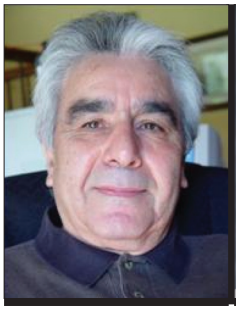
# ADVANCES IN PASSIVE OPTICAL NETWORKS



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As an ultimate broadband access solution for future Internet, the passive optical network (PON) brings many advantages such as cost effectiveness, energy savings, service transparency, and signal security over other last-/first-mile technologies. Over the past several years, we have witnessed significant development and deployment of time-division multiple access (TDMA) PONs such as IEEE 802.3ah Ethernet PONs (EPONs) and ITU-T G.984 Gigabit PONs (GPONs) to provide high-quality triple-play services for residential users. However, future Internet applications, apart from triple-play service (e.g., peer-to-peer [P2P] social networking, online video sharing, grid computing, and mobile Internet), along with their unique traffic characteristics and huge bandwidth requirements, pose big challenges for current PON design and migration, which in turn are driving legacy TDMA PONs toward ultra-high-speed flexible next-generation PONs such as wavelength-division multiplexed (WDM) PONs and optical orthogonal frequency-division multiplexed (OFDM) PONs, and/or a hybrid WDM/OFDM/TDM PON.

This special issue features recent and emerging advances in PONs. Of the large number of submitted papers, five were selected for this issue . The selected articles cover topics including next-generation PON architecture, energy-efficient PONs, layer 2 medium access control (L2 MAC), quality of service (QoS) provisioning in future PONs, and PON monitoring techniques. The first article, "Opportunities for Next Generation Optical Access," coauthored by Dirk Breuer, Frank Geilhardt, Ralf Hülsermann, Mario Kind, Christoph Lange, Thomas Monath, and Erik Weis, discusses the impact of the new business models on network architecture based on the comparison of different optical access network variants. It also provides perspective on access node consolidation for network operators.

One of the PON's advantages is the potential to provide high energy efficiency toward future green communications. The second article, "Cost and Energy Consumption Analysis of Advanced WDM-PONs" contributed by Klaus Grobe, Markus Roppelt, Achim Autenrieth, Jörg-Peter Elbers, and Michael Eiselt, focuses on the analysis of cost and energy-consumptions of future advanced WDM-PON options. The authors conclude that it is essential to carefully clarify the requirements for next-generation access with regard to per-PON client count and maximum reach. In particular, if client count does not exceed ~320, and a passive filter-based optical distribution network (ODN) is accepted, the most efficient solution, with regard to both cost and power consumption, is a simple WDM-PON. The article "Toward Energy-Efficient 1G-EPON and 10G-EPON with Sleep-Aware MAC Control and Scheduling," co-authored by Jingjing Zhang and Nirwan Ansari, presents L2 techniques, proposing sleep-aware MAC control and scheduling approaches for EPON. Two sleep-mode control and sleep-aware scheduling schemes are analyzed: sleep for over one DBA cycle and sleep within one DBA cycle.

In addition to reducing energy consumption, multirate and multi-QoS provision is a critical feature next-generation PONs shall possess naturally to cater for existing and emerging Internet applications. The article titled "Multirate and Multi-Quality-of-Service Passive Optical Network Based on Hybrid WDM/OCDM System" by Hamzeh Beyranvand and Jawad A. Salehi proposes a new scheme to guarantee multi-QoS in WDM/OCDM system. The basic idea is to use multilength variable-weight optical orthogonal codes (MLVWOOC) as the signature sequence of an OCDM system. The code weight and code length of MLVWOOC are designed based on the characteristics of the requested classes of services.

The last article, "Passive Optical Network Monitoring:

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[1] *Please note that several more papers were accepted as the second part of the special issue and will be published in the September 2011 issue of* IEEE Communications Magazine.

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Challenges and Requirements," co-authored by Mohammad M. Rad, Kerim Fouli, Habib A. Fathallah, Leslie A. Rusch, and Martin Maier, touches on a different problem. In addition to the discussion of challenges and requirements for PON monitoring, it presents a comprehensive review of techniques for in-service monitoring PONs to detect and localize faults. The authors recommend the hybrid techniques as promising solutions for delivering the maintenance and protection functionalities required by current and next-generation PONs.

We would like to take this opportunity to thank our reviewers for their effort in reviewing the manuscripts. We also thank the Editor-in-Chief, Dr. Steve Gorshe, for his supportive guidance during the entire process.

## BIOGRAPHIES

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