Part IV:
Case Studies: Challenges and Feedback

Any method, technique, or tool proposed for the development of software systems needs to be evaluated in the context of realistic case studies, which in turn also feed and challenge the research process according to the expectation of the concrete application domain. Thus, this last part of the book discusses three case studies which cover a large spectrum of autonomous systems: swarm robotics, autonomic cloud computing, and electrically-powered vehicle ensembles.

The first chapter introduces the three ASCENS case studies and describes the role they played in the project. While it is easy to see the differences, the case studies also contain many similarities and common abstract characteristics in the domain of knowledge-based, self-aware and adaptive behaviors, which are highlighted in this chapter.

Adaptation and awareness in robot ensembles are described in the second chapter. This domain is studied using a disaster recovery scenario in which a search-and-rescue operation must be performed by robots in a hazardous environment. The scenario has been used throughout ASCENS as a reference to coordinate the study of distributed algorithms for robot ensembles, and has led to the demonstration of awareness on the ensemble level without requiring awareness on the level of individual robots.

The third chapter discusses the autonomic cloud, which is a cloud providing a platform-as-a-service computing infrastructure formed by a loose collection of voluntarily provided heterogeneous nodes. The individual nodes communicate in a peer-to-peer manner and need to work together in the presence of problems such as failing or disappearing nodes to keep applications running. This requires a certain degree of self-awareness, monitoring, and self-adaptation, which is achieved by the ASCENS ideas and methods.

Finally, the last chapter of this part and the book discusses electro-mobility (e-mobility), one of the promising technologies for replacing combustion engines as a means of propulsions for automobiles. In particular, this case study deals with characteristics and challenges that arise when people travel with privately owned electric vehicles in a resource-constrained road environment. Predictive environment information such as traffic information and car park availability is used to make travel decisions which affect the environment and, in turn, future predictions. As in the other cases, the challenges are addressed by a combination of ASCENS approaches.

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