Preface

We are living in a world of mobile multimedia. The field of mobile computing and multimedia is expanding in an unprecedented pace. Indicators are the rapidly increasing penetration of the smart phones and other mobile devices market around the world, which is growing nearly twice as fast as the desktop market. In addition, technological advancements and the exponential growth and globalization of communication infrastructures have significantly enhanced the usability of mobile communication and computer devices. From the first CT1 cordless telephones to today’s smart phones and laptops/netbooks with wireless Internet connection, mobile tools and utilities have made the life of many people at work and at home much easier and more comfortable. As a result, mobility and wireless connectivity are expected to play a dominant role in the future in all aspects of economy. The addition of mobility to data communications systems has not only the potential to put the vision of “being always on” into practice, but has also enabled new generation of services, from reading books, playing games, taking photos, listening to music, checking the weather to sophisticated business, education, entertainment, finance, productivity, social networking travel, navigation applications. For these reasons, we believe that this is the right time to introduce this book in the area of mobile computing and multimedia communications.

Mobile multimedia is the set of protocols and standards for multimedia information exchange over wireless networks. It enables information systems to process and transmit multimedia data to provide the end user with services from various areas, such as the mobile working place, mobile entertainment, mobile information retrieval, user-generated content and context based services.

Multimedia information as combined information presented by more than one media type (text [+pictures] [+graphics] [+sounds] [+animations] [+videos]) enriches the quality of the information and is a way to represent reality as adequate as possible. Multimedia allows the user to enhance his/her understanding of the provided information and increases the potential of person to person and person to system communication.

The special requirements coming along with the mobility of users, devices, and services and specifically the requirements of multimedia as traffic type don’t only bring the need of new paradigms in software-engineering and system-development but also in non-technical issues such as the emergence of new business models and concerns about privacy, security or digital inclusion to name a few.

The primary goal of the book is to provide researchers and academic communities around the world with the highest quality articles while reporting the state-of-the-art research results and scientific findings allowing students, developers, engineers, innovators, research strategists and IT-managers in this field to gain greater insight into mobile multimedia as they relate to applications, management, and opportunities within any given construct.
The book provides an in-depth coverage of next-generation mobile computing paradigm, including mobile wireless technologies, mobile services and applications, and research and development challenges surrounding backend systems, network infrastructure, and mobile terminals including smart phones and other mobile devices. It substantially emphasizes the following components organized into four sections.

**SECTION 1: INNOVATIONS IN WIRELESS AND MOBILE NETWORKS MANAGEMENT**

The first section is about “Wireless and Mobile Networks Management” and consists of 7 chapters. The first chapter entitled “Multi-Purpose DS-Based Cluster Formation and Management in Mobile Ad Hoc Networks” by V. S. Anitha and M. P. Sebastian from India proposes a scenario-based algorithm for cluster formation and management in mobile ad hoc networks. In this algorithm, the clustering set up phase is accomplished by a distributed (k, r) – Dominating Set finding algorithm for choosing some nodes that act as coordinators of the clustering process.

The second chapter titled “Optimizing Resource Consumption for Secure Messaging in Resource Constrained Networks” by P. P. Abdul Haleem and M. P. Sebastian from India presents a method for reducing the verbosity of messages in the constrained wireless mobile networks. Wireless mobile devices, especially low cost devices are stifled by the limited resources such as battery power, screen size, input, memory and processors. The relevance of low cost wireless mobile devices in penetrating to the third world market demands for a cost effective messaging format that fits in the constrained wireless environment. The proposed scheme is based on YAML Ain’ Markup Language (YAML), a user friendly and lightweight messaging format. Measures to reduce the message size and energy consumption together with secure processing are proposed.

The third chapter “Improving Energy Efficiency and Throughput in Heterogeneous Mobile Ad Hoc Networks” by Manu. J. Pillai and M. P. Sebastian from India presents a MAC protocol, which adaptively transmits data frames using either the energy efficient nodes or a list of high data rate assistant nodes. In addition, a cross-layer based energy level on-demand routing protocol that adaptively regulates the transmission rate on basis of congestion is projected as well. Simulation results illustrate that the proposed protocols considerably diminish energy consumption and delay, and attain high throughput in contrast with the Hybrid MAC and traditional IEEE 802.11 protocols.

The fourth chapter in this section titled “Performance Enhancement of Routing Protocols in Mobile Ad hoc Networks” by Kais Mnif from Tunisia and Michel Kadoch from Canada, proposes the use of virtual backbone structure to handle control messages in ad hoc networks. The structure is effective in reducing the overhead of disseminating control information. The construction of the backbone is based on the Minimum Connected Dominating Set (MCDS). The novelty is in the way to find the MCDS. A Linear Programming approach is used to build a Minimum Dominating Set (MDS). A spanning tree algorithm is applied to provide the MCDS. A theoretical analysis based on probabilistic approach is developed to evaluate the size of MCDS. Different techniques of diffusion in ad hoc networks are presented and compared.

The fifth chapter in this section “Realization of Route Reconstructing Scheme for Mobile Ad Hoc Network” by Qin Danyang, Ma Lin, Sha Xuejun and Xu Yubin from China presents a mathematical exploring model for next-hop node in mobile ad hoc networks. The negative impact of wireless routes discontinuity on pervasive communication is alleviated by a novel route reconstructed scheme proposed
in this chapter based on restricting the route requirement zone into a pie slice region on intermediate nodes according the solution of the exploring equation. The scheme is an effective approach to increase survivability and reduce average end-to-end delay during route maintenance as well as allowing continuous packet forwarding for fault resilience so as to support mobile multimedia communication. The ns-2 based simulation results show remarkable packets successful delivery rate and end-to-end delay improvements of source-initiated routing protocol with route reconstructing scheme, and especially in the case of high dynamic environments with heavy traffic loads, more robust and scalable performance will be obtained.

The sixth chapter “Buffer Management in Cellular IP Network Using PSO” by Mohammad Anbar and Deo Prakash Vidyarthi from India proposes a model for buffer management in Cellular IP network using Particle Swarm Optimization (PSO), an evolutionary computational method often used to solve hard problems. The model considers two kinds of buffers: Gateway buffer and Base Station buffer. In the proposed two-tier model, the first tier applies a prioritization algorithm for prioritizing real-time packets in the buffer. In the second tier PSO algorithm is used on a swarm of cells in the network. PSO is applied for a given time slot, called window. In each window period the swarm can store number of packets depending on the window size and the total number of packets. The effect of various parameters e.g. number of packets, size of packets, window size, and a threshold value on buffer utilization has been studied by conducting the simulation experiments.

The last chapter in this section “Throughput Optimization of Cooperative Teleoperated UGV Network” by Ibrahim Y. Abualhaol and Mustafa M. Matalgah from USA proposes a low complexity dynamic channel assignment (DCA) technique with adaptive modulation and coding (AMC) strategy to allocate the available bandwidth over a number of communications links in a cooperative Unmanned Ground Vehicles (UGVs) network. The proposed DCA with AMC in a cooperative UGV network has two objectives. First, to maximize the overall throughput of the cooperative UGV network and second, to significantly reduce the probability of outage in the system.

SECTION 2: INNOVATIONS IN MOBILITY ENGINEERING, PERFORMANCE AND OPTIMIZATION

The second section is about “Mobility Engineering, Performance and Optimization” and consists of 4 chapters. The first chapter “The Accuracy of Location Prediction Algorithms Based on Markovian Mobility Models” by Péter Fülöp, Sándor Imre, Sándor Szabó, Tamás Szálka from Hungary proposes a novel Markov chain based model capable of utilizing user’s movement history thus providing more accurate results than other models in the literature. The new model is applicable in real-life scenarios, because it relies on information effectively available in cellular networks (e.g. handover history). The complexity of the proposed model is analyzed, and the accuracy is justified by means of simulation.

The second chapter titled “Frequency Domain Equalization and Adaptive OFDM vs. Single Carrier Modulation” by Inderjeet Kaur from India, compares multi-carrier and single carrier modulation schemes for wireless communication systems with the utilization of fast Fourier transform (FFT) and its inverse in both cases. With the assumption that in OFDM (orthogonal frequency division multiplexing), the inverse FFT transforms the complex amplitudes of the individual sub-carriers at the transmitter into time domain, the inverse operation is carried out at the receiver. In case of single carrier modulation, the FFT and its inverse are used at the input and output of the frequency domain equalizer in the receiver.
The third chapter titled “Definition and Analysis of a Fixed Mobile Convergent Architecture for Enterprise VoIP Services” by Joel Penhoat, Olivier Le Grand, Mikael Salaun, and Tayeb Lemlouma from France presents and analyzes an architecture for enterprises, named ‘Business Zone’ in order to enforce the concept of “Being always best connected”. After defining the Business Zone, the chapter shows its architecture and analyzes its main components while limiting the study to the transport of VoIP flows. Then two patented methods are presented: the first method authorizes a VoIP flow to be transmitted according to the available resources in the Business Zone; the second method enhances the decision process during a handover.

The last chapter in this section “A Qualitative Resource Utilization Benchmarking for Mobile Applications” by Reza Rawassizadeh, Amin Anjomshoaa, and A Min Tjoa from Austria identifies and classifies mobile resources and proposes a monitoring approach to measure resource utilization. It provides a monitoring tool, which generates traces about the resource usage and proposes a benchmarking model which studies traces and enables users to extract qualitative information about the application from quantitative resource usage traces. Results of the study could assist quality operators to compare similar applications from their resource usage point of view, or profile a single application resource consumption.

SECTION 3: INNOVATIONS IN MULTIMEDIA ANALYSIS, MODELING, PROCESSING AND TRANSFORMATION

The third section is about “Graphics, Video, Audio, Analysis, Modeling, Processing and Transformation” and consists of 6 chapters. In the first chapter entitled “Fast Vector Quantization Encoding Algorithms for Image Compression” by Ahmed Swilem from Egypt, two fast encoding algorithms for VQ are proposed. To reduce the search area and accelerate the search process, the first algorithm utilizes three significant features of a vector that are, the norm, and two projection angles to two projection axes. The second algorithm uses the first two features with the projection value of the vector to the second projection axe. The algorithms allow significant acceleration in the encoding process. Experimental results are presented on image block data. These results confirm the effectiveness of the proposed algorithms.

While the second chapter “Mobile Video Streaming Over Heterogeneous Networks” by Ghaida A. Al-Suhail, Martin Fleury, and Salah M. Saleh Al-Majeed present a simple cross-layer model that leads to the optimal throughput of multiple users for multicasting MPEG-4 video over a heterogeneous network. For heterogeneous wired-to-wireless network, at the last wireless hop, there are bit errors associated with the link-layer packets that are arising in the wireless channel, in addition of overflow packet dropping over wired links. The authors employ a heuristic TCP function to optimize the cross-layer model of data link and physical (radio-link) layer.

The third chapter “Automatic Talker Identification Using Optimal Spectral Resolution: Application in Noisy Environment and Telephony” by Siham Ouamour, Halim Sayoud and Mhania Guerti from Algeria deals with the problem of speaker characterization, for which the principal interest is the improvement of the techniques of speaker authentication. For this purpose, authors investigate the effect of spectral resolution in the speaker authentication performance. This investigation employs an approach based on the second order statistical measures using the Mel Frequency Spectral Coefficients (MFSC) and looks for the best spectral resolution (optimal number of MFSC).

The fourth chapter titled “A Fast Image Encoding Algorithm Based on the Pyramid Structure of Codewords” by Ahmed A. Radwan, Ahmed Swilem, Mamdouh M. Gomaa from Egypt presents an al-
Algorithm for codeword search in the vector quantization encoding. This algorithm uses 2-pixel merging norm pyramid structure to speed up the closest codeword search process. The algorithm first derives a condition to eliminate unnecessary matching operations from the search procedure. Then, based on this elimination condition, a fast search algorithm is suggested. Simulation results show that, the proposed search algorithm reduces the encoding complexity while maintaining the same encoding quality as that of the full search algorithm. It is also found that the proposed algorithm outperforms the existing search algorithms.

The fifth chapter titled “Analysis and Modeling of H.264 Unconstrained VBR Video Traffic” by Harilaos Koumaras, Charalampos Skianis, and Anastasios Kourtis from Greece presents and analyzes both a frame and a layer level of H.264 encoded sources. Analysis of the data suggests that the video traffic can be considered as a stationary stochastic process with an autocorrelation function of exponentially fast decay and a marginal frame size distribution of approximately Gamma form. Finally, based on the statistical analysis, an efficient model of H.264 video traffic is proposed.

The last chapter in this section “Speaker Discrimination on Broadcast News and Telephonic Calls Based on New Fusion Techniques” by Siham Ouamour and Halim Sayoud from Algeria describes a new Speaker Discrimination System (SDS), which is part of an overall project called Audio Documents Indexing based on a Speaker Discrimination System (ADISDS). Speaker discrimination consists of checking whether two speech segments come from the same speaker or not. This research domain presents an important field in biometry, since the voice remains an important feature used at distance (via telephone).

SECTION 4: INNOVATIONS IN MOBILE MULTIMEDIA APPLICATIONS AND SERVICES

The fourth section is about “Mobile Computing and Multimedia Applications and Services” and consists of 5 chapters.

The first chapter “FCVW: Experiments in Groupware” by Ivan Tomek, and Elhadi Shakshuki from Canada surveys several groupware products and describes FCVW (Federated Collaborative Virtual Workspace), an experimental project designed to explore certain groupware aspects that are not sufficiently addressed by existing products.

The second chapter “A Model for Mobile Learning Service Quality in University Environment” by Nabeel Farouq Al-Mushasha, and Shahizan Hassan from Jordan and Malaysia proposes a service quality model for m-learning in a university environment. A questionnaire survey was conducted which measured ten dependent variables and three independent variables. The dependent variables were meant to measure service quality, information quality, and system quality. The dependent variables were meant to measure the causal relationship between overall learners’ perceived service quality, learner satisfaction, and learner behavioral intention to use the service in future. The findings revealed that the factors that lead to service quality of m-learning in a university environment were interface design, reliability, trust, content usefulness, content adequacy, ease of use, accessibility, and interactivity. The findings also indicates that there are causal relationships between learner satisfaction with overall service quality, and learner satisfaction with learner behavioral intention.

The third chapter is “Evaluating E-Communities of Wireless Networks Worldwide” by Theodoros I. Kavaliotis and Anastasios A. Economides from Greece. This chapter presents an evaluation framework and analyzes the current status of such Electronic Communities of Wireless Networks (ECWNs) in
four continents: Africa, America, Europe and Oceania. The evaluation framework contains fifty criteria categorized into four categories: Usability, Technical Characteristics, Community’s Commitment, and Members’ Commitment. The results show that there are large differences among ECWNs with respect to the forum structure, archives accessibility, interactivity, services, members’ commitment, participation and relationships.

The fourth chapter in this section “Typology and Challenges in Developing Mobile Middleware Based Community Network Infrastructure” by Vijayan Sugumaran, and Shriram Raghunathan from India presents the factors contributing to the proliferation of mobile communities and places the mobile community networks in a current and future perspective. An architecture for the mobile community network is proposed and the challenges in implementing such a network are also discussed.

The fifth chapter titled “A Secure and Trustworthy Framework for Mobile Agent-Based E-Marketplace with Digital Forensics and Security Protocols” by Qi Wei and Ahmed Patel from Malaysia, proposes a framework which includes safe, secure, trusted and auditable services, as well as forensic mechanisms to provide audit trails for digital evidence of transactions and protection against illegal activities. The proposed framework and protocols provide a secure communication for mobile agents when they move to different security environments to deal with e-marketplace activities such as search information, negotiation and payments. The paper concludes by highlighting and discussing further research work to build viable systems.

In closing, we would like to thank all of the authors for their insights and excellent contributions to this book, in addition to all those who assisted in the review process.

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