Recent Advances in Mobile Middleware for Wireless Systems and Services

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The most visible technology advance in the last decade is arguably the popular uses of wireless mobile handsets such as cellular phones. These devices are not just for phone calls, but also for the Internet access and management of mobile data. Many of them are equipped with positioning systems such as GPS, creating significant commercial opportunities for a range of new applications such as location-based services. Indeed, despite the recent economic downturn, the mobile computing industry continues to boom.

A crucial technological challenge to develop applications for wireless mobile handsets is to deal with their heterogeneity. There are a large number of models running different operating systems. They come with vastly different capabilities in terms of computing power and applications they can support, and unlike traditional computers such as desktops and laptops, many times the software development kits are manufacturer-specific or even model-specific. Targeting at different consumer groups, they are also designed with different considerations on key components such as wireless interfaces, screen size, with or without keyboard/accelerometer/GPS, and so on.

Developing novel mobile middleware solutions appears to be a natural strategy to circumvent the heterogeneity problem. By allowing application developers to concentrate their efforts on application logic, without taking into account the device-specific issues, the development and deployment of applications over heterogeneous mobile devices can be greatly accelerated and simplified. It is motivated by this belief that in 2008 the International Conference on MOBILe Wireless MiddleWARE, Operating Systems, and Applications (Mobilware) was launched with the specific goal to identify, propose, validate, and spread the adoption of open and interoperable software-support solutions, specifically designed and implemented for wireless mobile handsets.

The past 2008 and 2009 editions of Mobilware were highly successful, attracting a large number of high-quality technical submissions from both academic and industrial communities. Mobilware'10 follows this success with a technical program that covers a wide range of hot issues in research and practitioning of mobile middleware technologies. Some papers address network, systems, and service management issues in dependence of location and context. Some contributions relate to middleware interface management, architectures, and security. A considerable part of the program is devoted to new applications for mobile services, such as multimedia, wireless sensor and vehicular network applications, and surveillance systems.

This special section of MONET is organized with the extended versions of the papers selected from the best

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submissions to Mobilware'11, with the goal of giving an up-to-date overview of several primary research directions in the field. It starts with the paper "*Towards an Elastic Application Model for Augmenting the Computing Capabilities of Mobile Devices with Cloud Computing*", by Xinwen Zhang, Anugeetha Kunjithapatham, Sangoh Jeong, and Simon Gibbstwo [1]. The proposed application model is elastic in the sense that it enables seamless and transparent use of cloud resources to augment the capability of resource-constrained mobile devices. In this model, a single application is partitioned into multiple components, called weblets, each of which can run transparently on either a single mobile device or a cloud that consists of one or more nodes offered by an Infrastructure as a Service (IaaS) provider.

The second paper, "*Using Smartphones to Detect Car Accidents and Provide Situational Awareness to Emergency Responders*", by Chris Thompson, Jules White, Brian Dougherty, Adam Albright, and Douglas C. Schmidt [2], considers the problems of preventing false positives in utilizing mobile context information and polling onboard sensors to detect large accelerations. It presents the architecture of a smartphone-based accident detection system prototype and empirically analyzes its ability to resist false positives as well as its capabilities for accident reconstruction.

The third paper, "*A Secure Mobile One-Time-Password (OTP) Token*", from Fred Cheng [3], consider the uses of OTP tokens in mobile industry. It argues none of the existing solutions can fully prevent the OTP seed (K) tracing from man-in-the-middle code interception or shoulder-surfing security attacks while being fully compliant with existing authentication systems, inter-operable with other tokens and easy to deploy or support. A new cipher called Rubbing Encryption Algorithm (REAL) is then introduced to deal with these issues, with detailed security and performance analysis. The practicality of the algorithm is also demonstrated through an implementation of a mobile OTP token using the algorithm.

Finally, the paper "*Access Network Discovery and Selection in the Future Broadband Wireless Environment*", authored by Marius Corici, Jens Fiedler, Thomas Magedanz, and Dragos Vingarzan [4] addresses the opportunities for smart network selection in emerging mobile broadband environments, which are characterized by the co-existence of a multitude of wireless access networks, e.g., LTE, UMTS, WiMAX, and WiFi. In order to be able to offer the optimized connectivity services in regard to quality of service, costs, security, etc., according to user and/or operator requirements, the paper introduces a novel function for access network discovery and selection (ANDSF) as standardized in the 3GPP Evolved Packet Core (EPC). The paper highlights the main concepts and technical implementation scenarios for this ANDSF. Moreover, a set of novel optimizations are evaluated, followed by the description of the Fraunhofer FOKUS OpenEPC testbed toolkit, which includes a reference implementation of this ANDSF.

We would like to take this opportunity to express our gratitude to all the contributors and to all the reviewers. Their work was crucial for the realization of this special section. Our thanks also go to Professor Imrich Chlamtac who trusted in the Mobilware conference series from the beginning and gave us invaluable support and suggestions. Thanks to all of them, we believe that this collection of selected papers as a whole can pleasantly introduce the readers to the challenging arena of mobile middleware and can help in giving a fresh sketch of currently hot topics and state-of-the-art solutions in the field.

Enjoy your reading!

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References

1. Xinwen Zhang, Anugeetha Kunjithapatham, Sangoh Jeong, and Simon Gibbstwo, "*Towards an elastic application model for augmenting the computing capabilities of mobile devices with cloud computing*"
2. Chris Thompson, Jules White, Brian Dougherty, Adam Albright, and Douglas C. Schmidt, "*Using smartphones to detect car accidents and provide situational awareness to emergency responders*"
3. Fred Cheng, "*A secure mobile one-time-password (OTP) token*"
4. Marius Corici, Jens Fiedler, Thomas Magedanz, and Dragos Vingarzan, "*Access network discovery and selection in the future broadband wireless environment*"

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