SOON: Semantic Opportunistic Object Networks

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The Semantic Opportunistic Object Networks (SOON) special session of SEMAPRO 2016 aimed at exchanging results and experiences about models, algorithms and tools for mobile and pervasive semantic-based environments. In such scenarios, information is attached to physical things, places and phenomena by means of large amounts of relatively inexpensive objects, endowed with minimal computation, memory and communication capabilities. Pervasive environments are characterized by high device and resource volatility, due to mobility as well as communication range and energy limitations. This impairs predictability and requires dynamic solutions for discovery and adaptation. Furthermore, typical computational elements include RFID tags, sensors and embedded microcontrollers, connected through low-power wireless ad-hoc protocols. In all such cases, computational resources are severely limited and communications are unreliable with respect to conventional distributed computing environments.

Nevertheless, advances in micro- and nano-electronics and in Micro Electro-Mechanical Systems (MEMS) increasingly enable the adoption of artificial intelligence technologies, and particularly semantic-based formal languages, for information processing. Such formalisms are especially useful to enhance interoperability for pervasive object communication and interaction. Annotating data as well as services with ontology-based structured descriptions allows articulated information exchange and coordination among different devices located in the same area. This in turn enables advanced contexts, where networks of smart objects cooperate in a highly automated fashion. In order to support this vision, opportunistic approaches to resource discovery and management are required. Each smart object should be able to discover, orchestrate and exploit dynamically the sensors, actuators, information repositories and computational elements in its proximity. Decentralized models for data dissemination, service/resource advertisement and discovery may leverage semantic-based information annotation for more flexible and robust coordination mechanisms between pervasive peer entities. Ubiquitous inference engines clearly become crucial tools in such contexts, requiring careful optimization in order to achieve adequate performance for on-the-fly management of a potentially high number of medium-complexity resource descriptions.

The three accepted papers in SOON illustrate well the diversity in technological solutions and application areas of opportunistic paradigms. The work by E. Bove is a novel proposal for on-demand resource sharing and allotment in a publish/subscribe distributed middleware platform. It allows semantic-based service/resource description and discovery in complex ubiquitous scenarios, including Industrial Internet of Things, Semantic Sensor Networks and many more. The approach exploits a ubiquitous Knowledge Base model for dissemination of both ontologies and annotated descriptions of individual resources. It augments capabilities of off-the-shelf middleware with on-the-fly reconstruction of the terminological knowledge and on-demand semantic matchmaking for resource ranking. The work by V.F. Annese *et al.* is a clear example of problem addressable through semantic-enhanced opportunistic computing. Wearable cyber-physical systems must perform complex bio-signal processing with hard real time constraints on embedded hardware. Limitations in computational resources require alternative approaches with respect to classical data mining, in order to achieve both effectiveness and efficiency. In the work, semantic-based information processing is used to annotated and reason about the output of a procedure for abnormal gait detection. In this way, the system can infer the most appropriate feedback muscular stimulus to prevent a fall before it occurs. Finally, the work of F. Nocera et al. combines Semantic Web and Complex Event Processing methodologies in a ubiquitous health monitoring platform. Also, in this case, semantic-based information characterization and processing gives cohesion to a variety of analysis techniques and data sources, including real-time data acquired from bio-sensors.

In conclusion, I would like to thank the SEMAPRO organization for constant support. As I am pleased with the quality of contributions, I hope the audience of the conference and the readership of the proceedings will find the contents stimulating.

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SOON: Organizer and Chair