Novel optical networking architectures and open interfaces for 5G and future 6G networks

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5G has provided us with an unprecedented vision of a fully connected society, with applications of smart cities, ubiquitous AR, mission critical services, remote surgery, medical first assist, support for fire brigades, etc.. However, the fully connected 5G vision can only come together if similar radical innovations are carried out, in parallel, for optical networks, in transmission systems spanning from access to core. This Special Issue brings together research work on novel optical network architectures, open interfaces in support of 5G, future 6G networks.

As Passive Optical Networks (PONs) are gaining popularity for their use beyond residential broadband, it is not surprising that we have three publications in this area. The first paper, from Dias et al., provides an overview of PON architectures, focusing on integration of MEC nodes, to achieve low latency and thus support cloud RAN and other latency sensitive applications and services. The other two papers focus instead on transceiver technology. The work from Plazas et al., demonstrates analogue radio over fibre (RoF) transmission using colorless VCSEL technology to reduce transceivers cost. We believe analogue RoF will become increasingly important to optimise the use of fibre bandwidth as we move to higher capacity wireless signals. The work from Zhang et al., addresses access network flexibility, showcasing the important advantages that coherent technology can bring, from variable rates to larger power budgets and additional levels of multiplexing.

Then, we have two contributions that address multi-service and multi-tenancy aspects started with 5G technology, and further developed towards 6G. The work by Larrabeiti et al., considers performance monitoring aspects of network slices, indicating how existing Operations Administration and Management protocols can be used towards this goal, and provides use cases related to mobile fronthaul. The paper by Alemany et al., focuses instead on the orthogonal aspect of security, for the creation and running of end-to-end slices over optical transport domains. They propose an architecture to address the Security Ser-

vice of Level Agreement (SSLA) for network slices that span multiple domains, showcasing resistance against Distributed Denial-of-Service (DDoS) attack as a test use case.

After this, we move to the paper from Akinrintoyo et al., which brings our attention to the important role that large scale and open testbeds can play in the development of many aspects considered by the other authors of this special issue. Besides showcasing the advantage that large testbed can bring to research, from physical layer to control planes, the authors also develop a digital twin for the COSMOS testbed, starting from data-based models of optical amplifiers.

We then enter into the area of network planning, where the work by Patri et al., provides a thorough techno-economic analysis on the advantage brought about by flexibility in transmission systems, focusing on flexible bandwidth variable transceivers. The authors show us how flexibility enables better optimisation, which can reduce the number of interfaces required and thus network cost of ownership.

Finally, for the last paper we have selected the work by Plant et al., which brings us down to the device level. The authors evaluate the performance of two traveling wave Silicon Photonic (SiP) modulators (respectively in the O and C bands), achieving a record in transmission speed using all SiP modulators. This carries great promises towards future component integration.

To conclude, we hope that the readers will enjoy this special issue and be inspired by the innovative technologies. We are optimistic that in the future they will converge together towards widespread adoptions.