# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>ix</td>
</tr>
<tr>
<td><strong>Chapter 1. Introduction</strong></td>
<td>1</td>
</tr>
<tr>
<td>1.1. Motivation</td>
<td>1</td>
</tr>
<tr>
<td>1.2. The problems</td>
<td>4</td>
</tr>
<tr>
<td>1.3. Summary of contributions</td>
<td>9</td>
</tr>
<tr>
<td>1.4. The organization of this book</td>
<td>11</td>
</tr>
<tr>
<td><strong>Chapter 2. Current Approaches for Resource Optimization and Security</strong></td>
<td>13</td>
</tr>
<tr>
<td>2.1. Service availability</td>
<td>14</td>
</tr>
<tr>
<td>2.2. Trustworthiness</td>
<td>16</td>
</tr>
<tr>
<td>2.3. Performance</td>
<td>18</td>
</tr>
<tr>
<td>2.4. The resource optimization problem subject</td>
<td>20</td>
</tr>
<tr>
<td>to an SLA</td>
<td></td>
</tr>
<tr>
<td>2.5. Public-key cryptography-based authentication</td>
<td>22</td>
</tr>
<tr>
<td><strong>Chapter 3. Single Class Customers</strong></td>
<td>27</td>
</tr>
<tr>
<td>3.1. The percentile of response time</td>
<td>28</td>
</tr>
<tr>
<td>3.2. A resource optimization problem for service models</td>
<td>29</td>
</tr>
<tr>
<td>with single-class customers</td>
<td></td>
</tr>
<tr>
<td>3.3. Approaches for the resource optimization</td>
<td>31</td>
</tr>
</tbody>
</table>
3.4. Numerical validations ........................................ 38
3.5. The balanced condition ..................................... 43
3.6. Services Performance Modeling and Analysis
          in a Simple Scenario of Cloud Computing ........... 49
          3.6.1. Overview ........................................ 50
          3.6.2. A computer service performance model .......... 54
          3.6.3. A numerical validation .......................... 62
          3.6.4. Discussions ........................................ 65
3.7. Concluding remarks ...................................... 66

Chapter 4. Multiple-Class Customers ............................. 69
          4.1. The SLA performance metric in the case of
               multiple class customers ............................. 70
          4.2. The resource optimization problem for multiple
               customer services ..................................... 71
               4.2.1. Resource optimization problem for multiple
                      class customers ..................................... 72
          4.3. Approaches for resource optimization ............... 72
               4.3.1. The LSTs of response time distributions for
                      two priority customers ............................. 72
               4.3.2. Algorithms for the resource optimization
                      problem ............................................. 77
          4.4. Numerical validations .................................. 86
          4.5. Concluding remarks .................................. 93

Chapter 5. A Trustworthy Service Model ......................... 95
          5.1. The trust-based resource optimization
               problem ............................................. 96
          5.2. A framework for solving the trust-based
               resource provisioning problem ....................... 99
          5.3. The calculation of SLA metrics ......................... 104
               5.3.1. The trustworthiness of resource sites ............ 104
               5.3.2. The percentile response time ..................... 108
               5.3.3. The service availability .......................... 110
          5.4. An approach for solving the trust-based
               resource provisioning problem ....................... 111
5.4.1. Single-class customers 112  
5.4.2. Multiple priority customers 120  
5.5. Numerical examples 130  
5.5.1. Single-class customers 130  
5.5.2. Multiple priority customers 134  
5.6. Concluding remarks 138  

Chapter 6. Performance Analysis of Public-Key Cryptography-Based Group Authentication 141  
6.1. Public-key cryptography-based authentication 142  
6.2. PKCROSS and PKTAPP 144  
6.2.1. Protocol analysis 145  
6.2.2. The calculation of the response time via queuing networks 150  
6.3. A new group authentication technique using public-key cryptography 156  
6.3.1. A single remote realm 156  
6.3.2. Multiple remote realms 161  
6.4. Performance evaluation of the new proposed technique 163  
6.4.1. The operations of encryption and decryption 163  
6.4.2. The calculation of the response time via a queuing network 167  
6.4.3. Discussions 170  
6.5. Concluding remarks 171  

Chapter 7. Summary and Future Work 173  
7.1. Research summary of the book 173  
7.2. Future research directions 176  

Bibliography 181  

Index 193