

Editors Paul Warren · John Davies · David Brown

# ICT Futures

Delivering Pervasive,  
Real-time and Secure Services



 WILEY

# Contents

<b>Editor Biographies</b>	<b>xiii</b>
<b>List of Contributors</b>	<b>xv</b>
<b>Foreword</b>	<b>xix</b>
<b>Introduction</b>	<b>xxi</b>
<b>Part One People and Technology</b>	
<b>1 Predicting the Socio-technical Future (and Other Myths)</b>	<b>3</b>
<i>Ben Anderson and Paul Stoneman</i>	
1.1 Introduction	3
1.2 Implicit Predictions	4
1.3 Socio-technical Futures	5
1.4 The Snooker Ball Model	6
1.5 The Conditional and Co-adaption Model	7
1.6 Feedback Mechanisms and the Evolutionary Model	11
1.7 Implications for Forward Thinking	13
Acknowledgements	14
References	14
<b>2 Social Networks, Social Computing and Knowledge Management</b>	<b>17</b>
<i>Nicholas J. Kings, John Davies, David Verrill, Sinan Aral, Erik Brynjolfsson and Marshall van Alstyne</i>	
2.1 Introduction	17
2.2 Do Social Networks Matter?	18
2.2.1 <i>Social Networks and Measuring Individual Information Worker Productivity</i>	19
2.3 Knowledge Management Applications	22
2.4 Future Research and Trends	24
References	25
<b>3 Device Futures</b>	<b>27</b>
<i>Jonathan Mitchener</i>	
3.1 Introduction	27
3.2 New Modes of Interaction	27

3.3	Device Component Trends	29
3.3.1	<i>Processors</i>	29
3.3.2	<i>Storage</i>	29
3.3.3	<i>Network Adaptors</i>	30
3.3.4	<i>Power Sources</i>	31
3.3.5	<i>Displays</i>	31
3.4	Broader Device Trends	31
3.4.1	<i>Co-operating Devices</i>	31
3.4.2	<i>Masking Device Complexity</i>	32
3.4.3	<i>Always-connected Devices</i>	33
3.5	Information Anywhere, Anytime	34
3.5.1	<i>The User Dimension</i>	34
3.5.2	<i>The Networked Device Perspective</i>	35
3.6	Ambient Information	35
3.7	Intelligent, Context-aware Interaction	36
3.8	Conclusion	37
	References	37

## **4. Online Trust and Customer Power: The Emergence of Customer Advocacy** **39**

*Glen L. Urban*

4.1	Introduction	39
4.2	What is Trust?	40
4.2.1	<i>Trust is More Than Privacy and Security</i>	40
4.2.2	<i>Site Design Affects Trust</i>	41
4.2.3	<i>Trust is a Process</i>	42
4.3	What to Do About Growing Customer Power?	42
4.4	New ICT Frontiers in Customer Advocacy	43
4.4.1	<i>My Auto Advocate</i>	44
4.4.2	<i>Customer Advocacy and Site Morphing to Match Cognitive Style</i>	47
4.4.3	<i>Cultural Morphing</i>	50
4.5	Future of Customer Advocacy	50
	References	51

## **Part Two Building the Infrastructure**

### **5 The Semantic Web – from Vision to Reality** **55**

*Paul Warren and John Davies*

5.1	Setting Out the Vision	55
5.2	Describing Semantics	56
5.3	Early Applications	58
5.4	Semantic Web Services	59
5.5	Semantic Web Technology in the Enterprise	61
5.5.1	<i>Semantic Data Integration</i>	61
5.5.2	<i>Knowledge Management and Business Intelligence</i>	62
5.6	The Next Steps for the Semantic Web	64
5.7	Conclusions	65
	References	65

### **6 Flexible ICT Infrastructure** **67**

*Mike Fisher and Paul McKee*

6.1	Introduction	67
-----	--------------	----

6.2	ICT in the Global Economy	68
6.3	ICT Resources	68
6.4	Distribution Transparencies – Hiding Complexity	70
6.5	Different Views of Infrastructure	71
6.6	Resource Virtualisation	72
6.7	Architectural Principles	73
6.8	SOI	74
6.9	Standardisation	75
6.10	Outstanding Challenges	76
6.11	Conclusion	76
	References	77
<b>7</b>	<b>Achieving Security in Enterprise IT</b>	<b>79</b>
	<i>Theo Dimitrakos and Ivan Djordjevic</i>	
7.1	Introduction	79
7.2	Concept	81
	7.2.1 <i>Overview of SOI-SSG</i>	81
	7.2.2 <i>Life-cycle Model</i>	82
	7.2.3 <i>Define Policies and Agreements</i>	83
	7.2.4 <i>Federate</i>	84
	7.2.5 <i>Virtualise</i>	85
	7.2.6 <i>Enforce</i>	86
	7.2.7 <i>Monitor</i>	86
	7.2.8 <i>Adapt</i>	87
7.3	Scenarios and Case Studies	88
	7.3.1 <i>Supply Chain: VO Management in Collaborative Engineering</i>	88
	7.3.2 <i>Entertainment Services: Online Gaming/Virtual Music Store</i>	89
	7.3.3 <i>Defence/Crisis Management</i>	90
7.4	Conclusion	91
	References	91
<b>8</b>	<b>The Future All Optical Network – Why We Need It and How We Get There</b>	<b>93</b>
	<i>David Payne</i>	
8.1	Introduction	93
8.2	Why Optical Networks?	94
	8.2.1 <i>Physics Considerations</i>	94
	8.2.2 <i>Commercial and Service Considerations</i>	95
	8.2.3 <i>Bandwidth Growth Scenario</i>	97
	8.2.4 <i>Burst-mode Operation</i>	97
8.3	FTTP Technology Options	99
	8.3.1 <i>Point-to-Point Fibre Solutions</i>	100
	8.3.2 <i>PONs</i>	101
8.4	Long-reach Access	101
	8.4.1 <i>Bandwidth Growth Cost</i>	101
	8.4.2 <i>A New Architectural Approach – Long-reach Access</i>	103
	8.4.3 <i>Future Evolution</i>	104
8.5	The Impact of FTTP on the Core Network	105
	8.5.1 <i>Core Traffic Growth</i>	105
	8.5.2 <i>Node Bypass</i>	106
	8.5.3 <i>Flat v Hierarchical Core Network</i>	107
	8.5.4 <i>Future Core Node Architecture</i>	108

8.6	Timeline for All Optical Networking	109
8.7	Conclusion	112
	Acknowledgements	112
	References	112
<b>9</b>	<b>End-to-End Service Level Agreements for Complex ICT Solutions</b>	<b>115</b>
	<i>John Wittgreffe, Mark Dames, Jon Clark and James McDonald</i>	
9.1	Introduction	115
9.2	Broadening the SLA Considerations	116
9.3	Application-level SLA	118
	9.3.1 Measures	118
	9.3.2 Overall Quality Scoring	119
	9.3.3 Reverse SLA Parameters	121
	9.3.4 Exceptions	121
	9.3.5 Business Rules	121
9.4	Transactional-level SLA	122
9.5	Requirements on Technology	123
9.6	An Example Solution	124
9.7	Longer Term – The Comprehensive Approach	126
9.8	Conclusions	126
	References	126
<b>10</b>	<b>Mobility and ICT</b>	<b>129</b>
	<i>Richard Dennis and Dave Wisely</i>	
10.1	Introduction	129
	10.1.1 Mobility – More Than Wireless Networks	129
10.2	Staircase to Success?	130
10.3	Key Challenges	130
10.4	Achieving the Foundations	131
	10.4.1 4G . . . 3G with a Turbo Charger?	132
	10.4.2 WiMAX as 4G	133
	10.4.3 4G Services	133
	10.4.4 Convergence as 4G	134
	10.4.5 Service Convergence	135
	10.4.6 Lifestyle Convergence	135
	10.4.7 4G Wireless and Mobile ICT?	135
10.5	Building Out of Connectivity	136
10.6	Authentication – Do You Have the Key?	136
10.7	Identification – Who or What Are You	137
	10.7.1 Multiple Identities	137
10.8	Entitlement – What Can I Allow?	137
10.9	Trust – How Do We Maintain This Relationship?	138
10.10	Design for Trust	138
10.11	Virtual Worlds and Second Earth	139
10.12	Heaven or Hell?	140
	References	140
<b>11</b>	<b>Pervasive Computing</b>	<b>143</b>
	<i>David Heatley, George Bilchev and Richard Tateson</i>	
11.1	Pervasive Information	143

11.2	Pervasive Sensing	144
	11.2.1 <i>Overview</i>	144
	11.2.2 <i>Challenges in Pervasive Sensing</i>	146
	11.2.3 <i>Pervasive Sensing Infrastructure</i>	146
	11.2.3.1 Physical Environment	146
	11.2.3.2 Gateway Environment	147
	11.2.3.3 Information Transport	147
	11.2.3.4 Information Processing	147
	11.2.3.5 Enterprise Integration	148
	11.2.3.6 Application Environment	148
11.3	Pervasive Intelligence	148
	11.3.1 <i>The Many Facets of Pervasive Intelligence</i>	148
	11.3.2 <i>Sensors Sharing Information to Coordinate Environments for Humans</i>	149
	11.3.3 <i>Wireless Devices Gossiping by Radio to Maintain and Adapt the Radio Network</i>	150
	11.3.4 <i>Information Shared to Ensure Services are Available to Users</i>	151
11.4	Closing Remarks	152
	References	152
<b>12</b>	<b>Artificial Intelligence Comes of Age</b>	<b>153</b>
	<i>Simon Thompson</i>	
12.1	Introduction	153
12.2	The AI Winter and AI Spring	155
12.3	Old Successes and New Failures?	156
12.4	Impact in BT: Heuristic Search and Constraint Satisfaction	157
12.5	Impact in BT: Fuzzy Logic and Data Analytics	158
12.6	The Wider Impact of AI	159
12.7	The Future	159
12.8	The Next Steps in AI	160
	References	161

## Part Three Applying Technology

<b>13</b>	<b>Healthcare</b>	<b>165</b>
	<i>Chris Wroe, Paul Garner and Janette Bennett</i>	
13.1	Introduction to the Healthcare IT Setting	165
13.2	Telemedicine, Telehealth, and Telecare	166
	13.2.1 <i>Telemedicine in Use</i>	167
	13.2.2 <i>Telehealth in Use</i>	168
	13.2.3 <i>Telecare in Use</i>	169
	13.2.4 <i>Pervasive Telecare</i>	170
13.3	Communication Technology and Advancing Practice	171
	13.3.1 <i>International Impact</i>	171
	13.3.2 <i>Career Advances</i>	171
	13.3.3 <i>Self-care Advances</i>	172
13.4	Information System in Healthcare: Advancing Care Delivery	172
	13.4.1 <i>Patient Record Systems</i>	172
	13.4.2 <i>Geographic Information Systems</i>	173
	13.4.3 <i>Clinical Decision Support Systems (CDSS)</i>	173
13.5	Standards	174

13.6	Healthcare Devices	176
	13.6.1 <i>Robotics in Care</i>	176
	13.6.2 <i>Robotics in Surgery</i>	177
13.7	Future Health IT – Pharmacogenomics and Personalised Medicine	177
13.8	Conclusion	178
	References	178
<b>14</b>	<b>Supply Chain Management in the Retail Sector</b>	<b>181</b>
	<i>Edgar E. Blanco and Chris Caplice</i>	
14.1	Introduction	181
14.2	Overview of SCM	182
14.3	Overview of Retail Supply Chain	183
	14.3.1 <i>Key Processes and Flows</i>	183
	14.3.2 <i>Fundamental Differences Between Retailers</i>	184
	14.3.2.1 Retail Channels	184
	14.3.2.2 Functional vs. Innovative Product Assortment	185
	14.3.2.3 Operational Performance Focus	185
14.4	Technology in the Retail Supply Chain	187
	14.4.1 <i>Technology Focus for Efficiency-centric Retailers</i>	187
	14.4.2 <i>Technology Focus for Customer-centric Retailers</i>	190
14.5	Summary	191
	References	191
<b>15</b>	<b>Technology Innovation in Global Financial Markets</b>	<b>193</b>
	<i>Lesley Gavin</i>	
15.1	Introduction to the Financial Services Sector	193
15.2	Key Technologies for the Sector	194
	15.2.1 <i>Collection of Data</i>	194
	15.2.2 <i>Storage of Data</i>	195
	15.2.3 <i>Processing of Data</i>	195
	15.2.4 <i>Display Technologies</i>	195
15.3	Key Issues for GFM	196
	15.3.1 <i>Regulation</i>	196
	15.3.2 <i>Automation</i>	197
	15.3.3 <i>Changing Work Environment</i>	198
15.4	Conclusion	199
	References	200
<b>16</b>	<b>Technology and Law: The Not So Odd Couple</b>	<b>201</b>
	<i>Marta Poblet, Pompeu Casanovas and Richard Benjamins</i>	
16.1	The Impact of Technology in the Legal Domain	201
16.2	ICT in Law Firms: Recent Trends	202
	16.2.1 <i>ICT Budgets</i>	202
	16.2.2 <i>Computing Technologies</i>	202
	16.2.3 <i>Online Research</i>	202
	16.2.4 <i>EDD</i>	204
	16.2.5 <i>Mobile and Web-based Communications</i>	204
	16.2.6 <i>XML Technologies</i>	205
16.3	E-justice and ODR	205
16.4	The Special Case of E-mail Management (EMM) in Law Firms	207
16.5	Future Trends: Towards the Legal Semantic Web?	208
	References	209

## **Part Four Final Words**

<b>17</b>	<b>Over the Horizon</b>	<b>215</b>
	<i>Ian Pearson</i>	
17.1	Social Change	215
17.2	Personal Needs	215
17.3	Lifestyle Change	216
17.4	Messaging	217
17.5	Anti-tech Backlash	218
17.6	Political Trends	218
17.7	Needs of Groups	219
17.8	Care Economy	220
17.9	Globalisation, Localisation	220
17.10	Virtual Business	221
17.11	IT Renaissance	221
17.12	Socially Integrated Companies	222
17.13	Urban Development	222
17.14	Simplicity	223
17.15	Storage Technology	223
17.16	Machine Consciousness	223
<b>18</b>	<b>Conclusions</b>	<b>227</b>
	<i>Paul Warren, John Davies and David Brown</i>	
18.1	Fundamental Trends	227
18.2	Delivering Services	227
18.3	Semantic Technologies	228
18.4	Ubiquity and Pervasiveness	230
18.5	Collaborating in an Open World	230
18.6	The Net as a Meeting Place	231
18.7	Security	232
18.8	ICT Trends – Prediction and Use	232
	References	233
<b>Index</b>		<b>235</b>