Pontifícia Universidade Católica
do Rio de Janeiro

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An Approach to Operationalize Regulative Norms in Multiagent Systems

Doctoral Thesis

Thesis presented in partial fulfillment of the requirements for obtaining a doctoral degree in Computer Science from PUC-Rio.

Advisors: Prof. Carlos José Pereira de Lucena
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Abstract

Felicíssimo, Carolina Howard; Lucena, Carlos José Pereira de; Briot, Jean-Pierre. **An Approach to Operationalize Regulative Norms in Multiagent Systems**. Rio de Janeiro, 2008. 170p. Doctoral Thesis – Computer Science Department, Pontifical Catholic University of Rio de Janeiro.

A major challenge in the research of multiagent systems (MAS) is the design and implementation of open MAS in which norms can be effectively applied to their agents and easily managed. These tasks are arduous because norms are usually written for general purposes, hindering a more precise regulation. The motivation for this research came forth from the need to resolve this challenge, providing an approach applicable in open systems. In such systems, heterogeneity and autonomy rule out any assumption concerning the way third-party entities are implemented and behaved. A viable solution for regulation in open MAS should not be hard coded inside agents' original implementations and must allow, for some degree of precision and flexibility, to update data (*e.g.*, norms) during the system execution. In this thesis, our DynaCROM approach for dealing with norms in open MAS is presented. From the individual agents' perspective, DynaCROM is an information mechanism that makes application agents aware of the norms they are bound to at a given moment. From the system developers' perspective, DynaCROM is a methodology for the application and management of norms in open MAS so developers are able to embody abstract norms with domain values. Therefore, norms are contextualized in the application domain wherein they hold, facilitating regulation. Considering that a regulated MAS should have its norms enforced, the integration of DynaCROM with two distinct enforcement mechanisms is also presented. In summary, the result of this thesis is our DynaCROM approach, which operationalizes regulative norms in MAS.

Keywords

Regulative norms, contextual classification, regulatory compliance.

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Resumo

Felicíssimo, Carolina Howard; Lucena, Carlos José Pereira de; Briot, Jean-Pierre. **Uma Abordagem para Operacionalizar Normas Regulativas em Sistemas Multiagentes**. Rio de Janeiro, 2008. 170p. Tese de Doutorado – Departamento de Informática, Pontifícia Universidade Católica do Rio de Janeiro.

Um grande desafio na pesquisa de sistemas multiagentes (SMA) é a concepção e implementação de SMA abertos em que normas podem ser eficazmente aplicadas aos seus agentes e facilmente gerenciadas. Estas tarefas são árduas porque normas são usualmente escritas para propósitos gerais, dificultando uma regulação mais precisa. A motivação para esta pesquisa surgiu diante da necessidade de resolver este desafio, proporcionando uma abordagem aplicável em sistemas abertos. Nesses sistemas, heterogeneidade e autonomia excluem qualquer hipótese relativa à forma com que entidades de terceiros são implementadas e como se comportam. Assim, uma solução viável para regulação em SMA abertos não deve ser rigidamente codificada dentro das implementações originais de agentes e deve permitir, a um certo grau de precisão e flexibilidade, atualizar dados (*e.g.*, normas) durante a execução do sistema. Nesta tese, nossa abordagem DynaCROM para lidar com normas em SMA abertos é apresentada. Da perspectiva individual de agentes, DynaCROM é um mecanismo informativo que torna agentes da aplicação cientes das normas as quais eles estão vinculados em um determinado momento. Da perspectiva de desenvolvedores do sistema, DynaCROM é uma metodologia para aplicação e gerenciamento de normas em SMA abertos de tal modo que desenvolvedores sejam capazes de incorporar em normas abstratas valores de domínio. Portanto, normas são contextualizadas no domínio de aplicação onde elas são válidas, facilitando regulação. Considerando que um SMA regulado deve ter suas normas respeitadas, apresentamos também a integração de DynaCROM com dois mecanismos distintos de cumprimento de normas. Em resumo, o resultado dessa tese é nossa abordagem DynaCROM que operacionaliza normas regulativas em SMA.

Palavras-chave

Normas regulativas, classificação contextual, conformidade regulatória.

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Glossary

ACL	Agent Communication Language
ASF	Agent Society Framework
COIN	Coordination, Organization, Institutions and Norms
CORBA	Common Object Request Broker Architecture
DTV	Digital Television
EI	Electronic Institutions
FIPA	Foundation for Intelligent Physical Agents
GIOP	General Inter-ORB Protocol
IIOP	Internet Inter-Orb Protocol
JADE	JAVA Agent Development Environment
KQML	Knowledge Query and Manipulation Language
MAS	Multiagent System(s)
NMAS	Normative Multiagent System(s)
OWL	Web Ontology Language
OWL-DL	Web Ontology Language - Description Logic
RMI	Remote Method Invocation
TADA	Trading Agent Design and Analysis
TAC	Trading Agent Competition
TCP/IP	Transmission Control Protocol/Internet Protocol
URL	Uniform Resource Locator
W3C	World Web Consortium

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