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Combining Theory and Systems Building in Pervasive Computing

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Pervasive computing are nowadays in widespread use, deeply penetrating into and increasingly demonstrating its significance in our everyday work and leisure life. In the last decade, cheap and low energy consuming devices made far-reaching impact on the pervasive computing paradigm and fueled up a plethora of new applications. For instance, solar-powered sensors are expansively deployed to monitor fragile environments [1]; smart telephony and wireless Internet access enabled personalised information provision [2]; and RFID and other identification technologies enhanced factory automation making manufacture easier and more cost-effective [3]. In various contexts, Pervasive Computing has been used interchangeably with other terms such as "ubiquitous computing", "ambient intelligence", or the most recent and hottest "Internet of Things". A single definition, therefore, is hard to achieve. Instead, a family of both conventional and emerging disciplines have been considered underpinning or relevant to pervasive computing. These include, but not limited to, contextual-awareness, mobile computing, wireless communication, human-computer interaction, sensor network, distributed artificial intelligence, etc. At the heart of the diverse landscape of enabling technologies, pervasive computing follows one single principle. That is Mark Weiser's vision of smart devices blending and disappearing into our surroundings so as to provide unobtrusive and continuous support to our everyday activities [4][5].

Indeed, there are so many interesting things to cover in pervasive computing. This special issue of the Computer Journal aims at reporting novel research, new developments, and directions for future investigation and applications in some chosen sub-fields. In particular, we selected papers from recent international conferences and workshops that have triggered interesting discussion in the audiences. We tried to select papers that jointly covered multiple aspects of pervasive computing. For instance, on the network front, the paper "Ant-based Energy-aware Disjoint Multipath Routing Algorithm for MANETs" by Wu and Song discussed a novel routing algorithm for mobile *ad hoc* networks. They utilised ant colony-based meta heuristics and confirmed a low routing overhead by way of comparative studies. A few other papers also devoted to improve our network experience through new algorithms and/or architecture.

In a pervasive computing environment, it is essential to channel diverse atomic services together so as to achieve a predefined goal. In the meantime, service composition should be flexible to adapt to the ever-changing user requirement and environment conditions. The paper "A Policy-Driven Service Composition Method for Adaptation in Pervasive Computing Environment" by Zhang, Shi and Xiao explored the potentials of a policy-driven service composition method. Leveraging a hierarchical policy model and a policy language, the proposed method triggers services based on the situation and/or location of users and events. A series of optimisation is then applied to fine-tune the composition. Although it has not been mentioned explicitly, context of services and users played an important role in Zhang, Shi and Xiao's model. Context has been increasingly recognised as an important feature in service provision and is also a main topic in this special issue. We, therefore, would like to draw the reader's attention to two papers. In "Smart-Context: A Context Ontology for Pervasive Mobile Computing", Moore, Hu and Wan reported a Web Ontology Language (OWL) [6] based context ontology. Apart from OWL's native description logic reasoning, they leveraged decision tree and presented some promising and interesting results, as well as more research questions to be further investigated in the field of "smart" context. Interestingly, environmental context was considered not the only factor that we need to respond to in "A Rule-based Method for Improving Adaptability in Pervasive Systems" by Lin, Song and Wang that calls for more investigation on "dynamic requirements" from "[the] application" itself. They proposed a rule-based system that separate changing factors from the actual systems and concluded a better system adaptability through real-life experiments.

Pervasive computing technologies have been widely applied and significantly impinged on our everyday life. We are obligated to report some exemplary, interesting cases. Rivera-illingworth, Callaghan and Hagras focused on domestic environments enhanced with computing devices that can detect and respond to inhabitants' behaviour. With great potentials in heath care and assistant living, their paper "Detection of Normal and Novel Behaviours in Ubiquitous Domestic Environments" fueled up the on-going research in "smart" environments. In a different domain, Luo, Kong and Ge brought us the paper titled "Implementation of Learning Path in Process Control Model". They investigated the application of pervasive computing technologies in web-based e-learning. The idea was to combine domain knowledge (e.g. learning path) with workflow technology. As a result, contents of the provided courses become well-targeted and optimised against individuals' needs.

Clearly, the articles in this special issue can only cover a small fraction of interesting research and application challenges in pervasive computing. We hope, however, that the set of articles gives the reader a broad appreciation of the progress and focus of the research community. In addition, we also hope that the presented results will stimulate further research and foster new collaboration.

Finally, we would like to take this opportunity to thank all the authors for their contribution to this special issue. Our gratitude also extends to the former Editor-in-Chief of the Computer Journal Dr Fionn Murtagh for accepting our special issue proposal and the current Editor-in-Chief Dr Erol Gelenbe, together with the entire production team, for making the publication of this editorial possible.

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