Index

Abstractness, 68
Accessibility, 67–8, 72
Active software, 42
Afferent coupling, 70

Battery Directive, 299, 312
Bill of Materials, 253
Blade servers, 88
BMS, 97
BRE Environmental Assessment Method (BREEAM), 306, 308
Business continuity, 244–5
Business drivers of Green IT, 153–6
Business process
  Environmental performance assessment, 266–8
  Fragment, 269
  Improvement, 268–70
Business value, 185, 220–221

Caching, 49
Capability Maturity Framework (CMF), 182–5
Carbon Disclosure Project (CDP), 315
Carbon Emission Management System, 156
Carbon footprint, 212, 366
  of a project, 73
Carbon Reduction Commitment (CRC), 305, 311
Chargeback model, 177–8
Chlorofluorocarbons (CFCs), 28
CIO, CTO, IT Manager, 283
  Innovations, 283
  Impact, 283
Circular economy, 260
Cloud computing, 318–22
  Deployment models, 321–2
  Hybrid, 322
  Private, 321
  Public, 321
  Energy efficiency, 327–31
  Energy usage model, 323
  Environmental sustainability, 317
  Virtualization, 325, 327
Cloud storage, 122
Communication, 294
Commute greener, 175
Computational efficiency, 42–4
  Efficient algorithms, 42–3
  Multithreading, 43–4
  Vectorization, 44
Constrained optimization challenge, 134
Consumer Electronics Association (CEA), 305
Context awareness, 49–52
  Platform power policies, 51
Continuous Risk Management, 293–4
Corporate Social Responsibility (CSR), 182, 216
Corporate Social Responsibility (CSR) (continued)
Green IT dimensions, 217
SITS dimensions, 217
Corporate sustainability, 216
Cost management, 244, 251–2, 255
Cost reduction, 244, 246
Cost savings, 212–13, 225–6
CRAC, 95
CRAH, 96
Cross-layer utilization and redundancy, 138
C-States, 40–41
CUE, 107
Customer value, 220

Data Centre, 256, 325, 329
Consolidation, 101
IT infrastructure, 87–92
IT infrastructure management, 98
Networking, 89
Server power management, 99–106
Servers, 87–9
Storage, 89–90
Virtualization, 104

Data Centre facility
AC power, 94
Cold aisles, 95
Cooling, 95
DC power, 94
Hot aisles, 95
Implications for efficiency, 92
Infrastructure, 92
Infrastructure management, 97
Power distribution unit, 93
Power system, 92
Thermal map, 105

Data Centre metrics, 176–8
Carbon Usage Effectiveness (CUE), 177
Data Center computer Efficiency (DCcE), 177
Data Center energy Productivity (DCeP), 177
Data Center infrastructure Effectiveness (DiCE), 176

Energy Reuse Effectiveness (ERE), 177
Power Usage Effectiveness (PUE), 176

Data efficiency, 45–9
Managing disk I/O, 45–8
Pre-fetching and caching, 49

Data storage, 113–25
DBpedia, 352–4
DCiE, 106
DCIM, 97
Decision Support Systems (DSS), 248–9
Demanufacturing, 258–61
Department of Energy, 306, 309, 311
Dependability, 67–8, 71
Design for Environment (DFE), 244, 246–7, 249–50, 256, 258

Device design, 25
Device life cycle, 24–6
Digital revolution, 23
Disassembly, 258–60
Disk I/O, 45
Dublin City Council, 181

Eco-Industrial Park, 259–60
Eco-Label (Flower Label), 304
Eco-sustainability, 202
EERAID, 120
Efferent coupling, 70
Efficiency, 67–8, 73
Electronic Commerce (E-Commerce), 244, 258–61
Electronic Industries Alliance (EIA), 305
Electronic Product Environmental Assessment Tool (EPEAT)
see EPEAT
Electronic revolution, 23
EMAN, 140
Energy, 244, 247–8, 252, 255–7
Costs, 244
Flow, 250, 253–4
Savings, 256, 262
Use, 244, 246, 248, 250, 252–4, 256
Energy Checker, 58–9
Energy efficiency, 212, 220–221, 225–7, 229
   Data Centre, 176–8
Energy efficient network, 129
Energy efficient network communication, 143
Energy Star, 29, 211, 298, 303, 305–7, 313
Enterprise architecture, 286–8
   Artifacts, 286
   Definition, 286
   Framework, 286
Enterprise architecture planning, 286–8
Enterprise Ecosystem,
   Change propagation, 273–5
   Definition, 270–272
   Equilibrium, 272
   Impact analysis, 272
   Perturbation, see equilibrium
   Trade-off analysis, 275–6
Enterprise Resource Planning (ERP), 250, 252–5
Environmental concerns, 3
Environmental impact of software, 63
Environmental impacts, 1, 4, 63
Environmental Management Systems (EMS), 244, 246, 252
Environmental Protection Agency (EPA), 28, 176, 174, 211, 302, 307
Environmental sustainability, 341, 344–6
EPEAT, 26, 256–7, 299, 305–7, 313
E-readiness, 201
EU Code of Conduct on Data Centres, 306, 309
EUP, 299, 303
e-waste, 24, 34–6, 63
   Disposal techniques, 35–6
   Recycle, 35
Executive Support Systems (ESS), 248–9
Extended Enterprise, 256
Flower Label, 298, 304
GeSI, 298, 305–8, 312–13
GHG Protocol, 310–315
Global e-Sustainability Initiative (GeSI), see GeSI
Global warming, 2–3
G-Readiness, 202–7
Green audit, 375
Green awareness, 365–7
Green BPM, 265
Green Cloud, 315, 332–4
   Architecture, 332–4
   Data centre efficiency, 326
   Dynamic provisioning, 326
   Enabling features, 325
   Multi-tenancy, 326
   Server utilization, 326
Green communications, 127–47
Green computing, 283
   Definition, 283
   Implementation, 288–9
Green Data Centre, 85–111, 367
   Energy Challenges, 85–6
   Metrics, 106–8
   see Data centre, Data centre facility
Green data storage, 113–25
   Hierarchical storage management, 121
   Power-aware data layout, 120
   System level energy management, 119–24
Green devices, 23, 367
Green engineering, 367
Green enterprise, 150–151, 243–62, 372–3
Green for IT, 168, 173
Green Grid, 176, 306, 309
Green hardware, 23, 367
Green IS, 168, 190
Green IT, 2, 5–7, 24, 167, 212, 297–300, 303–7, 309–14
   Adoption models, 201
   Attitude, 203
   Capability, 202
   Definition, 199
   Description, 2, 5–7
Green IT (continued)
Dimensions, 5
Direct effects, 297–8, 305, 312
Enabling effects, 297–8, 303, 306, 313
Objectives, 212
Policy, 204
Practice, 205
Primary drivers, 212
Products, services, and technologies, 229–31
Technology, 205
Value dimensions, 221
Green IT 1.0, 7
Green IT 2.0, 7
Green IT readiness, 202–7
Assessment, 206–7
Calculating Index, 207
Components, 202–4
Definition, 203
Nomological structure, 203
Propositions, 204–5
Green IT research, 376–7
Green IT strategy, 149, 375–6
Approaches, 151
Business dimensions, 156
Business drivers, 153
Development, 161
Evolving strategies, 152
Organizational considerations, 160
Green IT transformation, 156
Green IT trends, 366–7
Green Networks, 127–47
Components, 132
Objectives, 131
Protocols, 132–40
Protocol design, 133
Standards, 140
Green packaging, 28
Green Sigma, 65–6
Green software, 13, 39–61
Green supply chain, 371
Green transparency, 366
Green use of computers, 29–34
Green washing, 17
Greenhouse Gas (GHG), 3, 297–9, 303–13
Greenhouse gas (GHG) emissions, 245, 249, 297
Greenhouse Gas Protocol (GHG Protocol), 172–3, 179, 298, 311
Greening by IT, 368–73
Technology enablers, 368
Greening IT
Green Data Centre, 10
Green Data Storage, 12
Green Networking and Communications, 13
Green PC, 10
Green Software, 13
Holistic approach, 7
Opportunity, 17
Standards, 15
Greenpeace, 298, 301, 308–11, 313
Guide to Greener Electronics, 309
Guidelines for IT managers
SITS transition, 238
Hard disk, 115–16
Caching, 118–19
Dynamic RPM, 119
Energy management techniques, 118–19
Hardware life cycle, 65
Hazardous materials, 26–7
Effect on humans, 27
Hazardous Waste, 245, 249–50, 253–4, 257
Hibernator, 120
Idle efficiency, 52–5
Background activity, 55
Deep C-state residency, 53–4
Idle software, 42
Information assurance, 292
Definition, 292
Information Management for Environmental Sustainability, 344
Innovation Value Institute, 182
Instability, 68
Intangible value, 223
International Standards Organization (ISO), 305, 307
ISO standards, 307
Inter-Organizational Systems, 243–4, 256, 262
Inventory Management, 244, 246–7, 249, 253
ISO 14000, 246, 251, 257
IT for Environmental Sustainability, 14
IT for Green, 168
IT Infrastructure, 199
   Capabilities, 200–201
   Definition, 199
   Human, 200
   Managerial, 200
   Technical, 200
IT’s environmental impact, 4
Kyoto protocol, 3

Leadership and best practices, 233
Leadership in Energy and Environmental Design (LEED), 306, 308–9
Learnability, 72
Legal requirements, 154
Life Cycle Analysis, 244, 249–50, 253–4, 342, 359
Life Cycle Assessment (LCA), 173–5, 244, 249–250, 253–4
   Goal and scope definition, 173
   Impact assessment, 174
   Interpretation, 174
   Inventory analysis, 173
   ISO 14040, 173
   ISO 14044, 173
Linking Open Data, 361
Logistics, 243–6, 249, 252–3

MAID, 114
Market segments, 229
Materials management, 245, 247–8, 252–4, 256–9
Materials Requirement Planning (MRP), 252–3, 259
MediaWiki, 346–8
Metcalfe’s Law, 361
Metrics, sustainable software, 68, 70
   Collecting, 73
   Tools, 74
Minimising power consumption, storage, 29–34
   Defragmenting, 31
   Hibernate, 31
   Standby mode, 31
   Under clocking, 31
Modifiability, 67–8
Multilevel Sustainable Information, 168–9
OCED Green IT Framework, 6
Open data, 361
Organizational Capability, 202
   Input, 202
   Transformational, 202
   Output, 202
Organizational changes, 232

Performance states, 40
   see P-states, 41
Platform analysis, 76
Political pressure, 155
Portability, 67–8, 70
Portability
Power characteristics, storage, 115–19
   Hard disks, 115–16
   Magnetic tapes, 117
   Solid-state drives, 117–18
Power Informer, 58
Power states, 40
   see C-states, 40–41
Power Usage Effectiveness (PUE), 106, 306, 308–9
Predictability, 67–8, 72
Pre-fetching, 49
Processes, sustainable, 226
Processor power states, 40–41
Product design, sustainable, 226
P-States, 41

Quality attributes, 66
Quality of service, 317

Race to idle, 42
RAID, 120
Read-ahead buffering, 41, 49
Recycling, 245–7, 254, 256–61
Registration, Evaluation and Authorisation of Chemicals (REACH) Regulation, 299, 301–2, 313
Regulatory requirements, 154
Remanufacturing, 245, 259–60
Resiliency, 244–6
Restriction of Hazardous Substances (RoHS) Directive, 253, 257, 299
see RoHS
Return on Investment, 289–90
Reusability, 67–8
Reuse, 246–7, 254, 257–9
Reverse logistics, 247–8, 258
RFID, 368
Risk Management, 292–4
Characteristics, 293
Objectives, 292
RoHS, 26, 65, 298–303, 253, 257, 312–13

Semantic mediawiki, 348–50
Semantic Web, 351–3
Server Virtualization, 104
Service science, 229
Service-dominant logic, 219
Operand resources, 223
Operant resources, 223
Value-in-exchange, 220, 222–3
Value in use, 220, 222–3
Six Sigma, 66
Lean Six Sigma, 65
Sleep states, 40
see C-states, 40–41

Smart buildings and homes, 371
Smart Grid, 175, 369–70
Social issues, 64
Social media, 294–5
Societal value, 220–222
Socio culture pressure, 155
Software energy efficiency, 39
Software energy saving techniques, 41–55
Computational efficiency, 42
Context awareness, 49
Data efficiency, 45
Idle efficiency, 52
Platform policy, 51
SPARQL, 350
SSD, 117
Stakeholders, 212, 214
Engagement and collaboration, 226–7
State transitioning, 116, 118
Storage media, 113–15
Storage Networking Industry Association (SNIA), 305
Storage virtualization, 122
Strategic development, 285
Strategic implementation, 286
Strategic plan, 285
Strategic planning, 261, 285
Strategic social responsibility, 224–6
Strategic thinking, 284
Goal, 285
Strategy integration, 228
Supply Chain, 243–8, 256–61
Supportability, 67–8, 71
Sustainability Frameworks, 170–171
Ecological Footprint, 171
Natural Capitalism, 170–171
Natural Step, 171
Triple Bottom Line (TBL), 171
Sustainability Principles, 171–2
Earth Charter, 172
Reduce, Reuse, Recycle (3R’s), 172
Sustainability Reporting, 248–9, 252, 255
Sustainability strategy, 178–80, 186
Sustainability, 64
Sustainable development, 3–4
Sustainable IT, 212
Corporate sustainability, alignment with, 219
Construct for green IT and SITS, 212
Driving forces, 214
Roadmap, strategic planning, 229–31
Strategy migration, 227
Sustainability dimensions of IT, 213–16
Sustainable IT maturity, 182–9
   Capability building blocks, 186–7
   Goal and scope, 173
   Governance, 186
   Maturity curve, 185–6
   People and culture, 186
   Process management, 186
   Strategy and planning, 186
Sustainable IT services (SITS), 219
   Defined, 219
   Innovation platform, 226
   Second wave of sustainable IT, 212
   Service innovation, 212
   Standards and reporting, 231
   Strategic framework, 224
   Value curve, 225
   Value dimensions, 221
Sustainable software, 65
   Attributes, 66
   Case study, 78
Metrics, 68, 70
   Sustainable software system, 66
Telecommuting, 367
Testing effectiveness, 71
Testing efficiency, 71
The Green Grid, 176, 306, 309
Transaction Processing, 248–9
Usability, 67–8, 71
Value Chain, 245–58
Vectorization, 44
Virtualization, 104
Wake on LAN (WOL), 32
Warehousing, 244, 246–7
Waste Exchange, 261
Waste Management, 245, 248, 252, 254, 258–61
   WEEE 299, 302–3, 312–13
Wireless networks, 131
World Wildlife Foundation (WWF), 298, 305, 308
WUE, 107