Wireless Communications and Mobile Computing

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Special Issue on
Hybrid Optical-Wireless Networks and Architectures

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The integration of optical and wireless networks has emerged as a promising solution for providing a cost-effective, efficient, and flexible architecture in modern access networks. Hybrid optical-wireless networks, which are also known as Fiber-Wireless (FiWi) networks, are able to combine advantages from both domains: the huge bandwidth of optical backhaul can be efficiently offered in the wireless back end, while advancing the inherited features of such hybrid approach such as mobility, ubiquitous access, less infrastructure, and independency of the user location. However, the benefits of optical-wireless architectures have not yet been fully exploited. Significant challenges have to be addressed towards the final integration of optical and wireless networks.

The 5th Generation (5G) Infrastructure Public Private Partnership (5G-PPP) promotes the integration of mobile and wireless with the wired and optical communications, given licensed and unlicensed spectrum features, while supporting the ubiquitous communication access to Machine-to-Machine (M2M) and Internet of Things (IoT) infrastructures under a common, flexible, and virtualized network architecture. By utilizing three challenging technologies, namely, the Network Function Virtualization (NFV), the Software Defined Radio (SDR), and the Software Defined Networks (SDN), the optical-wireless integration could be highly leveraged. On the other hand, recent advancements in passive optical networks (PONs) have led to the New Generation PON2 (NG-PON2) standards that are capable of supporting network throughput of 40 Gbit/s by using Time and Wavelength Division Multiplexing (TWDM) in the upstream and downstream directions. The convergence of 5G wireless standards with recent PON advancements could pave the way for effective, SDN-based architectures that will address the current deficiencies in access domain

The objective of this special issue is to bring together the state-of-the-art research contributions that address design, evaluation, and deployment issues of hybrid optical-wireless networks.

Potential topics include but are not limited to the following:

- Traffic engineering in modern optical-wireless networks (connection maximization, energy consumption minimization, mobile user bandwidth availability maximization, adaptive bandwidth allocation mechanisms, and SDN-based resource allocation)
- Convergence of NG-PON2 standards with 5G applications (efficient mobile front-haul techniques, new polling mechanisms, converged bandwidth allocation, coordination of optical backhaul with radio access network)
- Convergence of elastic optical networks with 4G and 5G wireless networks (enhanced survivability, efficient routing allocation, adaptive spectrum allocation, and advanced resource scheduling)
- Quality-of-Service (QoS) provisioning and QoS services in optical-wireless communications (delay aware Quality-of-Service guarantees, optimization techniques, and performance evaluation)
- Lasers and photonic components for optical-wireless networks (THz wireless communication, metaphotonics, nanophotonics)
- Optical modulation and signal processing (advanced optical modulation formats, optical phase and intensity multiplexing, and optical signal processing technologies)
- Optical-wireless communication systems for indoor applications (protocols, proof-of-concept experiments, and performance evaluation)
- Energy management and energy-efficient schemes (modeling, optimization, beamforming designs, and algorithms)
- Quality of Experience (QoE) in converged optical-wireless networks (digital television platforms, multicast network services, and QoE-guaranteed design and operation)
- Dynamic Bandwidth Allocation (DBA) schemes for hybrid optical-wireless access networks (fairness, energy-efficient algorithms, performance evaluation, and coordination of the optical and wireless layers)
- Modeling and simulation techniques for optical-wireless communications (simulation tools, platforms, traffic modeling, and analytic performance evaluation)
- Cloud Radio Access Network (C-RAN) advancements (platforms, cloud-based network services and applications, and small cell paradigms)
- FiWi enhanced smart grids (energy consumption and greenhouse gas emissions, optical-based smart grid communications infrastructure, and power system perspectives)
- M2M communications over FiWi (e.g., resource allocation, energy efficiency, performance evaluation, polling mechanism, and power-saving mechanism)
- Efficient network and service monitoring for SDN/NFV-based mobile networks (network abstraction models, advanced SDN controllers, advancements in control layer, and managing optical-wireless networks)
- Virtualization of services and applications (load balancing, energy consumption, and planning and operational methodologies)
- Standardization of integrated optical-wireless architectures (open platforms, challenges, prospects, recent advancements, deployment scenarios, market-based plans, and regulatory frameworks and business-oriented infrastructure)
- Application of access optical-wireless networks and IoT (new applications, new demonstrations, and power transmission line monitoring)
- Orchestration, administration, and management of SDN-based optical-wireless networks (end-to-end connectivity services, scalability, secure management, cross-layer approaches, and demonstrations)
- Security, authentication, and privacy techniques and algorithms for 5G-based optical-wireless networks

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