

SIMULATION OF AN ENERGY MANAGEMENT SYSTEM BASED ON AGENT TECHNOLOGY

RALF BIERNATZKI

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Ralf Biernatzki

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Vorwort des Herausgebers

Die Elektrische Energietechnik erfuhr durch die Liberalisierung des Energiemarktes einen revolutionären Strukturwandel und damit verbunden auch eine inhaltliche Neuorientierung. Dies bildet sich auch in den Forschungsarbeiten der energietechnischen Institute ab. Neue Fragestellungen aus dem Bereich der Energiewirtschaft treten in den Vordergrund. So haben Aufgaben der Lastprognose und der Optimierung von Bezugsverträgen, die Prognose zukünftiger Energiepreise und die Simulation des Energiemarktes eine ganz andere Bedeutung im liberalisierten Energiemarkt gefunden.

Das Fachgebiet Automatisierungstechnik des beteiligten Wrangell-Instituts für Umweltgerechte Produktionsautomatisierung widmet sich Themen an der Schnittstelle zwischen intelligenten Automatisierungssystemen und energietechnischen Anwendungsfeldern. Ein neues Forschungsgebiet ist die Simulation komplexer Systeme mit Multiagentensystemen. Dieses Forschungsgebiet wurde dem Anwendungsfeld des Elektrizitätsmarktes zugeordnet, und im Rahmen der Arbeit wurden wesentliche Aspekte für die Entwicklung solcher Systeme und deren Vorteile aufgezeigt. Die Arbeiten wurden in Kooperation mit der Strombörse in Leipzig EEX und der Firma IEBT umgesetzt. Dafür sei herzlich gedankt.

Die Entwicklung des Simulationssystems war ein Teilprojekt eines größeren europäischen Forschungsprojekts INNOPSE (Innovation Studio and Exemplary Developments for Product Service Engineering). Dieses europäische Projekt wurde in Kooperation mit europäischen Universitäten und Unternehmen durchgeführt. Allen beteiligten Mitarbeitern sei für die tatkräftige Unterstützung des Projekts herzlich gedankt. Dem Autor des vorliegenden Bandes gilt hierbei mein besonderer Dank als Projektkoordinator, da er das Gesamtprojekt als Projektmanager begleitete.

Soest, im Januar 2005

Berthold Bitzer

Abstract

The electricity supply industry is undergoing rapid and significant changes because of the liberalisation of the energy market. Recent changes in the German energy policy initiated a deregulation process from a monopolistic to a competitive market, fundamentally changing the market structure, transaction relationships and trading processes. This put the customers of electric energy in a new position, where they can shop around for the best supplier.

There is a need for new computational tools and software solutions for market participants which support open and dynamic architectures, such as the emerging competitive market environment. These novel software systems need to provide high performance in communication, negotiation, planning and learning skills. Agent technology is currently one of the most exciting research fields in computer science and provides a promising approach to realize such open and dynamic systems.

This thesis is divided into two parts. Part 1 deals with general issues related to deregulation and foundations of agent technology. Part 2 describes the application of agent technology to energy management systems.

The main task of this work is the development of a systematic engineering approach to complex agent systems for the simulation of energy management systems. Thereby a novel simulation system for portfolio management based on a multi-agent system has been developed. The portfolio analysis carried out by the simulation system has shown promising results, especially by comparing the results to a full supply agreement.

It is argued that agent technology is very useful for the design and implementation of simulation systems and highly applicable for the simulation of energy management systems required for electricity procurement and portfolio management. The research has shown that agents, acting autonomously, are an effective way to study the many issues that affect the electric power market as it struggles with adapting to changes caused by liberalisation.

Dedication

I wish to dedicate this work to my daughter, Inga Marie, for the delight and joy she has given me; to my wife Heike, for her patience, encouragement and belief in me; and to my grandfather Josef Biernatzki.

Acknowledgements

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May, 2004

Ralf Biernatzki

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