EDITORIAL MESSAGE
Special Track on Collective and Cooperative Systems (CCS)

Maurice H. ter Beek, *ISTI-CNR, Pisa, Italy*
Barbara Re, *University of Camerino, Italy*
Mirko Viroli, *University of Bologna, Italy*
Rachid Anane, *Coventry University, UK*
Rami Bahsoon, *University of Birmingham, UK*

This CCS track brings together the CAS track on Collective Adaptive Systems and the COSYS track on Cooperative Systems, which have been organized successfully as separate events in previous editions of the annual ACM/SIGAPP Symposium on Applied Computing.

Many aspects of our daily life are affected by pervasive technology, consisting of a vast amount of heterogeneous components (e.g., devices, software applications, smart objects), featuring complex interactions among themselves and potentially with humans. Modern distributed systems are governed by collective and cooperative schemes; they leverage intelligent mechanisms to manage deployment, operation, coordination, and evolution over time. These systems are characterized by dynamic and adaptive interactions between various entities and their environments, in order to provide services that help achieve specific goals.

Collective systems are enhanced with dynamic and autonomous adaptation capabilities, to effectively deal with the changes in their environments and to manage the interactions between themselves. Collective systems are also cooperative systems as they involve a large number of cooperating components, trading off individual tasks with overall system goals. Cooperative systems are characterized by their level of distribution, the underlying mode of interaction, and the degree of autonomy of the entities. Resources are also harnessed and marshalled across dynamic and heterogeneous environments in order to realize synergies between humans and systems.

In pervasive environments, for example, symbiotic relationships and seamless transitions are initiated and maintained, within secure and trusted environments. Effective cooperation requires that autonomous systems and their components overcome environmental heterogeneity and resolve semantic differences. Adherence to common abstractions and models facilitates the unfolding of processes such as data and system integration, coordination of behavior, resource access and sharing, and participation in complex activities. In managing the differences between entities, systems and environments, a range of methods and techniques are called upon to support interoperation and facilitate semantic interoperability. Resource and process management, configuration, adaptation, and negotiation define a wide spectrum of cooperation, from reactive behavior to proactive intervention. These tasks are being enhanced by ontologies, context awareness and self-configuration.

The development of collective and cooperative systems is closely related to, and overlaps with other contemporary software and system engineering areas, such as self-adaptive systems, component-based systems, service-based systems, and middleware platforms, as well as other areas of computer science, such as distributed artificial intelligence, agent-based programming, pervasive computing, internet of things, and

autonomic computing. This track aims to provide researchers and practitioners in these areas with a forum for discussing their different viewpoints and for sharing their ideas. The main objective of CCS is to attract relevant and innovative contributions from many different research communities. Of particular interest to the track are foundational approaches (e.g., theories, methods, formalisms, models) and practical and experimental implementations (e.g., systems, programming languages, middleware, development and runtime environments, tools).

CCS 2018 received a total of 15 submissions, many of which were of high quality and in line with the main themes of the track. Each submission was subjected to a systematic and rigorous review process by at least 3 PC members, often more. This resulted in the selection of the following four papers for an oral presentation at the conference (an acceptance rate of 26%):

- Comparing Languages for Engineering Server Software: Erlang, Go, and Scala with Akka, by Ivan Valkov, Natalia Chechina and Phil Trinder
- Coordinated Composition of Continuous Service Collaborations in Decentralized Smart Computing Environments, by Markus Wutzler, Thomas Springer and Alexander Schill
- Online Team-Based Game Development Discussions Patterns Summarised using Probabilistic Models, by Akiko Teranishi, Minoru Nakayama, Theodor Wyeld and Eid Mohamad
- No Longer Alone: Finding Common Ground In Collaborative Virtual Environments, by Li Liu and Adam Kaplan

In addition to these full papers, the following submission was selected for a poster presentation at the conference:

- A Pipelining-based Framework for Processing Events in Multimedia Sensor Networks, by Chinnapong Angsuchotmetee, Richard Chbeir, Yudith Cardinale and Shohei Yokoyama

We would like to thank the PC members for their detailed reports and the ensuing and stimulating discussions during the reviewing phase. We would also like to thank the authors of all submissions, the session chairs, and the attendees for contributing to the success of the track. Finally, we would like to thank the chairs of SAC 2018 for their invitation to organize the CAS and COSYS tracks, which led to this joint CCS track, and for their excellent assistance and support throughout the process.