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The Emerging Domain of Cooperating Objects

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 Springer

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The emerging domain of Cooperating Objects



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Foreword

The document you have in your hands presents the vision of the CONET consortium and its associated industrial partners regarding the future development of research in the field of Cooperating Objects. This vision is presented in the form of a technology roadmap and is the result of the compilation of several factors:

- The individual **expertise** and **practical experiences** of each of the partners involved in the project.
- The analysis of the current technologies and **current trends** that show future research directions.
- A **market analysis** of Cooperating Objects performed with the input from industrial partners and other research institutes.
- **Innovative applications** obtained partially from a wider audience and from within the consortium.
- **Identification of gaps** and research agendas in the different areas that compose the field of Cooperating Objects.

Given the balanced research and industrial background of the contributors and the fact that the field of Cooperating Objects is advancing rapidly, this document should be seen as input for research and development departments in industry and academia that would like to benefit from information about the possible direction and the timeframe for Cooperating Objects research.

The CONET Research roadmap has been written with three different audiences in mind:

- **Researchers:** That work or intend to work in the field of Cooperating Objects and would like to understand the current state of the art, current trends and possible gaps for future research.
- **Industry:** That would like to understand the current state of the art and possible market developments to be used as an additional source of information for the definition of specific strategies and business opportunities related to Cooperating Objects.
- **R&D Managers and policy directors:** To achieve a better understanding of the field of Cooperating Objects and its potential as a topic that can be included in upcoming calls or other financing instruments.

Depending on the interest of the reader and its adhesion to one or more categories described above, the reader should select the chapters and sections that most fit his/her interests.

Chapter 1

Executive Summary

The field of Cooperating Objects envisions vast numbers of embedded devices, such as networks of sensors and actuators, industrial production lines and machines, and household appliances that are interconnected and cooperate with each other in order to provide advance services. The functionality and sensor data these devices will be offering, are often referred as *real-world services* because they are provided by embedded devices, which are part of the physical world. Unlike most traditional enterprise services, which are designed to interact with human users, real-world services provide real-time data about the physical world.

According to several market studies, the number of devices around us is going to continue to grow tremendously and, more significantly, these devices will not be isolated! As the advances on networked embedded devices have been overwhelming, these devices will be able to communicate with each other and develop cooperation capabilities.

A study from ON World Inc.[Hat07] predicts that Wireless Sensor Network (WSN) systems and services will be worth \$6.6 Bn in 2011, and in 2012 it is expected that \$25.1 million WSN units will be sold for smart home solutions only, a significant increase from the 2 million in 2007. The business opportunities for real-world services are huge [Spi07]. As mass market penetration of networked embedded devices is realized, services taking advantage of the novel functionality of devices will give birth to new innovative applications and provide both revenue generating and cost saving business advantages. From a technological point of view, the key challenge is how to discover, assess, and efficiently integrate the new data points into business applications.

Wireless Sensor Networks are a canonical example of a wider field dealing with Cooperating Objects that attempts to create the necessary technologies to make the vision of Mark Weiser of the disappearing computer a reality. Cooperating Objects are, in the most general case, small computing devices equipped with wireless communication capabilities that are able to cooperate and organize themselves autonomously into networks of sensors, actuators and processing units to achieve a common task.

The book you have in your hands contains information about the research roadmap envisioned for Cooperating Objects by the CONET consortium (www.cooperating-objects.eu) and its associated industrial and academic partners. The project was started in June 2008 as a Network of Excellence co-funded by the European Commission to investigate the field of Cooperating Objects, foster the collaboration of experts already doing research in this field as part of a network of excellence, and devise a research roadmap that could be used for the definition of future research programs within the European Commission. This book is the result of the work performed in the first two years of the project and, although it is the revision of first year's roadmap, it has been expanded with new sections and new data to include the latest advances in the field.