Guest Editorial
Vehicular Communications and Networks—Part II

THIS JSAC special issue has selected 34 papers for publication out of 124 submissions. It is devoted to reporting on cutting-edge research achievements covering various aspects of vehicular communications and networks that are distinctively different from communication networks in general. These 34 accepted papers are classified as five categories. Part I of our special issue, published in January 2011, included the first three categories of 21 papers and focused on the physical layer, MAC layer, and physical-link cross-layer design technologies. In particular, the first category was comprised of five papers focusing on physical layer aspects in vehicular communications. The second category included five papers addressing MAC layer protocols. The third category contained 11 papers, discussing cross-layer design schemes combining mainly the physical layer and link layer techniques.

Part II comprises the last two categories of the remaining 13 papers, which deal with handover, routing, security, and privacy preserving technologies. The fourth category consists of six papers, addressing handover and routing protocols. Finally, the fifth category has seven papers, dealing with security and privacy preserving technologies. In the following, we briefly discuss each of the papers in the remaining two categories.

I. Category IV: Handover and Routing Protocols

The fourth category of six papers is related to handover and routing protocols for solving network connectivity problems in vehicular communication networks.

The paper "Seamless Connectivity and Routing in Vehicular Networks with Infrastructure" by Annese, Casetti, Chiasserini, Maio, Ghittino and Reineri studies the joint problem of traffic delivery and connectivity management in a vehicular communication scenario with vehicles connecting to different roadside mesh nodes as they move in an urban environment. The authors propose an improved routing protocol along with a handover mechanism that allows vehicles to connect to different roadside mesh nodes in a seamless manner. The proposed routing and handover protocols are implemented in two roadside vehicular testbeds, which prove the feasibility of the solutions.

The next paper "Dynamics of Network Connectivity in Urban Vehicular Networks" by Viriyasitavat, Bai, and Tonguz presents a comprehensive analytical framework, as well as a simulation framework, for network connectivity of urban VANETs, using some key system parameters such as link duration, connection duration, and re-healing time. The analytical framework leads to closed-form expressions which capture the impact of four critical parameters (network density, transmission range, traffic light mechanisms, and size of a road block) on network connectivity. The predictions of the analytical framework also shed light on which type of safety and non-safety applications can be supported by urban VANETs.

In the paper "Optimal Distributed Vertical Handoff Strategies in Vehicular Heterogeneous Networks", Shafiee, Attar, and Leung investigate the problem of optimal vertical handoff (VHO) decision making in heterogeneous vehicular networks in order to minimize the cost of communications or alternatively minimize the communication time. It is shown that in a heterogeneous network consisting of a cellular network and wireless local area networks (WLANs) with only vehicle-to-infrastructure (V2I) capability, use of VHO is an appropriate choice in lower speeds, while it would be better to avoid VHO and stay in the cellular network at higher speeds. If both V2I and vehicle-to-vehicle (V2V) capabilities are possible, the combination of WLAN plus cellular plus ad hoc networking outperforms any other networking strategies in terms of transmission times and costs.

Chung, Kim, Park, Choi, Lee, and Oh, in "Time Coordinated V2I Communications and Handover for WAVE Networks", propose a time coordinated multiple access scheme, named wireless access in vehicular environment (WAVE) point coordination function (WPCF), for improved V2I communications and WAVE handover controller (WHC) for minimizing service disconnection time. The mathematical and simulation results show that the proposed scheme can significantly improve the handover latency performance compared to the existing protocols.

The paper "Dynamic Clustering-Based Adaptive Mobile Gateway Management in integrated VANET — 3G Heterogeneous Wireless Networks" by Benslimane, Taleb, and Sivaraj introduces a novel heterogeneous architecture that integrates IEEE 802.11p-based VANETs and 3G/UMTS networks. In this architecture, vehicles are dynamically clustered and a minimum number of vehicles are selected as vehicular gateways to link VANET to UMTS, considering issues such as route stability, mobility features, and signal strength of vehicles. Simulation results demonstrate the promising performance of the envisioned architecture with the proposed adaptive mobile gateway management in terms of high data packet delivery ratios and throughput, reduced control packet overhead, and minimized delay and packet drop rates.

"Cross-Layer Routing Using Cooperative Transmission in Vehicular Ad-hoc Networks" by Ding and Leung is the last paper of this group. It studies two types of cross-layer routing optimization schemes for VANETs by applying cooperative transmission and a new strategy of path selection to achieve a better tradeoff between the transmission power consumption and end-to-end reliability. The effect of cooperative transmission on the wireless link cost and consequently on the routing

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decision is studied. Analytical and simulation results show that using cooperative transmission typically yields more efficient routes than the comparable schemes in terms of end-to-end reliability and total transmission power.

II. Category V: Security and Privacy Preserving Technologies

The last category of seven papers belongs to security and privacy preserving technologies.

The paper "P^2DAP — Sybil Attacks Detection in Vehicular Ad Hoc Networks" by Zhou, Choudhury, Ning, and Chakrabarty presents a lightweight and scalable protocol for VANETs to detect Sybil attacks. The proposed protocol can detect a malicious user, pretending to be multiple (other) vehicles, in a distributed manner through passive overhearing by the so-called road-side boxes (RSBs). Simulation results illustrate that the proposed scheme can achieve good tradeoff between the privacy of vehicles and security, i.e., the detection of Sybil attacks with low overhead and delay.

The next paper "Efficient Certificate Revocation List Organization and Distribution" by Haas, Hu, and Laberteaux proposes a lightweight privacy-preserving mechanism for revoking security certificates appropriate for the limited bandwidth and hardware cost constraints of a VANET. Certificate Authorities use Certificate Revocation Lists (CRLs) to distribute revocation information in an epidemic manner via V2V communications. Simulation results show that the V2V exchange mechanism is quicker than distributing CRLs through RSUs alone.

In the paper "Threshold Anonymous Announcement in VANETs", Chen, Ng, and Wang present a novel Threshold Anonymous Announcement (TAA) scheme for VANET communications using direct anonymous attestation and one-time anonymous authentication. It is demonstrated that the proposed TAA scheme can satisfy the three security requirements of reliability, auditability, and user privacy preserving against both authorized parties and adversaries.

Hao, Cheng, Zhou, and Song in the paper "A Distributed Key Management Framework with Cooperative Message Authentication in VANETs" presents a novel distributed key management scheme based on the short group signature to provide privacy in VANETs. The authors develop security protocols to detect compromised RSUs and their colluding malicious vehicles and propose a practical cooperative message authentication protocol to alleviate the verification burden. A MAC layer analytical model is further developed and ns2 simulations are carried out to examine the key distribution delay and missed detection ratio of malicious messages.

The paper "ABACS: An Attribute-Based Access Control System for Emergency Services over Vehicular Ad Hoc Networks" by Yeh, Chen, and Huang, analyzes the steps involved in a rescue process after an emergency event is reported, and addresses the security and performance issues involved in initiating the rescue process over VANETs. By adopting fuzzy identity-based encryption and novel cryptographic preliminaries, an attribute-based access control system is proposed which can realize security and reduce the computational delay and transmission overhead.

The paper "RSU-based Distributed Key Management (RDKM) for Secure Vehicular Multicast Communications" by Park, Gwon, Jeong, and Seo, presents an efficient group key management (GKM) scheme, the so-called RDKM, for secure multicast services in V2I communications between RSUs and vehicles. The proposed RDKM scheme reduces the communication overhead through decentralizing the management functions for movement across RSUs and update of Key Encryption Keys (KEKs) into each RSU. An optimization algorithm is further proposed for the RDKM scheme that minimizes the GKM overhead defined as the weighted sum of the communication and storage overhead.

Finally, the paper "RescueMe: Location-Based Secure and Dependable VANETs for Disaster Rescue" by Sun, Zhu, Zhang, and Fang proposes RescueMe, a location-based secure and dependable post-disaster rescue network, for the efficient allocation of rescue resources. By solving the challenging problem of exploiting the stored location information for postdisaster rescue, and at the same time preserving location privacy in normal network operations, RescueMe offers a functional, secure, and sound networking solution for disaster rescue.

Acknowledgments

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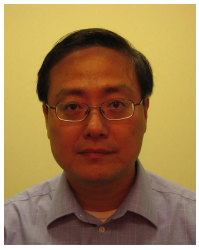

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