

Contents

Part I: Multi-commodity Market Model (M³) Fundamentals

M³ – Motivations and Formal Model	3
Mariusz Kaleta and Eugeniusz Toczyłowski	
1 Introduction	3
2 Market Design	6
3 Market Game	7
4 M ³ Architecture Overview	11
5 M ³ Formal Model	12
6 Multi-commodity Balancing Model	18
7 Summary	19
References	19
M³ Data Structures	21
Tomasz Traczyk	
1 Introduction	21
2 M ³ Data Model	22
3 M3-XML Language	29
4 Applications of M3-XML Data Structures	34
5 Evolution of M ³ Data Structures and M3-XML Language	35
6 Conclusion	35
References	35
Appendix: M3-XML Schema	37
Communication Models Used in the Context of Multi-commodity	
Trade	47
Piotr Pałka	
1 Introduction	47
2 Trade Models	47
3 Evolution of Agents Communication Languages	50
4 Agents Communication Language	53

5	Conclusion	63
	References	63
Integration between Web Services and Multi-Agent Systems with Applications for Multi-commodity Markets		65
Dominik Ryżko and Weronika Radziszewska		
1	Introduction	65
2	Existing Results	66
3	Integration between Web Service Technology and FIPA Agent Technology	68
4	Architecture for Multi-commodity Markets	73
5	Conclusions	75
	References	76
Application of the Multi-Agent Systems in the Context of the Multi-commodity Market Model M^3		79
Piotr Pałka		
1	Introduction	79
2	Multi-Agent Exchange Platforms	80
3	Design of the Multi-Agent Platform for Multi-commodity Exchange	81
4	Java Implementation	87
5	AIMMS Implementation	92
6	Summary	96
	References	97
A Semantic Web Approach to the M^3 Model		99
Przemysław Więch and Tomasz Gidlewski		
1	Introduction	99
2	Ontologies	101
3	Web Ontology Language	101
4	Describing Offers with Ontologies	102
5	Ontologies for M^3	105
6	Problems with Ontologies	109
7	Conclusion	110
	References	110
Reliability Aspects of Multi-commodity Markets		113
Jacek Malinowski		
1	Introduction	113
2	Multi-Agent Model of Multi-commodity Trade	115
3	Topologies of Interaction in Multi-Agent Systems	116
4	Game Theoretical Approach to MAS Functionality	119
5	Analysis of Technical Conditions for the Fulfillment of a Contract	123
	References	125

Part II: M³ Applications

M³ Applications on the Electricity Markets	129
Mariusz Kaleta, Przemysław Kacprzak, Kamil Smolira, and Eugeniusz Toczyłowski	
1 Introduction	129
2 Market Processes in Electricity Market	130
3 Day-Ahead and Intra-day Markets	131
4 Development of Balancing Markets with M ³ Model	138
5 Real Time Segment	141
6 Summary	146
References	147
A Market for Pollution Emission Permits with Low Accuracy of Emission Estimates	149
Zbigniew Nahorski and Joanna Horabik	
1 Introduction	149
2 Uncertainty and Evaluation of Compliance	150
3 Compliance	153
4 Effective Emissions	154
5 Trading Estimated Emissions versus Trading Effective Emissions	155
6 Market in Effective Emissions	159
7 Conclusions	161
References	162
Application of Multi-commodity Market Model for Greenhouse Gases Emission Permits Trading	165
Zbigniew Nahorski, Jarosław Stańczak, and Piotr Pałka	
1 Introduction	165
2 Centralized Model	166
3 Dynamic Bilateral Trading	167
4 Application of M ³ Model to GHG Emission Permits Market ...	169
5 Results	173
6 Conclusion	176
References	176
Modelling Virtual Network Market Data with Open Multi-commodity Market Model	179
Janusz Granat, Kamil Kołtyś, and Krzysztof Pieńkosz	
1 Introduction	179
2 Virtual Private Networks	180
3 Implementing VPN Auction Models in M ³	181
4 Conclusions	191
References	191