Intelligent Decision Technologies 2 (2008) 1–2
IOS Press

Guest-editorial

Ontology driven interoperability for agile applications, using information systems: Requirements and applications for agent mediated decision support

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The continuous development of Artificial Intelligence (AI) supports Intelligent Decision Technologies (IDT) applications as featured in this journal. Network-centric environments deliver this technology and make such applications principally accessible to the user wherever and whatever system is being used. While today's networks have integrated the Internet and wireless technologies to enable technically reliable communication and coordination between dispersed systems, one of the urgent challenges is to achieve a common understanding between systems regarding how to interpret the data that are exchanged. Agent mediated solutions using ontological means are among the promising candidates that can contribute to a generally applicable solution

The papers in this special issue originate from the domain of distributed complex and model-based information systems interacting with real-world systems. While distributed information systems of the first generation used proprietary protocols to solve problems mainly on the technical level of networking, the current standards are targeting the semantic level, which is the unambiguous exchange of data between implementations. The advent of the era of service-oriented architectures and intelligent software agents leads to new potentials, such as model-based operational services that can be composed by agents to fulfill the needs of a user to support business processes "on the fly." However, models are meaningful abstractions of reality and, as such, use different assumptions and constraints. These different ideas are normally captured on the abstraction level above the implementation, which is known as the conceptual level. In order to describe complex and dynamic services such as model-based services, the unambiguous exchange of information is necessary, but not sufficient. The same data can be used in different contexts leading to different results. This pragmatic use of information must be part of the description of services to avoid variances within systems using both services to solve a common problem. Furthermore, the internal change over time in such services must be orchestrated. This is the dynamic component of the challenge. Finally, the services – or composing agents – must be aware of the assumptions and constraints under which the model is valid. This is the conceptual component. The *Levels of Conceptual Interoperability Model* (LCIM) was introduced to deal with the challenges of model-based services in agent-mediated environments. It distinguishes between technical layers ensuring that services can be integrated, implementation layers for

ISSN 1872-4981/08/$17.00

interoperability of the executable services and providing systems, and conceptual layers for modeling and abstractions. It serves as the common frame for all papers.

The paper *"Implied Ontological Representation within the Levels of Conceptual Interoperability Model"* introduces the LCIM and shows the interconnection with current technologies and means applied within the Semantic Web initiatives. A logic-based approached to integration and mediation is described in *"Ontology enabled Decision Support and Situational Awareness."* Also using agents, but focusing more on the conceptual constraints for composition on the application side, the paper *"Reasoning about Conceptual Interoperability of Simulations Using Meta-level Graph Relations"* introduces some metrics in support of conceptual composition as envisioned in this special issue. While these first three papers focus on current research topics, the last two papers address more practical issues of applying such ideas. In the paper *"A Rich Semantic Model of Track as a Foundation for Sharing Beliefs Regarding Dynamic Objects and Events,"* semantic concepts are made explicit to agents in support of reasoning about dynamic objects and events using examples from the United States Navy. A more general application in support of integration of heterogeneous information infrastructure in support of homogeneous decision support is described in *"A Translation Engine in Support of Context-Level Interoperability."*

In summary, this special issue evaluates basic research topics, recent research results, and feasibility studies and proofs of concepts. As such, it addresses the scholar as well as the practitioner in the domain of Intelligent Decision Technologies.

Acknowledgment

In addition to the authors of all submitted papers, I would like to thank the following individuals for their support as reviewers for this issue. Their input helped to select the best papers and improve them significantly:

Michael Bailey, *Technical Director US Marine Corps Training and Education Command*

Don Brutzman, *Professor, Naval Postgraduate School*

Rudy Darken, *Director MOVES Institute, Naval Postgraduate School*

Niki Goerger, *Engineering Management, West Point Academy*

Simon Goerger, *Engineering Management, West Point Academy*

Reiner Huber, *Professor Emeritus, University Munich*

Axel Lehmann, *Professor, University Munich*

Tuncer Oren, *Professor Emeritus, University of Ottawa*

Mikel Petty, *Director Center for Modeling, Simulation, and Analysis, University of Alabama*

Gloria Phillips-Wren, *Professor, Loyola College*

Mark Pullen, *Director C4I Center, George Mason University*

Ghaith Rabadi, *Professor, Old Dominion University*

John Sokolowski, *Director for Research, Virginia Modeling Analysis and Simulation Center*

Alexander Stoyen, *Professor, University of Nebraska*

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