Editorial

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Biographical notes: Ciprian Dobre received his PhD in Computer Science at the University Politehnica of Bucharest in 2008. His research interests are monitoring and control of distributed systems, modelling and simulation, advanced networking architectures, parallel and distributed algorithms. He is member of the RoGrid consortium and is involved in a number of national projects and international projects. His research activities were awarded with the Innovations in Networking Award for Experimental Applications in 2008 by the Corporation for Education Network Initiatives (CENIC). He has published in leading international journals and conferences and has served in the Organising Committees of many conferences and workshops.

Fatos Xhafa got his PhD in Computer Science from the Department of LSI in 1998. He is Hab. Full Professor and holds a permanent position of Professor Titular at the Department of LSI and member of the ALBCOM Research Group. His current research interest includes parallel and distributed algorithms, combinatorial optimisation, approximation and meta-heuristics, networking systems, distributed programming, Grid and P2P computing. He is awarded research merits for the period 1996–2007 (dos sexenios) and for the period 2001–2006 (sexeni compl. autonòmic.). Currently, he teaches at UPC and also at Open University of Catalonia (UOC).

Energy consumption is a major factor in the performance and deployment of modern computational and communication systems. It is increasingly necessary to preserve scarce resources and have such systems perform with the utmost energy efficiency. It has been estimated that the global ICT energy consumption amounts to 7% of the entire electricity production while the energy requirements of data centres and network equipment are foreseen to grow with a yearly rate of 12%. Furthermore, with the ever-increasing demand for bandwidth, connection quality and end-to-end interactivity, computer networks and mobile devices are requiring more and more sophisticated and power-hungry technologies. To achieve as minimal energy consumption as possible while maintaining extreme adaptability to environmental challenges and resources it is

necessary to develop highly autonomous systems with the capability to adapt dynamically to energy availability and usage.

Emergent behaviour, such as self-organisation, is also a concern in seeking to model and reason about the control structures of such systems in energy use. Self-organisation means that structures appear within the system without the use of explicit programming or environmental constraints. The foremost example of such phenomena is the emergence of power law connectivity in web graphs, which is widely seen to emerge in many such systems. It is just such pattern/signature identification at the local level that can be beneficial in establishing energy levels and controlling energy usage, up to zero net consumption, at the global level. Thus, green communication and computing research is concerned with the best practice support, for optimum energy consumption, in all manner of highly distributed computing systems. This entails the addressing of three very important issues: firstly, scalable methods of monitoring and feedback in systems to ascertain energy levels and control usage patterns; secondly, specification of cognitive systems to reason efficiently on the high volumes of data; finally, a characterisation to detect both newly emergent forms and previously observed instances of self-organisation with relevance to energy use.

Such issues are nowadays real challenges to the development of large distributed systems and applications. The special issue comprises four papers that addressed exactly such challenges. They were carefully selected based on their originality, significance, technical soundness and clarity of exposition. The papers in this special issue are organised as follows.

In the first paper, R-C. Marin presents a novel mobile collaboration solution for mobile devices based on a contextual search, namely HYCCUPS. Today smartphones are gaining more and more popularity due to cutting edge technology added on top of wearability. Unfortunately, offering good performance by means of sophisticated hardware and software does not come cheap: the energy requirements of mobile phones tend to stretch beyond the extents of modern battery technology, which, ironically, is reaching the theoretical physical limit. At this crossroad, mobile device manufacturers and software engineers alike are obliged to take energy efficiency into consideration. Most research in the aforementioned issue has mostly been oriented at tweaking and restricting resource utilisation, by methods such as Dynamic Voltage Frequency Scaling (DVFS). HYCCUPS considers a different approach and takes advantage of the pervasive nature of smartphones and of current wireless communication technologies as to offer offloading the execution of mobile applications in an opportunistic on-the-fly hybrid computing cloud.

Touray et al. in the second paper propose Clustering-Biased Random Algorithm for Load Balancing (C-BRALB), a solution where energy consumption is a key design criterion for WSN routing. The routing mechanism in C-BRALB is based on energy biased random walk. It does not require any global information apart from the initial flooding initiated by the sink to create the clusters. The authors show using simulation that in the worst case scenario, C-BRALB uses the same energy as the shortest path first routing. This protocol is applicable for scenarios where the message to be sent is comparatively small in size, with the inquiry message among the neighbours. The proposed algorithm is also shown to balance the load (i.e. the packets to be sent) among the neighbouring cluster head nodes and thus extend the network life time, which is essential in preventing network partitioning due to the death of reused nodes.

The proposed algorithm is demonstrated to have considerably improved the latency and the energy conservation.

In the third paper, Negru and Cristea present an analysis of cost models for Cloud Computing. Today Cloud providers offer a wide portfolio of services, whilst Cloud clients access them against some financial arrangement. There is a fundamental trade-off between what Cloud provider can offer and what Cloud clients are willing to pay. This is why providers are today especially interested in reducing the energy consumption in their data centres, as this has the capability to lead to great cost reductions needed to meet the requirements coming from their customers. Knowing the bottleneck in the structure of the cost is a very important business aspect for all participants in the market from a total cost of ownership perspective. The authors demonstrate the need to forecast the cost over a period of time imposes building of cost models which have to be accurate and error free.

In the last paper, Ciobanu and Dobre propose a novel energy-based routing algorithm for *ad hoc* challenged networks. Since uninterrupted connectivity has become such an important part of everyday life, the amount of energy consumed by the various devices used has increased considerably. The authors propose a way to limit this consumption by employing opportunistic networks, which are mainly composed of mobile devices that have no need for a static network infrastructure. Devices communicate when they are in wireless or Bluetooth range, using a paradigm entitled store-carry-and-forward, and delays are accepted. Therefore, the authors propose the addition of social data to existing opportunistic routing algorithms. They investigate the approach using two traces collected in two different environments and we present an analysis of our findings. Among the results, authors show that by adding knowledge such as social links between participants, the performance of the opportunistic network can be improved, achieving good hit rates which make us believe that opportunistic networks can be deployed in real life, leading to a reduction in energy consumption.

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The guest editors of this special issue wish to thank the referees who have carefully reviewed the papers and gave useful suggestions and feedback to the authors. We hope that the readers will find this special issue useful in their research. Finally, we would like to thank all editors and stuff members of the *International Journal of Intelligent Systems Technologies and Applications* (IJISTA) for the opportunity to edit this special issue.