

Guest editorial

Cross layer design for cognitive networks

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Cognitive wireless access networks interact and respond to requests of a specific user by dynamically altering their topologies and/or operational parameters to enforce regulatory policies and optimize overall network performance. A cognitive infrastructure consists of intelligent management and reconfigurable elements that can progressively evolve the policies based on their past actions. In this context, the structure of conventional layer protocols is inflexible because it requires layers to communicate in a strict manner rather than adapting to dynamic conditions. This results in inefficient use of both energy and spectrum which are valuable resources in wireless environments. A new paradigm is needed for designing protocols in such environments and can be characterized by cross-layer designs and adaptation approaches. Cross-layer design is an emerging research area where some recent results have been reported. However, this area still holds great potential for more comprehensive results that can address many outstanding research issues for emerging applications being deployed in networking environments such as 3G, 4G, Cognitive Networks or Next Generation Networks (NGNs).

The Call for Papers for this Special issue attracted more than 30 submissions from Asia, Europe, and the US covering a wide range of topics in the field of cross-layer design for cognitive networks. Each paper was carefully evaluated by

three reviewers. This careful evaluation process has allowed us to select 12 high quality research papers. We strongly believe that the selected papers will make a significant contribution to researchers, practitioners, and students working in the area of the Cross Layer Design and in the specific field of Cognitive Communications.

Our special thanks go to Professor Bezalel Gavish (Editor-in-Chief) for his valuable support throughout the preparation of this Special Issue. We would like to thank all authors who have submitted papers to the Special Issue and in particular those whose papers have been accepted for this Special issue. Assistance from the editorial staff of the Telecommunication Systems is also much appreciated. Finally, the Guest Editors wish to gratefully acknowledge all those who have generously given their time to review the papers submitted for consideration for this SI.

The twelve accepted papers are divided into three categories. Five papers relate to Cross Layer Design regarding mobility management, file sharing, etc. “SHIP: Cross-Layer Mobility Management Based on Session Initiation Protocol and Host Identity Protocol” by Shuigen Yang et al. proposes a cross-layer mobility management scheme based on SIP and the Host Identity Protocol (HIP) which is a new protocol designed to provide secure and continuous communications between two nodes by separating the identifier and the locator roles of the traditional IP address. “A Cross-Layer Congestion and Contention Window Control Scheme for TCP Performance Improvement in Wireless LANs” by Der-Jiunn Deng et al. proposes a novel and pragmatic cross-layer approach with joint congestion and contention window control scheme to improve the performance of TCP in IEEE 802.11 wireless environments. “A Cross-Layer Framework for Position-Based Routing and Medium Access Control in Heterogeneous Mobile Ad Hoc Networks” by Xinyu Yang et al. presents a two-layer approach which extends the MAC

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and network layers for H-MANETs to minimize the problems caused by link asymmetry and exploits the advantages of H-MANETs simultaneously. “Cross-Layer Design of P2P File Sharing over Mobile Ad Hoc Networks” by Ren-Hung Hwang et al. proposes an efficient and scalable P2P file sharing system over MANET based on Swarm Intelligence, referred to as P2PSI. “Routing Optimization over Network Mobility with Distributed Home Agents as the Cross Layer Consideration” by Chung-Sheng Li et al. proposes an enhanced architecture by deploying Home Agents Location Registration Agents (HALRA) on cellular data switch (3G/B3G) network incorporating Distributed Home Agents (NEMO-DHA) on NEMO for a Mobility Critical Area.

Three papers address Cognitive Radio issues. “Weighted Sum Rate Maximization for OFDM-based Cognitive Radio Systems” by ZhiHua Tang et al. focuses on the sub-carrier and power allocation problem in the downlink of an OFDM system in a cognitive radio environment. “A Cross Layer Approach Based on Queuing and Adaptive Modulation for MIMO Systems” by Abbas Mohammadi et al. designs an adaptive modulation scheme using MIMO systems combined with finite-length queuing at the data link layer. “Cross-Layer Resource Allocation for Real-Time Services in OFDM-based Cognitive Radio Systems” by Yonghong Zhang et al. proposes a cross-layer (MAC and PHY layers) approach with the aim of satisfying Quality of Service (QoS) requirements of real-time applications.

The last four papers are about power consumption. “Optimization of Multilevel Power Adjustment in Wireless Sensor Networks” by Mingzoo Wu et al. proposes a multilevel power adjustment (MLPA) mechanism for Wireless Sensor Networks to prolong the individual node lifetime and the overall network lifetime. “Adaptive Transmission Scheduling over Fading Channels for Energy-Efficient Cognitive Radio Networks by Reinforcement Learning” by Zhu Jiang et al. addresses a cross-layer issue of long-term average utility maximization in energy-efficient cognitive radio networks supporting packetized data traffic under the constraint of collision rate with licensed users. “Energy Efficient Virtual MIMO Communication for Wireless Sensor Networks” by Jong Hyuk Park et al. investigates virtual MIMO for fixed and variable rates by energy efficient routing based on virtual MIMO. Finally, “An Energy-Efficient Interface Selection for Multi-Mode Terminals by Utilizing Out-of-Band Paging Channels” by SungHoon Seo et al. proposes an energy-efficient interface selection scheme for MMTs in the integrated WLAN and cellular networks by taking advantage of existing out-of-band paging channel of cellular networks.



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