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Editorial

Adaptive Cross-Layer Strategies for Fourth Generation Wireless Communications

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Ubiquitous support of heterogeneous services with prescribed QoS requirements is an ever-increasing demand in the fourth generation of wireless communication systems. Unpredictable and variable nature of environment and scarcity of resources necessitate exploiting efficient adaptive resource allocation strategies in operating the emerging networks. Recent growth in popularity of high-data rate-applications and the need for larger bandwidths for transmission of multimedia content have also made the ideas of "resource sharing" and "cognitive radio" very attractive. Again sharing or allocation of resources should be dynamic and adapted to the network condition.

On the other hand, for attaining the optimal perceived quality, QoS requirements and the respective resource allocation techniques for the new wireless applications should be considered across the open system interconnection (OSI) layers. For example, quality of video streaming application is best measured at higher layers, while this quality is affected by resource allocation within lower layers.

This special issue aims to shed light on the above concepts from a number of perspectives.

The first paper "*Particle swarm optimization (PSO) for adaptive resource allocation in communication networks*" focuses on adaptive centralized and distributed resource allocation strategies in communication networks. For a low-complexity design, a generalized model of particle swarm optimization (PSO) technique is used. By deploying the concept of PSO for subcarrier allocation, the required computational complexity and traffic overheads are significantly lowered.

The next three papers study adaptive cross-layer schemes in cognitive radio (CR) systems.

The paper "*A cross-layer approach in sensing and resource allocation for multimedia transmission over cognitive UWB networks*" studies medium access control (MAC) centric cross-layer approach to address the problem of multimedia transmission over cognitive ultra wideband (C-UWB) networks. This paper proposes a cross-layer design while considering UWB wireless channel conditions, time slot allocations at the MAC layer, and MPEG-4 video at the APP layer. Then, the performance of the proposed approach is investigated.

The paper "*Cross-layer design in dynamic spectrum sharing systems*" in this special issue proposes to employ a cross-layer design policy that incorporates adaptive power and coded discrete M-QAM modulation scheme into the physical layer with a truncated automatic repeat request (ARQ) protocol at the data link layer, while satisfying several constraints such as the packet error rate (PER) and average interference limit.

The paper titled "*Cross-layer dynamic spectrum map management framework for white space applications*" proposes a dynamic management framework of white space (unused spectrum) for shortening the total spectrum sensing time by cognitive users who aim to exploit unoccupied spectrum.

Complexity of throughput-optimal scheduling schemes in wireless networks has been analyzed in "*On the complexity of scheduling in wireless networks*" under interference constraints. The authors show that one can develop simple

distributed algorithms whose worst-case throughput is a nonvanishing fraction of the optimal throughput for a wide range of wireless networks.

Cross-layer resource allocation for multiclass traffic, with different QoS requirements, is considered in "*Uplink cross-layer scheduling with differential QoS requirements in OFDMA systems*" for an OFDMA-based wireless system. The authors show that their proposed cross-layer method guarantees the application layer QoS requirements and simultaneously minimizes the integrated residual workload in the MAC layer.

In "*Intercell radio resource management through network coordination for IMT-advanced systems*" users are classified to cell-edge and cell-interior users; radio resources for each class are managed separately. The authors present a solution where a user switches the user type so as to maximize overall network throughput subject to the condition that their own throughput does not decrease upon switching.

The eighth paper "*A cost-based adaptive handover hysteresis scheme to minimize the handover failure rate in 3GPPLTE system*" considers a cost-based adaptive handover hysteresis scheme for the horizontal handover decision strategies, which can be a candidate of self-optimization techniques minimizing the handover failure rate (HFR) in the 3rd generation partnership project (3GPP) long-term evolution (LTE) system. The authors claim that based on their proposed scheme a proper hysteresis value is easily obtained according to the dominant factors. Thereby they would effectively achieve handover parameter optimization for minimizing the HFR.

The authors in "*Reference chaser bandwidth controller for wireless QoS mapping under delay constraints*" present a control scheme that adapts the bandwidth to be allocated to a buffer which conveys heterogeneous traffic (both concerning traffic sources and QoS requirements) with delay constraint in a layer-in-cascade model.

The last paper "*Analysis of the tradeoff between delay and source rate in multiuser wireless systems*" addresses the limits on the information that can be transmitted over the wireless networks given the channel conditions in the MAC layer, in terms of a selected scheduling discipline and an ensured level of quality of service (QoS). This paper studies the joint influence of the channel fading, the data outsourcing process, and the scheduling discipline on a QoS metric based on the effective bandwidth theory.

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