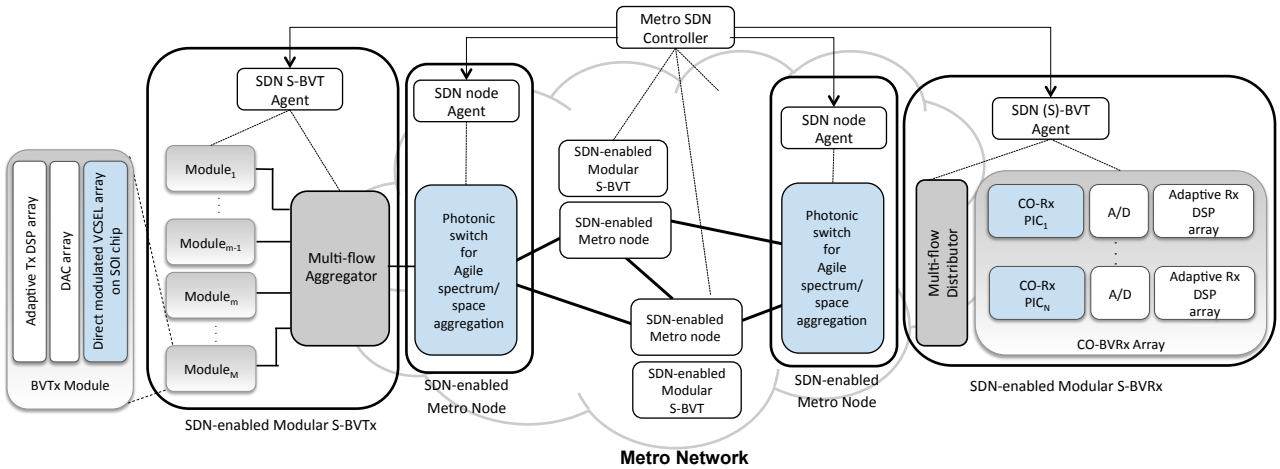
Alternatively, PASSION will develop an innovative technological platform based on directly-modulated vertically emitting laser sources (VCSEL) and on multi-channel coherent receivers integrated on Silicon-Photonics technology, providing high modularity and aggregating signal flows with a capacity of 16 Tb/s per spatial channel and 112 Tb/s per link exploiting a 7-core fiber. PASSION technologies will achieve a 10-fold power-consumption reduction with respect to commercially available modules based on externally modulated traditional sources. The dimensions of the PASSION modules will be even 3 orders lower than the current WDM solutions.

Thanks to these innovative transmitters and receivers PASSION will design a flexible network architecture, optimized for metro applications, based on aggregated signal flows, exploiting the full wavelength spectrum and the "space" dimension in a multi-core fibre.

Photonic devices capable of aggregating/disaggregating and/or routing data flows in spectrum and/or in space will allow a switching capacity of 1 Pb/s node. The metro network architecture that will be developed in PASSION will thus provide a full programmability to match the traffic evolution.

The exploitation of PASSION expected results represents a step forward compared to the existing technological solutions employed for metro network architectures, paving the way for the future metropolitan infrastructure of European high-bitrate communications that will connect people, content, clouds and things. PASSION will contribute to reinforce the European industrial technological leadership in high-capacity photonic devices and sub-systems, addressing the growing market of metro network scenarios, and improving business opportunities in Europe.

The PASSION project aims at sustaining bandwidth requirements in metro networks supporting a highly connected and communicating society by developing a photonic platform based on the integration of VCSELs and Silicon Photonics (SiPh) and of highly functional multichannel coherent receivers for the high bandwidth, low cost, reduced footprint and low power consumption.



In order to pursue its ambitious goal, PASSION is organized in **four technical WPs** plus **two additional WPs**, **WP6** devoted to the exploitation plan, dissemination, standardization, and technology transfer and **WP1** devoted to the project coordination. The technical WPs focus on **five Objectives**. The first one is the design and development of photonic technologies for the realization of a new generation of energy-efficient and compact transmitter modules for the metro network enabling up to **Tb/s capacity per PIC**. Specifically, in **WP3** the WDM VCSELs are produced and aggregated by the development of compact SiPh integration solutions. The second objective is the design and development of photonic technologies for the realization of a new generation of compact, flexible receiver modules able to sustain the PASSION sliceable-bandwidth/bitrate approach. In **WP4** few coherent polarization-division multiplexed receivers are integrated to obtain footprint reduction with respect to the commercial modules. The third objective is the development of energy-efficient and small-footprint switching technologies for a node featuring functional aggregation/ disaggregation, together with switching in the space and wavelength domain in order to handle **1-Pb/s capacity**. In particular, in **WP4** a flexible switching node is achieved thanks to the exploitation of monolithic and hybrid integrated active (gain and tuneable) devices with passive circuitry on InP and SiPh, respectively. The fourth objective is the design and development of scalable and modular sliceable variable bandwidth/bitrate transceiver (S-BVT) architectures, allowing to adaptively generate multiple flows of Tb/s capacity and enabling up to **100 Tb/s aggregated capacity per link**. The last objective is the development of scalable and modular metro network architectures for subsystem sharing and functional reuse to support flexible agile spectrum/spatial switching addressing capacities of Pb/s per node. Regarding the last two objectives, **WP2** defines network, systems and subsystems requirements and use cases for the designed metro network and node architectures featuring different levels of aggregation to match the traffic demand. The network relies on programmable (SDN-enabled) **scalable and modular systems** including S-BVT and node architectures. Exploiting the polarization and spectral dimension over the whole C-band and the spatial dimension (multi-core fiber or fibre bundle) up to 100 Tb/s aggregated capacity per link are enabled. Moreover, **WP5** supports all the other R&D WPs integrating, testing and demonstrating the PASSION design and the developed technologies/solutions. WP5 includes a network-wide proof-of-concept demonstration, exploiting the developed devices and technologies.

The PASSION consortium collects all the skills needed to fulfill the tasks of the project as the different Partners have **complementary expertise and are capable of addressing the entire supply chain**. The PASSION consortium includes universities (*POLIMI*, *TUE*), research centres (*CTTC, VTT, NICT, ETRI*), small medium-size enterprises (*VERT, VLC, OPSYS, EFP*) for devices manufacturing, an industrial consortium (*EPIC*), a supplier of communication equipment (*SMO*), and a network operator (*TID*). The strong industrial commitment is reflected in the composition of the consortium and in the 50% portion of the budget dedicated to industry (32% to SMEs).