

Preface

This special volume of *Annals of Information Systems* explores the issues associated with the design and use of real-time DSS in ubiquitous, mobile and distributed computing environments with the focus on the importance of context for successfully addressing dynamic decision-making processes.

The idea of the book on real-time decision support was born as a result of international collaboration on the topic of context-aware computing as part of the Task Force of the Australian Research Council initiative called Research Network in Enterprise Information Infrastructure [EII].¹ This unique initiative supported a series of events and activities, which brought together academics and practitioners keen on promoting an integration of ubiquity and mobility of devices, applications and users in order to significantly improve business processes and to reduce operational costs. This initiative is also aiming at establishing a focal point for bringing together researchers and practitioners working in the area of context-awareness in pervasive computing in Australia and worldwide. This collaboration gave us an opportunity to reflect and consolidate many years of research results in the use of intelligent technologies for decision support. We were able to establish the boundaries of current approaches to applying advanced technology for supporting context-specific and personalised information needs of field workers. One of such boundaries was established in the area of real-time decision support. The invitation from the *Annals of Information Systems* for the issue in the topical area of decision support provided us with a fortunate opportunity to put together this book with the aim of crossing this boundary and extending this exciting cross-disciplinary research area.

Sponsored by the Association for Information Systems, Special Interest Group on Decision Support, Knowledge and Data Management Systems (AIS SIG DSS), we organised a workshop “Supporting real-time decision-making: The role of context in decision support on the move” as a part of the International Conference in Information Systems ancillary events (pre-ICIS DSS workshop) in December 2008 in Paris. The call for papers for the event invited authors to contribute related theories, tools and techniques, as well as to share some case studies from their

¹<http://www.eii.edu.au/>

experience. We were interested in collecting cases in which the real-time decision support was successfully provided based on context-aware information systems, as well as those where time-critical support failed due to the shortcomings of technology or social components of the information systems. Some of the chapters in this book are based on the presentations from that workshop. The authors came to present and discuss their research ideas on the role of context in real-time DSS. The presenters debated advantages of and obstacles to real-time DSS and the role of context in it. The workshop included a key note and a panel discussion on the future research required to successfully advance the DSS field, capitalising on the opportunities of the ubiquitous technologies and addressing the challenges of making better decisions ‘on the move’.

The review of the recent literature on decision support and submissions to the workshop reconfirmed to us that there was no other source, which would systematically cover theory, technologies and techniques applicable to capture dynamic context for the needs of real-time decision support. Hence, the need for this book has become even more evident.

Based on the identified themes, an open call for book chapters was issued, which resulted in multiple submissions not only from the participants of the workshop, but from other active researchers in the field. Each chapter of the book underwent at least three rounds of peer and editorial review. Although not all submissions found their way into this book, we do appreciate the effort of all the authors.

The overarching research question this book aims to address is: How discovering, extracting, interpreting, predicting and managing context can assist in real-time decision support? The volume’s focus is on the challenges of context modelling and management as a component of knowledge management for decision making and support. We collected a number of case studies and example projects where such technologies were successfully applied. A number of authors describe potential innovations which could support real-time decision making processes. In particular, the book contains a few examples of the use of innovative approaches for dealing with context in crisis and emergency management situations.

The volume focuses on the role of context for time-critical decision support. It includes chapters describing theory and practice of real-time decision support, and decision support ‘on the move’ in particular. The topics covered in the book include theoretical and technical aspects and application case studies of:

- Context-based decision-making methods and tools
- Contextualising information for time-critical decision making
- Processes and procedures of extracting contextual information for decision support
- Identifying context in decision making/support process
- Managing the contextualization process of decision making/support
- Dynamic filtering of information for real-time decision making and support.

The chapters describe concrete and constructive research results on the topics as well as more broad theoretical frameworks about the role of context in

decision-making and support, a comprehensive review of the available approaches to mobile real-time decision support.

The book is organised around three themes, which can be broadly labelled as theories in, technologies for and application cases of real-time context-aware DSS. The final theme covers a wide range of sample applications among the many that have been successfully implemented to deal with the contextual needs of decision-makers in various applications. It is represented by ten chapters. First three chapters of the final theme explore the real-time decision support for groups in emergency and crisis management. They are followed by four chapters looking at the real-time decision support in medical and business contexts. The remaining three chapters explore the issues related to mobile decision support.

The first theme provides a solid foundation by exploring paradigms and methods associated with real-time DSS, and how they fit with other studies and theories of computerised decision-making support. The theme is represented by an introductory note from the editors and two full chapters, which establish the ontology of the field of real-time decision support and establish foundations and new outlooks for enabling such systems and supporting organisations in realising the full potential of opportunities provided by the *anywhere, anytime computing* paradigm.

Chapter 1 by Dan Power looks at the problem of successful implementation of real-time decision support systems (DSS) emphasising on three major categories of challenges: technical, organisational and social/psychological. The author justifies why these are the challenges that the managers should be aware of in order to successfully implement real-time DSS and what benefits such awareness brings.

In Chapter 2, Eric Stein explores the concept of improvisation as a framework for understanding real-time dynamic decision making and systems support for it. He introduces a framework that classifies improvisational contexts according to problem structure and foreseen consequences, identifies the elements necessary for effective individual and team improvisation, and lists the design requirements necessary to support improvisational behaviours and conversations.

The second theme consists of five chapters that explore various innovative approaches trailed by the authors and offered as potentially beneficial technical solutions when making time-critical decisions.

Chapter 3 by Arkady Zaslavsky and Andrey Boytsov addresses the problem of context prediction and subsequent proactive adaptation. The authors start by developing and justifying the principles to analyse and compare various context prediction methods, followed by analysing the development in the area and comparing different context prediction techniques to identify their benefits and shortcomings. They conclude their empirical research by identifying current challenges in the area and proposing the potential solutions to address these.

In Chapter 4, Patrick Brézillon proposes modelling of real-time decision making in order to support the self-training of actors to modify weaknesses of their behaviour during task realisation. The author introduces a contextual methodology composed of a series of ten steps that cross the four levels of human behaviour known as policy, strategy, tactic and operation. Such contextual methodology proposes a unified framework that brings together aspects that are generally

contrasted – procedure versus practice, task versus activity, logic of functioning versus logic of use – and explains the two types of contextualisation in a context-oriented model with three layers. The contextual methodology and the framework are applied in the road safety domain.

In Chapter 5, Seng Loke uses a declarative programming approach to the situation programs that encapsulate and modularise the way context is aggregated to infer various situations. The author treats the situation programs as first-class entities, describes the initial prototype LogicCAP-S based on the language LogicCAP, and discusses how it could be further applied in the mobile environment.

In Chapter 6, Florence Aligne and Juliette Mattioli explore crisis management as a typical situation in need for real-time decision support. The authors outline the importance of the contextualisation of information in the situation understanding process. They propose a crisis management cycle structured along three crucial steps: information gathering, situation understanding and decision making. For each step, the authors describe the processes involved and propose some relevant techniques to implement them.

In Chapter 7, Norita Ahmad and Reza Barkhi attempt to establish how various contextual and collaborative approaches influence human decision makers through interface manipulations. Focusing on the Second Life (SL) technology that creates a virtual world, the authors design an experiment where they explore the SL context, user behaviour and perceptions about SL. Experiment results provide empirical evidence of the use of SL and the future of this technology for human interaction in the real-time decision-making context.

For the last theme, we have selected a range of case studies covering a range of opportunities and challenges associated with providing time-critical decision support on the move. Some of the case studies look specifically into the role of context in their cases and reflect on some lessons learnt in dealing with context in a particular way. We start this section of the book with three chapters addressing case studies in emergency, disaster and crisis management, which were identified in the previous section as one of the obvious areas in need of real-time decision support.

Chapter 8 by Tung Bui and Ina Sebastian explores the crisis scene and proposes that under extraordinary conditions that information provided to the decision makers should help them in dealing with emotions and stress, reinforce motivation to help and nurture a sense of altruism. In their research, the authors step outside of the rational decision-making paradigm and provide a new perspective on what constitutes effective decision support to the volunteer helpers.

Chapter 9 by Murray Turoff, Connie White and Linda Plotnick looks at the Threat Rigidity Syndrome and information overload as the genesis of various design problems of the emergency decision support systems. The authors investigate how these problems can be overcome using the example of High Reliability Organisations (HRO) that utilise a set of practices to manage low-probability/high-consequence events.

In Chapter 10, the authors Linda Plotnick, Murray Turoff and Connie White explore how the use of electronic communications allows Partially Distributed Emergency Teams (PDET) accomplish various tasks remotely instead of face to

face. The authors discuss how such teams, being empowered by the new technologies, form virtual communities of practice, and identify strategies that can help build and nurture these virtual communities by looking at the ways to further utilised new technologies.

Chapter 11 by Fergal Carton, Frederic Adam and Patrick Brézillon opens a subsection concerned with real-time decision support in business context. The authors look at the problems of providing real-time decision support to managers in the context of a case study of a multinational manufacturing firm that relies on an ERP (enterprise resource planning) package for transaction processing. Aligning the ERP system with the reality of doing business proves to be a real challenge and a subject to constraints arising from both the business and virtual context of the firm. By analysing the emerging gaps between the inflexible ERP system and the decision support needs of managers, the authors offer a theoretical framework for the relationship between real-time transaction processing and decision support.

Chapter 12 by Robert Baksa and Murray Turoff contrast continuous auditing systems with the emergency management and response systems that integrate continuous auditing's detection and alerting functions with the tracking of decisions and decision options for situations that could be more effectively handled by human judgement. The authors propose using emergency management and response systems as a prototype to help overcome some of the implementation obstacles of the auditing systems. The authors suggest possible architectures for the continuous auditing systems, list some common implementation challenges, and provide a case study to illustrate a few successful implementations.

Chapter 13 by a team of researchers and practitioners from Canada consisting from Ziad Kobti, Anne W. Snowden, Robert D. Kent, Gokul Bhandari, Shamual F. Rahaman, Paul D. Preney, Carol A. Kolga, Barbara Tiessen and Lichun Zhu is concerned with the real-time decision support in medical context. The authors discuss challenges faced by semiautomated decision support systems in health care, mainly in generating evidence-based recommendations in a short critical time-frame. They report on a multidisciplinary project between computer and health sciences resulted in a cumulative framework that encapsulates innovative distributed data collection methodology, coupled with an intelligent multi-agent, socially driven decision support system.

In Chapter 14, Shane Grigsby, Frada Burstein and Nyree Parker discuss the role of decision context within time-critical decision support in medical triage. The authors believe that establishing a decision context in time-critical decision support could assist in provisioning time-critical information to improve decision outcomes. They look at the safety measures and risk mitigation in the clinical health care setting, and how decision support systems can refine contextual guidelines on the task being undertaken in such settings. They identify contextual elements of a task being undertaken as a means to establish rules that can influence provided decision support in the given settings and subsequently improve decision-making outcomes.

Three final chapters of the book look at the approaches specific to mobile decision support. Chapter 15 by Yves Vanrompay and Yolande Berbers looks at how the current and future context of the system affects the quality of support provided

by that system. The authors propose to run a DSS on top of a middleware that helps the decision maker to contextualise information. They provide a set of requirements the middleware should fulfil to learn, detect and predict patterns in context to optimise the information flow to the decision maker, and validate their findings in the medical health care domain.

Chapter 16 written by Supavich Pengnate, Ramesh Sharda, David Biroš, Michael Hass and Upton Shimp looks at the military domain where availability of needed ammunition information is critical for decision making, especially in a war zone. The authors use a case study where the extension of a web-based ammunition multimedia encyclopaedia (AME), developed for the US Army Defence Ammunition Center (DAC), used mobile handheld technology to provide Quality Assurance Specialist Ammunition Surveillance (QASAS) personnel access to needed ammunition information via a personal digital assistant (PDA).

The final Chapter 17 of the book by Pedro Antunes, Claudio Sapateiro, Gustavo Zurita and Nelson Baloian describes the development of a model and tool supporting collaborative construction of situation awareness. The model organises awareness information elements according to situation dimensions, dimensional elements and correlations between dimensional elements, while the developed tool supports collaborative information management using mobile devices and pen-based interaction. The reported case study illustrates implementation of the developed model and tool in the support to disaster recovery of business operations.

From the above description, the reader can gain a fair idea of the breadth and the depth of the material covered in the book. We believe that this book will have a wide range of appeal to the readers who recognise the importance of providing relevant knowledge on the move in timely manner. It is written by academics and practitioners for academics and practitioners. It does not require the reader to have specific background in information systems in general and decision support in particular. It targets to reach four audiences:

- Practitioners involved with the design of real-time DSS
- Users of various levels concerned with effective use and management of these systems
- Technologists searching for empirical evidence and feedback on opportunities and drawback associated with the use of real-time DSS
- Researchers and students interested in study and further research in the area of context-aware DSS

The goal of this book is not to bring a final point to the current state on DSS on the move, but rather emphasise the importance of this new field for extensive research in the near future.

Supporting Real Time Decision-Making

The Role of Context in Decision Support on the Move

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