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EDITORIAL

Special Issue on Mobile Computing and Networking Technologies

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The new technological and economic environment along with the increasing demand for reliable communication services have necessitated broadband access to information anywhere at anytime. The current telecommunications environment, where multiple access technologies and standards are deployed, and the increased users mobility give rise to new challenges and opportunities for research and development of ubiquitous computing via wireless and mobile equipment. Furthermore, important networking issues concerning wireless communications are raised with regard to network design, channel estimation, propagation, radio resource management and Quality of Service provision. Dealing with these issues is imperative due to the non-uniform spectrum allocation, the different radio resource management policies, the scarcity of radio resources, the transmission impairments inherent in wireless links and users mobility.

The present Special Issue aims at fostering the dissemination of high quality, original, unpublished research work covering many aspects related to Mobile Computing and Networking Technologies as mentioned above. Moreover, this Special Issue collects extended versions of best papers from the IEEE Workshop on Mobile Computing and Networking Technologies 2009 (WMCNT09) that took place in St. Petersburg, Russia, in conjunction with the International Conference on Ultra Modern Telecommunications (ICUMT) 2009. Each paper submitted to the Telecommunications Systems Journal was peer reviewed by at least three reviewers expert in their corresponding area. Finally, based on the reviews collected, after two review rounds, 29 of 136 papers initially submitted were selected for inclusion in the special issue.

In the first paper, entitled "**Vacant Codes Grouping and Fast OVSF Code Assignment Scheme for WCDMA Networks**", Vipin Balyan and Davinder S. Saini delve into the channelisation codes used in WCDMA, namely OVSF. They propose a fast OVSF code assignment design which aims to reduce number of codes searched with optimal/suboptimal code blocking. The code assignment scheme aims to use those vacant codes whose parents are not free (already blocked). This leads to occurrence of vacant codes in groups (adjacent vacant codes) which ultimately leads to less code blocking for higher rate calls. Using simulation results the design of these codes is validated and verified.

In the second paper entitled "**Performance Evaluations of Channel Estimations in IEEE 802.11p Environments**" a Time-Domain (TD) channel estimation (CE) technique is proposed to enhance the CE performance of IEEE 802.11p standards in cases when the pilot density is insufficient to

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accurately estimate channel states in rich-scattering environments. In this paper, Chi-Sheng Lin, Che-Kang Sun, Jia-Chin Lin and Bo-Chuan Chen perform extended simulations including urban, suburb and express-way scenarios to validate their channel estimations.

The contribution of the third paper entitled "**Capacity of Practical Wireless Multihop Broadcast Networks**" lies on the study of an Ad-hoc network with infinite nodes. The authors, Cagdas Atici and Oguz Sunay, propose two heuristics, one distributed and one centralized, to find the optimal number and positions of rebroadcasting relay nodes to achieve the optimal broadcast capacity. The results illustrate that the benefits of peer-assisted broadcasting are more pronounced in the centralized relay selection algorithm when compared to the fully randomized and distributed selection under a realistic system model.

The next paper is entitled "**Using Novel Distributed Heuristics on Hexagonal Connected Dominating Sets to Model Routing Dissemination**" and it examines data routing in the CDS models. The authors, Maria Striki and Tony McAuley examine the difference in the impact of conditions on key performance metrics, such as this of network density on routing overhead as well as a tradeoff between routing overhead and routing stretch in CDS modes. Novel heuristics are employed to approximate the theoretically optimal CDS-HEX models for dynamic environments. In the presented analysis it is shown that: (a) although the distributed scheme naturally operates suboptimally compared to its centralized ancestor, it is still superior to MPRs over certain metrics of interest, (b) the set-up overhead of CDS-HEX is not significantly higher than this of MPRs, while at the same time, the steady state overhead of CDS-HEX turns to be adequately lower than this of MPR, and (c) all the closed analytical formulae and asymptotic results derived in the previous analysis are verified by simulations.

In the next paper, entitled "**Route Selection in IEEE 802.11 Wireless Mesh Networks**", the authors Usman Ashraf, Slim Abdellatif and Guy Juanole propose a novel routing—Expected Link Performance (ELP)—metric for wireless mesh networks which takes into consideration multiple factors pertaining to quality (link loss ratio, link capacity and link interference) to select the best end-to-end route. Simulation based performance evaluation of ELP against contemporary routing metrics shows an improvement in terms of throughput and delay.

The issue continues with the paper entitled "**RELD, RTT ECN Loss Differentiation to Optimize the Performance of Transport Protocols on Wireless Networks**", where the authors are presenting a loss differentiation method (RELD), based on ECN signaling and RTT, which is applied to TC-Plike which is one of the three current congestion controls present in the new transport protocol DCCP (Datagram Congestion Control Protocol). The authors Wassim Ramadan, Eugen Dedu, Dominique Dhoutaut and Julien Bourgeois, present results, where a more realistic simulated loss error model for wireless networks is used, show that RELD optimizes congestion control and therefore it increases the performance of transport protocols over wireless networks.

In the next paper, entitled "**Multi-user Precoding Techniques for a Distributed Broadband Wireless System**", the authors Reza Holakouei, Adao Silva and Atilio Gameiro, propose a practical distributed precoding technique to remove the intercell interference and improve the user's fairness at the cell-edges and assessing multi-user linear precoding techniques for downlink of distributed MIMO OFDM systems. The performance of the proposed scheme is evaluated and compared with an iterative precoding scheme designed to minimize the bit error rate, extended to the proposed multi-user distributed scenario, considering typical pedestrian scenarios based on LTE specifications.

In the subsequent paper, entitled "**Path Selection Algorithms for Fault Tolerance in Wireless Mesh Networks**", the authors are studying routing aspects in a Wireless Mesh Networks (WMN). The authors, Apostolia Papapostolou, Vasilis Friderikos, Tara A. Yahiyal and Hakima Chaouchi propose routing schemes to provide fault tolerance without sacrificing the energy and computational complexity efficiency. Numerical investigations, based on extensive simulations, validate the effectiveness of the proposed schemes even when faulty nodes subsist in the environment.

In the following paper, entitled "**A Holistic Approach in Minimizing Handover Latency in Heterogeneous Wireless Networking Environments**", the authors Elias Tragos, George Karetsos and Georgios Tsiropoulos, deal with the problem of handover time minimization for bandwidth demanding and real time services in 4th generation wireless communications systems. In particular, a framework for handover execution is presented who operated adaptively to the available resources for achieving bounded latency. The performance of the proposed scheme is evaluated via simulations demonstrating its improved behaviour.

In the next paper, entitled "**Network Virtualization as an Integrated Solution for Emergency Communication**", the authors Peter Dedecker, Jeroen Hoebeke, Ingrid Moerman, Joris Moreau and Piet Demeester, propose the development of a Virtual Private Ad-hoc Networking (VPAN) platform as an integrated networking solution for many applications that require secure transparent continuous connectivity such as the emergency communications. The authors present a virtual logical self-organizing network on top of existing network technologies reducing complexity and maintaining session continuity. The evaluation of the proposed architecture was performed via measurements realized on a real hardware platform.

The special issue continues with a paper entitled "**Stochastic Game Theoretical Model for Packet For-**

warding in Relay Networks", where a new game theoretical method is proposed to model packet forwarding in relay networks. Both cooperative and noncooperative solutions are provided for this model by Fatemeh Afghah, Abolfazl Razi and Ali Abedi. Best strategy set taken by players as well as system performance are studied for different system parameters. Also, the proposed method is extended to model more general case of Ad-hoc networks considering different packet error rates in case of collision occurrence that further improves the system performance. Simulation results show that performance of the noncooperative solution, in which players do not require to know each other's selected strategy, asymptotically approaches the cooperative system performance.

In the next paper, entitled "**Sensing Error Aware Delay-optimal Channel Allocation Scheme for Cognitive Radio Networks**", the authors, Wei Wang, Kejian Wu, Guanding Yu and Zhaoyang Zhang are presenting a new channel allocation scheme where two kinds of sensing errors are considered. The sensing errors are modeled to derive the metric of mean delay for each user-channel combination using the vacation queueing model. Further, the optimal resource allocation is determined based on the mean delay metric by bipartite graph matching. The simulation results indicate that the proposed mean delay metric can represent the transmission performance successfully and the proposed resource allocation scheme is robust to sensing errors.

The next paper is coauthored by Lambros Lambrinos and Constantinos Djouvas and it is entitled "**Improving Quality of Experience in Wireless VoIP through Novel Call Scheduling**". In this paper, the authors propose an enhanced scheme that aims to manage access to the available lines so that they are used in a fair manner and utilized to the highest possible degree. This management is facilitated by enhancing a proxy implementation with a number of call scheduling policies. The ability to satisfy pending call requests as soon as lines become available, results in increased user service satisfaction. Moreover, it increases line utilization which is crucial from an economic viewpoint and users Quality of Experience.

The contribution of the next paper, entitled "**Achieving Seamless Handoffs via Backhaul Support in Wireless Mesh Networks**" is focused on ensuring handoff procedure in Wireless Mesh Networks, where mobile clients may experience frequent handoffs due to the relatively small transmission range of the mesh routers. The authors, Yan He and Dmitri Perkins, propose a new scheme that takes advantage of the wireless backhaul feature of WMNs, and allows a mobile station to directly access the backhaul channel to probe the neighbouring mesh routers. The presented results show that the proposed scheme exhibits improved performance reducing handoff latency.

In the next paper of this special issue entitled "**Field Experiments on MIMO-OFDM System Combined with Adaptive Beamforming Based on IEEE 802.16e WMAN Standard**", field experiments on a Multi-Input Multi-Output (MIMO) system that combines Adaptive Beamforming (ABF) and Spatial Multiplexing (SM) procedures are presented by Jaeho Chung, Yusuk Yun and Seungwon Choi. The combination of SM signal processing with ABF is applied to WiBro, the South Korean Orthogonal Frequency Division Multiplexing (OFDM) system that follows the IEEE 802.16e standard. The system implementation and its field experimental results verify that the combination of MIMO OFDM system with ABF provides improved performance over a simple MIMO OFDM system in real propagation channel environment and, in particular, it is more effective in highly correlated fading channel.

In the subsequent paper, entitled "**Efficient Scheduling Algorithms for Mixed Services in Wireless OFDMA System"**, Yejun Liu and Qingyang Song, study the Orthogonal Frequency Division Multiple Access (OFDMA) modulation and access scheme which is an attracting system for combating the frequency selective fading for next generation mobile communication systems. In this paper, two scheduling algorithms applicable to mixed services (i.e., real-time and non-real-time services) are proposed, that is QoS-oriented Dynamic Threshold Control (DTC) algorithm and fairness-oriented Fairness Aware and QoS Aware (FAQA) algorithms. Simulation results demonstrate that, DTC algorithm not only guarantees the quality of both services, but also increases the spectrum efficiency. Moreover, FAQA algorithm maintains fairness among users, and guarantees QoS as well.

In the next paper, entitled "**Modelling and Performance Analysis of an Alternative to IEEE 802.11e Hybrid Control Function**", the authors Thomas Lagkas, Dimitrios Stratogiannis and Periklis Chatzimisios, present and study an alternative to HCF protocol, called Priority Oriented Adaptive Polling (POAP). POAP is an integrated channel access mechanism which is collision free and it employs priorities to differentiate traffic in a proportional way. Furthermore, it provides fairness, and generally supports QoS for all types of multimedia applications, while efficiently serving background data traffic. Extensive simulations are employed to evaluate the performance of POAP which is compared to HCF in order to examine the wireless network performance when serving integrated traffic.

In the next paper, entitled "**An Incentive Energy-efficient Routing for Data Gathering in Wireless Cooperative Networks"**, the authors Yindong Zhang, Liusheng Huang and Hongli Xu are studying the problem of selecting energy-efficient paths from source nodes to sink for data gathering in wireless Ad-hoc networks. In this paper, a utility function is proposed to stimulate nodes to behave honestly leading to a Nash Equilibrium. Also, it is demonstrated that the selection of forwarding nodes and relay nodes for data transmission is a NP-hard problem even when nodes

behave honestly. Finally, a heuristic algorithm (ANSA) is provided to solve this selection problem. The numerical results show that, if nodes behave honestly then better utility is obtained and more energy is saved.

In the next paper, entitled "**A Scalable Network-based Mobility Management Framework in Heterogeneous IP-based Networks**", Kyoung-Hee Lee, Hyun-Woo Lee, Won Ryu and Youn-Hee Han propose a mobility management scheme to provide a mobile node with high-quality handovers among heterogeneous wireless access networks. This scheme is based on the network-based mobility management framework which requires the minimum modifications on terminal devices and it is based on the interaction between Layer 2 and 3, addressing the well-known problems of the Mobile IP. The simulation and experimental results show that the proposed scheme provides improved performance in terms of handover latency, data packet loss, data delivery latency and load balancing.

In the next paper, entitled "**Evaluation of Channel Dependent Bandwidth Allocation in Wireless Access Networks: Centralized and Distributed Approach"**, the authors contribution lies on the investigation of the problem of bandwidth allocation in wireless access networks. Two approaches are presented by Stavroula Vassaki, Athanasios Panagopoulos and Philip Constantinou: (a) the centralized algorithms, such as bankruptcy division rules and Nash bargaining and (b) a distributed algorithm to find the optimal solution of the bandwidth allocation problem. The allocation rules are properly modified in both approaches to incorporate the influence of the channel state resulting in an efficient and fair bandwidth allocation. The channel dependent centralized and distributed schemes are compared in terms of efficiency and fairness with a view to highlighting the advantages and disadvantages of every approach.

In the next paper, entitled "**Optimized Radii and Excitations with Concentric Circular Antenna Array for Maximum Sidelobe Level Reduction Using Wavelet Mutation Based Particle Swarm Optimization Techniques"**, the authors Durbadal Mandal, Sakti Prasad Ghoshal and Anup Kumar Bhattacharjee propose a Particle Swarm Optimization with Constriction Factor and Inertia Weight Approach with Wavelet Mutation (PSOCFIWA-WM) applied to the process of synthesizing three-ring Concentric Circular Antenna Arrays (CCAA) without and with central element feeding, focused on maximum sidelobe level reductions. The extensive computational results show that the method of PSOCFIWA-WM provides a maximum sidelobe level reduction of 96.06% with respect to the uniformly excited case for the particular CCAA containing 4, 6, and 8 numbers of elements in the three successive rings along with central element feeding.

The special issue continues with the paper "**A Hybrid Mobility Management Scheme Integrating Mobile IP and SIP for Seamless Invocation of Services in All-IP Network**" by Pampa Sadhukhan, Sayantani Sah and Pradip K. Das. The authors extensively study and explore some existing mobility management methods integrating the functionalities of Mobile IP and SIP in this paper. New hybrid mobility management schemes that integrate two existing Mobile IP and SIP-based schemes are proposed. They are based on modifications in the IP layer of BS which is incorporated separately with the micro-mobility protocol Hierarchical Mobile IP (HMIP). The numerical results show that the integration of HMIP into the existing methods reduces both the signalling cost and the delay; mainly the active handoff disruption time.

In the subsequent paper, entitled "**Protection of MANETs from a Range of Attacks Using an Intrusion Detection & Prevention System**", the authors Adnan Nadeem and Michael Howarth, present a new approach for preventing intrusion in MANETs, which are vulnerable to a wide variety of attacks. This approach is based on a combination of anomaly-based and knowledge-based intrusion detection to secure MANETs. This approach also has the capability to detect new unforeseen attacks. Simulation results of a case study shows that their proposed mechanism can successfully detect attacks, including multiple simultaneous different attacks, and identify and isolate the intruders causing a variety of attacks, with an affordable network overhead.

In the following study, entitled "**Distributed Power Control with Multiuser Detection for Asynchronous DS-CDMA Networks Subject to Time-Delays**", the authors Luna-Rivera and Campos-Delgado, address the goals of reducing transmission power and increasing network capacity by jointly considering power control and multiuser detection. The proposed framework is used to investigate the design of a distributed power control strategy enhanced with linear multiuser receivers in an asynchronous uplink channel, subject to multipath and quality of service constraints. The simulation results provided are used to show the advantages of the schemes in terms of saving energy, increasing network capacity and robustness against propagation delays.

In the next paper, entitled "**Opportunistic Power Allocation Strategies and Fair Subcarrier Allocation in OFDM-based Cognitive Radio Networks**", the authors Lun Tang, Qian-bin Chen, Guang-yu Wang, Xiao-ping Zeng and Huan Wang study the subcarrier and optimal power allocation strategy for an OFDM-based cognitive radio system. To limit the interference caused by cognitive users within the range that primary users can tolerate, the mathematical optimization problem is formulated as maximizing the capacity of cognitive users under the interference constraint at the primary receiver. In this paper the Lagrange method is employed to get the optimal solution for this problem. Finally, an optimal subcarrier power allocation scheme among multiple cognitive users is presented. Simulation results show

that this scheme can efficiently guarantee the fairness of cognitive users and the capacity performance is close to the optimum.

The next paper is entitled "**Symbiotic Cooperative Relaying in Cognitive Radio Networks with Time and Frequency Incentive**" and it is focused on Cognitive Networks. The major contribution of this paper by Taskeen Nadkar, Vinay Thumar, Uday Desai and Shabbir Merchant, lies on the proposed symbiotic architecture for a cognitive radio network in which the secondary users lend their resources to relay the primary's traffic; in return they are rewarded with the complete licensed bandwidth of the primary for short time durations or few free frequency bands for longer durations of time or both. Moreover, simulation results are provided, which indicate that a significant time and frequency incentive is achieved for the secondary users from the proposed schemes.

In the next paper, entitled "**A Novel Hierarchical Model for Vehicular Traffic Regulation**", the authors Rajini Girinath and S. Selvan, propose a novel Location based 2hop Multicast Flooding (L2MF) protocol for data forwarding. The main objective is to provide a new technique to regulate traffic in Vehicular Ad-hoc Networks (VANET). By comparing the proposed protocol with previous protocols, the enhanced performance in packet delivery ratio, control overhead and end-to-end delay has been proved.

In the next paper, entitled "**FPGA-based Architecture and Implementation Techniques of a Low-Complexity Hybrid RAKE Receiver for a DS-UWB Communication System**", the architecture of a low-complexity Direct Sequence Ultra-Wideband (DS-UWB) receiver subsystem which incorporates a Channel Estimator (CE) and a novel hybrid Partial/Selective (HPS) maximal ratio combining (MRC) RAKE receiver is presented by Christos Thomos and Grigorios Kalivas. The proposed architecture combines the benefits of both partial and selective RAKE receiver algorithms and the obtained results demonstrate the trade-off between energy capture, performance and receiver complexity.

Finally in the last paper of this issue, entitled "**A Self Optimized Random Access Protocol for an Infrastructure-Less Mission Critical Wireless Networking System**", the authors Jahangir Sarker and Hussein Mouftah present and analyze a new access protocol for mission critical systems. The proposed protocol is optimized based on the trade-off achieved between the maximized throughput and the cost per mobile node. The presented results demonstrate the performance supremacy of the proposed scheme in terms of the offered load to a mobile node and the throughput per mobile node for the case of a mission critical system.

Given the amount of research work in the areas of mobile computing and networking technologies, this Special Issue aimed at covering a variety of topics of interest in the area of wireless communications presenting the recent progress in these areas, worldwide. At this point, we would like to express our gratitude to the authors who submitted their work in this Special Issue. Also, we are grateful to the reviewers who referred the manuscripts and it was our pleasure and honour to work with numerous people worldwide for the preparation of this Special Issue. Finally, we would like to thank the Editor in chief of the Telecommunications Systems Journal Prof. Bezavel Gavish and Mrs Jackie James for their excellent cooperation and help for the accomplishment of this Special Issue.