

# Intelligent Agent-Based Decision-Support Systems for Complex C<sup>2</sup> Applications

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## Abstract

In many time and mission-critical real-time applications there are humans in the loop. These humans are expected to make correct or largely correct decisions under conditions of massive information overload, uncertainty and stress, i.e., sources of exceptional complexity of these systems! We help these humans in their tasks through intelligent agent-based decision support systems (DSS). Utilizing suites of heuristics from many different fields of applied mathematics, optimization theory, scheduling and resource allocation and Artificial Intelligence, these DSS provide quality advice and rationale when it is needed, where it is needed and in the terminology and at the level of detail that is needed. The result is increased situational awareness, increased ability to assess risk and decision tradeoffs, reduced stress and, in general, very substantially reduced system complexity and as a result, considerably better operation of the time - and mission-critical real-time application by the humans in the loop.

Alexander D. Stoyen is an academic and technologist with significant experience in the fields of complex real-time systems and decision support systems. As a technologist, he is Founder and Chief Technical Officer of 21st Century Systems, Inc. (21CSI), a small-business researching, prototyping and developing revolutionary intelligent agent-based decision support systems for time - and mission-critical systems with humans in the loop. In its five years of operation (since 1996), 21CSI has fielded DSS prototypes for a wide variety of military platforms. 21CSI has also developed and is now licensing and selling commercially a product AEDGEtm. AEDGEtm is a DSS construction toolkit, suitable for commercial and R&D organizations. With offices in Nebraska, Colorado, New York and Washington, DC, the company is now in the process of further expansion and creation of a separate commercial division, to support the AEDGEtm product and to develop, market and sell commercial AEDGEtm-based products.

As an academic, Dr. Stoyen is on federal research development leave from the University of Nebraska at Omaha, where he has been Endowed Full Professor of Computer Science since January 1999 and Director, Center for Management of Information Technology AY'1999-2001. He is also appointed by courtesy to the Department of Computer Science Engineering (UN-Lincoln). At the University of Nebraska, Dr. Stoyen is advising Doctoral and Master's students and is working on a major NSF-funded project in the area of Quality of Service networking and communications over Internet-2.

Dr. Stoyen received his Ph.D. in Computer Science from the University of Toronto in 1987. Upon graduation, he joined IBM T.J. Watson Research Center as a research staff member. In 1990, he became an Assistant Professor of Computer Science at the New Jersey Institute of Technology, where he built the Dependable Real-Time Systems Laboratory. At the time of leaving NJIT in January 1999, Dr. Stoyen was an Associate Professor of Computer Science and of Electrical and Computer Engineering. Dr. Stoyen has held visiting, consulting and advisory appointments at universities, corporations and other organizations throughout North America, Europe and Asia. He has contributed significantly to a number of key technological concepts in real-time systems and has published more than 110 articles in journals, books and conference proceedings. Dr. Stoyen has served as an organizer of many professional events, chair of IEEE Technical Committees, and editor or guest editor of book series and archived peer-reviewed journals, including *IEEE Computer*, *J. Real-Time Imaging* and *J. Real-Time Systems*. Dr. Stoyen is a Senior Member of the IEEE and is an IEEE Computer Society Golden Core Member.