

# Contents

- 1 Introduction . . . . . 1**
  - 1.1 Motivation . . . . . 1
  - 1.2 Key Issues and Challenges in Resource Allocation . . . . . 2
  - 1.3 Contribution of the Thesis . . . . . 3
  - 1.4 Organization of the Thesis . . . . . 4
- 2 Implementation Theory . . . . . 5**
  - 2.1 What is Implementation Theory?. . . . . 5
    - 2.1.1 Preliminaries . . . . . 5
    - 2.1.2 Game Forms/Mechanisms . . . . . 6
    - 2.1.3 Implementation in an Appropriate  
Equilibrium Concept . . . . . 8
    - 2.1.4 Implementation in Nash Equilibrium  
and Maskin’s Mechanism. . . . . 8
    - 2.1.5 Interpreting Nash Equilibrium . . . . . 11
    - 2.1.6 Desirable Properties of Game Forms . . . . . 12
  - References . . . . . 13
- 3 Unicast Service Provisioning. . . . . 15**
  - 3.1 Introduction . . . . . 15
    - 3.1.1 Contribution of the Chapter . . . . . 15
    - 3.1.2 Comparison with Related Work . . . . . 16
    - 3.1.3 Organization of the Chapter . . . . . 17
  - 3.2 The Unicast Problem with Strategic Network Users,  
Problem Formulation . . . . . 18
    - 3.2.1 The Centralized Problem . . . . . 18
    - 3.2.2 The Decentralized Problem with Strategic Users. . . . . 19

3.3	A Mechanism for Rate Allocation . . . . .	20
3.3.1	Specification of the Mechanism . . . . .	21
3.3.2	Discussion/Interpretation of the Mechanism . . . . .	25
3.4	Properties of the Mechanism. . . . .	27
3.5	Implementation of the Decentralized Mechanism. . . . .	29
3.6	An Extension . . . . .	29
	References . . . . .	30
<b>4</b>	<b>Power Allocation and Spectrum Sharing in Multi-User, Multi-Channel Systems . . . . .</b>	<b>31</b>
4.1	Introduction . . . . .	31
4.1.1	Contribution of the Chapter . . . . .	32
4.1.2	Comparison with Related Work . . . . .	32
4.1.3	Organization of the Chapter . . . . .	33
4.2	The Model and Objective . . . . .	33
4.2.1	The Model . . . . .	33
4.2.2	Objective . . . . .	36
4.3	A Mechanism for Power Allocation and Spectrum Sharing. . . . .	37
4.4	Interpretation of the Mechanism . . . . .	38
4.5	Properties of the Mechanism. . . . .	38
	References . . . . .	45
<b>5</b>	<b>Multi-Rate Multicast Service Provisioning . . . . .</b>	<b>47</b>
5.1	Introduction . . . . .	47
5.1.1	Motivation and Challenges. . . . .	47
5.1.2	Why is Strategic Behavior Justified? . . . . .	48
5.1.3	Contribution of the Chapter . . . . .	48
5.1.4	Comparison with Related Work . . . . .	48
5.1.5	Organization of the Chapter . . . . .	49
5.2	The Multi-Rate Multicast Problem with Strategic Network Users, Problem Formulation . . . . .	49
5.2.1	The Centralized Problem . . . . .	50
5.2.2	The Decentralized Problem with Strategic Users. . . . .	52
5.2.3	Key Features/Natures of the Problem . . . . .	53
5.3	A Mechanism for Rate Allocation . . . . .	54
5.3.1	Guidelines for the Design of the Mechanism . . . . .	54
5.3.2	Specification of the Mechanism . . . . .	55
5.3.3	Discussion/Interpretation of the Mechanism . . . . .	60
5.4	Properties of the Mechanism. . . . .	62
	References . . . . .	65

Contents	xv
<b>6 Summary and Future Directions.</b>	<b>67</b>
6.1 Summary	67
6.2 Future Directions.	68
6.2.1 Algorithmic Issues	68
6.2.2 Dynamic Environments	68
6.2.3 Beyond Quasi-Linear Forms.	69
References	69
<b>Appendix A: Appendix for Unicast Service Provisioning.</b>	<b>71</b>
<b>Appendix B: Appendix for Multi-rate Multicast Service Provisioning</b>	<b>81</b>

Resource Allocation in Decentralized Systems with  
Strategic Agents

An Implementation Theory Approach

Kakhbod, A.

2013, XVII, 88 p., Hardcover

ISBN: 978-1-4614-6318-4