Photonics technologies for future 5G mobile networks

Roberto Sabella
ERICSSSON, Research Corporate Center, Pisa , Italy, Italy
e-mail: roberto.sabella@ericsson.com

The evolution of mobile networks towards 5G will really enable the networked society and create significant opportunities for Industry and Society.
Huge traffic growth as well as a significant reduction of latency dictated by time-sensitive MTC services will require a substantial transformation of the radio access networks (RAN) and, consequently, imposes a rethinking of the underlying transport network.
The conventional point-to-point fronthaul concept is evolving towards a geographical network connecting a pool of DUs with a plurality of RRUs using the CPRI protocol. Centralization of radio baseband processing functions is gaining great interest for its potential to allow a consolidation of nodes and network elements, so as to lower CapEx and OpEx (e.g. fewer nodes to install, to maintain, to upgrade, and to power supply), while at the same time increase radio coordination functions.
Optical technologies with their conventional benefits of high bandwidth, protocol transparency, scalability, low latency, high resiliency and network re-configurability, are today perceived as a promising key piece of the radio access network puzzle, in both front haul and back haul transport areas. But previous generation of optical networking technologies (e.g. SDH/SONET, WDM, OTN etc.), based on discrete components and modules, that played a relevant role to realize an affordable transport medium in metro and core networks are not adequate for the needs of the emerging RAN transport segments requiring low cost, lower power consumption and a level of miniaturization.
Re-configurability features, provided by WDM technologies, can further increase CPRI transport efficiency.
Photonic Integration and in particular silicon photonics with its recent advances in integrating many optical circuits and functions (for instance multiplexer, attenuator, switches, couplers) in a single chip using the well-developed CMOS production infrastructure, is the ideal technology to fit the RAN needs.
In addition to this, the exponential growth of traffic is driving important evolutions in the development of HW platforms of next generation telecom and data-com equipments. Future hardware platforms will have to be much more efficient with regard to energy consumption, footprint and cost. Hence, the critical challenges for telecom/data-com vendors will be to continuously increase bandwidth density at every point in the communication infrastructure. This leads to put more and more features onto the same hardware unit (e.g. a chip, a module, or even a board); and integrate as much as possible multiple functions in a single chip and also integration of many chips in the same module. This is crucial.
Photonics has become the key technology for board to board and chip to chip interconnects for its characteristics of large bandwidth, nearly reach and data rate agnostic characteristics and reduced energy consumption. Similarly to RAN transport application, also in the new HW platform evolution, the traditional optical devices based on discrete components cannot be used for cost and footprint reasons. Whole new optical devices based on photonic integration have to be envisaged. In particular, rapidly maturing CMOS compatible photonics which is mass-producible at low cost and high level of integration is a proven candidate to ensure effective integration with the control and host electronics.