Guest Editorial Preface

Ad Hoc Ambient Computing

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Ambient, pervasive, and ubiquitous computing are seen as a drastic shift for computing systems. Indeed, networked computing resources should become invisible to users and cooperatively provide them with the right services at the right time. At the same time, ad hoc networks are wireless infrastructure-less systems dynamically formed by cooperating nodes within communication range of each other. As such, they appear as an attractive networking paradigm for ambient computing.

Latest evolutions in both the computing and the networking domain have been impressive. Handheld user devices, such as smartphones, now embed computing resources that make them comparable to desktop computers of the previous decade. Wireless networks become ubiquitous and offer overlapping coverage and alternative attractive features. Sensors become embedded in most user devices but also in any imaginable object of the physical environment. While the above offer a powerful substrate, ambient computing has still a long way to go before becoming truly ad hoc.

In this special issue, we consider ‘ad hoc’ as a wider notion, not only focused on the networking infrastructure, but rather characterizing all aspects of ambient computing, in the sense that an ambient computing system should be able to not only function but also be formed in a dynamic and unpredictable context. This calls for emerging software system architectures able to tolerate but also to leverage dynamics and heterogeneity, as well as for innovative supporting models, algorithms, protocols, and overall system engineering, which can deal with such features. More specifically, ad hoc ambient computing requires solutions spanning: networks, such as in ad hoc networks, peer-to-peer networks, opportunistic networks, sensor networks, and cross-layer design and optimization; middleware, such as with regard to distributed computing principles, service-oriented computing, and pervasive computing; data and meta-data, such as in mobile data management, semantic ontologies, and context awareness; user orientation, such as in social networking, and situation awareness;
cross-cutting concerns, such as dependability, quality of service, scalability, security, privacy, and trust.

This special issue provides a small but well-representative sample of the numerous, above identified, topics related to ad hoc ambient computing. This comes as a follow-up to the 1st International Workshop on Ad hoc Ambient Computing (AdhocAmC), which we organized in conjunction with the 7th International Conference on AD-HOC Networks and Wireless (AD HOC-NOW) in September 2008 in Sophia Antipolis, France. The success of this workshop and the fruitful discussions it generated showed that ad hoc ambient computing is still a very challenging field, which is reflected in the articles included in this special issue.

In the first article, Cardoso and Caporuscio present another aspect of ad hoc network routing. The presence of a number of overlapping, heterogeneous, wireless networks, and of mobile devices with multiple network interfaces can be exploited for supporting multi-path communication, which enhances reliability and privacy in the open, volatile ambient environment. The authors discuss challenges and issues in implementing multi-path communication management in middleware, in a cross-layer fashion.

Next, Ben Mokhtar et al. also consider multi-network ambient environments, but from the viewpoint of service discovery in service-oriented architectures deployed in such environments. They introduce an interoperable discovery middleware function that can effectively and efficiently process service descriptions and discovery requests from both semantic and syntactic service discovery protocols spanning multiple networks, thus overcoming the description heterogeneity – in both syntax and expressiveness – of networked resources.

Mancinelli presents an architectural solution to ambient computing based on the “Web Platform” architectural style, also known as REST (Representational State Transfer). The simple, well-established principles that we find in the World Wide Web can be transcribed into ambient computing to ensure “ubiquitousness” and interoperability, precisely due to the pervasiveness of the Web.

Transactions in ambient computing are examined in the two last articles, but from two different standpoints. Böse and Broß consider distributed transactions in mobile ad-hoc networks (MANETs), where the probability of communication failures and thus transaction blocking is high. They propose a probabilistic model to evaluate such transactions based on a coordinator, and show how the integration of a backup coordinator can reduce blocking risks.

On the other hand, Fotopoulos et al. take a user-oriented approach to transactions by integrating user-context information into distributed mobile transaction protocols deployed in ambient environments. Such a protocol takes into account schedule information of users roaming between ambient environments, thus enabling transactions which are tolerant to temporary disconnections of users that leave an environment for short but return later.

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