# CALL FOR PAPERS
## IEEE Signal Processing Society

Special Issue
**IEEE SIGNAL PROCESSING MAGAZINE**

## Special Issue on
## Advanced DSP and Coding for Multi-Tb/s-per-Channel Optical Transport

**Aims and Scope**

The exponential growth of Internet traffic places enormous transmission bandwidth demand on the underlying information transport infrastructure at every level, from the core to access networks. In response to the high bandwidth demands, IEEE ratified its 40/100 Gb/s Ethernet Standard IEEE 802.3ba in June 2010. Deployment of 100 Gb/s Ethernet (GbE) and its photonic transport layer has already started and is expected to be accelerated within a couple of years. To meet the ever-growing bandwidth demand, 1 Tb/s Ethernet (TbE) systems and multi-TbE are to be standardized in the near future. There are several optical transmission technology options, such as DWDM, multiband-superchannel, and polarization-division-multiplexed high-level QAM, for enabling TbE. However, some challenges still remain with respect to using these techniques as practical technologies for realizing optical TbE. Optical transport in the terabit-per-sec-per-channel range calls for optimal channel design and requires some extent of parallel processing. The envisioned growth in Internet traffic will place an enormous demand on overall transmission capacity and on the transport infrastructure at all levels. This will also require major improvement in energy efficiency for the processes of bandwidth creation and distribution. As a current example, large data centers are being built closer to power plants in order to facilitate the supply of the energy needed. Recent studies indicate that the power consumed by information and communication technologies, currently at 2-4% of the total carbon emissions, will have doubled by the end of this decade, assuming that the current trend continues. The Internet is evidently becoming constrained not only by capacity, but also by the energy consumption. It is imperative that the research community addresses both bandwidth and energy constraints sooner rather than later, and any advances, even seemingly incremental ones, will be deemed meaningful.

This Special Issue of IEEE Signal Processing Magazine aims to explore novel advanced digital signal processing (DSP) and coding strategies to enable multi-Tb/s-per-channel optical transport for addressing the pressing bandwidth and energy-efficiency demands. The topics addressed here range from more sophisticated modulation and coding schemes, to advanced detection schemes that are potentially enabling technologies for multi-TbE optical transport. We welcome contributions on DSP and coding techniques for multi-Tb/s-per-channel optical transport over either single-mode fibers or few-mode/few core fibers, as evolution to spatial multiplexing is recently being contemplated for fiber-optic communications. Proof-of-concept of novel DSP and coding techniques through experimental verification will be highly regarded but so will innovative ideas and concepts backed by theoretical proof and simulation.

**The main areas to be covered by the special issue include, but are not limited to:**

1. MIMO signal processing enabling multi-Tb/s optical transport
   - 2x2 MIMO signal processing for polarization-division multiplexing
   - MIMO signal processing for spatial-domain-based optical transmission systems
   - Polarization-time coding
   - Space-time coding for few-mode/few-core based optical transmission
2. Advanced multilevel and multidimensional modulation schemes
   - Hybrid modulations
   - Multidimensional modulation
   - Power-efficient modulation schemes
   - Spatial domain modulation
   - Optimum signal constellation design
3. Advanced multiplexing schemes
   - Polarization-division multiplexing
   - Spatial-domain-based multiplexing
   - Optical angular momentum (OAM) based multiplexing
   - Filter-bank based sub-banding
4. Signal processing for multi-band superchannel enabling beyond 1 Tb/s optical transport
   - Channel estimation
   - Timing recovery
   - Frame synchronization
   - Frequency synchronization
   - Maximum likelihood (ML) channel estimation
   - MMSE channel estimation
   - Carrier phase recovery
   - Subcarrier recovery
   - Mode-multiplexed superchannel
5. Advanced DSP, detection and equalizations schemes enabling multi-Tb/s optical transport
   - Adaptive equalization

- Maximum-likelihood sequence detection (MLSD)
- Blind equalization
- Turbo equalization
- Digital back-propagation
- Wiener filtering
- Nonlinear equalization based on Volterra series representation
- Factor graph based equalization
- Low-complexity DSP algorithms

6. Advanced coding for multi-Tb/s optical transport
    - Turbo and turbo-product codes
    - LDPC codes
    - Coded-modulation
    - Non-binary LDPC coded-modulation
    - Low-complexity decoding algorithms

7. Experimental demonstration and implementation issues
    - FPGA/ASIC implementations
    - Experimental demonstrations

8. Software defined optical transport (SDOT)
    - Adaptive modulation
    - Rate-adaptive coding
    - Adaptive LDPC-coded modulation

9. Optical channel capacity studies
    - Calculation of channel capacity of few-mode/few-core fibers based optical communication systems
    - Impact of nonlinear effects in few-mode/few-core fibers
    - Compensation of nonlinear effects
    - Nonlinear interaction modeling in few-mode/few-core fibers
    - Advanced design of an optical channel

10. Energy-efficient DSP
    - Energy efficient DSP algorithms
    - Energy efficiency aspects of coding
    - Energy efficiency aspects of advanced modulation formats
    - Energy-efficient transmission link design

## Submission Process

**Articles submitted to this special issue must contain significant relevance to advanced signal processing and coding enabling multi-Tb/s optical transport.** All submissions will be peer reviewed according to the IEEE and Signal Processing Society guidelines for both publications. Submitted articles should not have been published or be under review elsewhere. Manuscripts should be submitted online at http://mc.manuscriptcentral.com/sps-ieee using the Manuscript Central interface. Submissions to this special issue of the IEEE SIGNAL PROCESSING MAGAZINE should have significant tutorial value. Prospective authors should consult the site http://www.signalprocessingsociety.org/publications/periodicals/spm/ for guidelines and information on paper submission.

**Important Dates:** Expected publication date for this special issue is **Februray 2014.**

| Time Schedule | Signal Processing Magazine |
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| White paper (4 pages) due | **February 10, 2013** |
| Invitation notification | **February 24, 2013** |
| Manuscript submission due | **May 15, 2013** |
| Acceptance notification | **July 8, 2013** |
| Revised manuscript due | **August 20, 2013** |
| Final acceptance notification | **September 20, 2013** |
| Final material from authors | **November 8, 2013 (strict)** |
| Publication date | **March 2014** |

## Guest Editors

**Ivan B. Djordjevic**, *Lead GE,* University of Arizona, USA, ivan@email.arizona.edu
**William Shieh**, University of Melbourne, Australia, shiehw@unimelb.edu.au
**Xiang Liu**, Bell Labs, Alcatel-Lucent, USA, xiang.liu@alcatel-lucent.com
**Moshe Nazarathy**, Technion, Israel, nazarat@ee.technion.ac.il