

# Index

## A

actions 188  
 adaptability 22, 39, 140  
 ALFT 163  
 algorithm of mutual suspicion 199  
 ARGUS 168  
 Ariane 5 disaster 65  
 Ariane 5 Flight 501 28  
 Ariel 41, 45, 82, 167, 172, 193, 204,  
     205, 207, 208, 209, 210, 211,  
     212, 214, 215, 217, 219, 220,  
     221, 222, 223, 231, 232, 235,  
     296, 297  
 aspect-compliant programming languages  
     242  
 aspect-oriented programming 243, 244  
 aspect-oriented programming (AOP) 243  
 AspectC++ 246, 248  
 AspectJ 244, 245, 246, 249  
 aspect orientation 242–249  
 aspect oriented programming 165  
 aspect programs 243  
 asynchronous system model 25, 26

attribute grammars 170  
 availability 5

## B

Backbone 126, 179, 180, 187, 188,  
     189, 194, 195, 197, 198, 199,  
     200, 201, 203, 205, 208, 209,  
     210, 216, 223, 228, 229, 232,  
     233, 234, 237, 241, 250, 259,  
     271  
 backward recovery 14  
 basic services library 179  
 basic tools 179

## C

C-Linda 140  
 checkpoint 51, 52, 160  
 checkpointing and rollback (CR) 58  
 commercial-off-the-shelf, & nodes 176  
 ComposeJ 163  
 compositional filters 163  
 composition filter 165  
 computational reflection 138

computer system, trustworthiness 1  
 concurrency 50, 147, 172, 249, 253  
 concurrent execution 139  
 configuration language, custom 180  
 consensus 49, 65, 74, 131, 239, 272, 273, 282  
 consensus recovery blocks 185  
 conventional programming language 243  
 correlate object-oriented language 168  
 Cygwin tools 142

## D

data hiding 136  
 de-multiplexing 183  
 dependability iii, x, xviii, xix, xxii, 1–20, 23, 50, 69, 129, 238, 272  
 dependability, attributes of 3  
 dependability, impairments to 6  
 dependability, means for 12  
 dependability tree 3  
 dependable parallel services 277  
 dependable parallel software 276  
 dependence among systems 23–52  
 design by contract 245  
 design concern 81, 85  
 DIR net 55, 56, 57, 79, 80, 82, 179, 228, 250, 259, 260, 261, 263, 265, 266, 267, 269, 270, 271, 311, 312, 315, 316, 317, 320  
 distributed voting mechanism 56, 282, 285  
 Dtool 312  
 dual processors 177  
 dynamic weaving 246

## E

EFTOS 55  
 EFTOS voting farm 68  
 encapsulation 136  
 error detection 13  
 error diagnosis 13  
 error notifications 279  
 error recovery 13, 172, 190, 280  
 expressiveness 271, 277

## F

failure, early timing 7  
 failure, performance 7  
 failure detection 250, 250–274, 252  
 failure detection protocols 252  
 failure detectors 251, 252, 271  
 failure domain 9  
 failure notifications 166  
 fault-tolerance 1, 161  
 fault-tolerance groups 12  
 fault-tolerance method 13  
 fault-tolerance provisions 275  
 fault-tolerance toolset 178  
 fault-tolerance toolset, adoption of 179  
 fault-tolerant program 22  
 fault-tolerant software 21–52  
 fault-tolerant system 27  
 fault forecasting 13  
 Fault model 23–52  
 fault model 23, 225  
 fault prevention 12  
 fault removal 12  
 faults 10  
 faults, design 11  
 faults, interaction 12  
 faults, physical 11  
 feedback loops 144  
 filter types 164  
 FOG 169  
 FT-SR 165  
 functional language 161

## G

generative communication 277  
 GluonJ 136, 246, 247  
 GUARDS 178, 282

## H

HATS system 57  
 heartbeat 181, 253, 272  
 heartbeat method 182  
 hybrid language 161

**I**

input cache 184  
 inter-process communication 178  
 introspection 134, 135, 136

**J**

Javassist 135, 136, 158, 247  
 Java Virtual Machine 245

**L**

Lex 152, 158  
 Libckpt 59  
 LINDA 108, 116, 139, 318

**M**

maintainability 6  
 maintenance costs 247  
 Mariner 1 30  
 Markov model 302  
 Markov reliability model 303, 304, 307, 324  
 mean time to failure (MTTF) 4  
 mean time to repair (MTTR) 5  
 meta-object protocols 134, 137, 138  
 MetaC++ 136  
 multiple-version protocols 53  
 multiple-version software fault-tolerance 60  
 MVSFT 125, 282

**N**

N-version programming 53, 57, 61, 65, 105, 211, 270, 282  
 N-Version Programming (NVP) 64  
 NMR 69, 70, 76, 214, 282, 303  
 nodes 176  
 N Self-Checking Programming 65

**O**

object-oriented language 161  
 OpenC++ 135  
 output program 243  
 overshooting 28  
 Oz case 161, 171

**P**

parallel computing 107  
 parallelism 140  
 parallel processing 138, 140, 170  
 partially synchronous system model 26  
 performance failure 7  
 persistent object stores 282  
 Porch 141  
 POSIX standards 55  
 programming language 161  
 programming languages 252  
 Project FRIENDS 135  
 PvmLinda 127, 140

**R**

RAFTNET 106, 107, 116, 117, 121, 124, 127, 282  
 Raynal, Michael 251  
 reconfiguration 231  
 recovery blocks 61, 64, 65, 170  
 recovery language 79, 104, 106, 172, 175, 186, 187, 190, 191, 193, 195, 204, 210, 225, 234, 235, 275, 276, 277, 282, 294, 296  
 recovery language approach 175–241, 277  
 recovery languages 186  
 redoing 170  
 redundancy 15, 127, 159, 282, 309  
 redundant data structures 151  
 redundant variables 133, 143, 145, 155  
 reflection 134, 158  
 reflective variables 133, 141  
 refractive variables 133, 141  
 reliability 4, 49, 50, 51, 65, 115, 127, 128, 130, 131, 236, 238, 239, 272, 273, 302, 307, 321  
 reliability analysis 65, 321  
 replicated decomposition 170  
 replication 170  
 restartability 167  
 retry blocks 170, 181, 184, 211, 215  
 rollback 22, 39, 45, 46, 47, 54, 57, 58, 59, 126, 140, 141, 169, 171, 282

R&L 175, 176, 178, 179, 180, 183, 186, 189, 190, 191, 192, 196, 200, 202, 205, 223, 273, 275, 276, 281, 283, 289, 290, 291, 294, 297

ReLinda approach 277

## S

safety 6, 31, 32, 50, 129, 240  
 scrambler 305, 308, 310, 311, 312  
 security 126  
 self-checking 177  
 separation of concerns 171  
 separation of design concerns 22, 271  
 signature checking 177  
 single-version protocols 53  
 single-version software fault-tolerance 54  
 software fault-tolerance 53, 54, 60, 184, 211  
 spares 302  
 stateless systems 9  
 SWIFT 57  
 synchronous model 24  
 synchronous notification 166  
 syntactical adequacy 22  
 system failure 7  
 System model 23  
 system model 23, 226  
 system structures 275

## T

Therac-25 accidents 32  
 time-free system model 251  
 time-out 194, 195, 202, 203, 210, 262, 265, 267, 268

time-out management system 254  
 timed asynchronous distributed system model 177, 278  
 TIRAN 180  
 TIRAN Backbone 195, 197, 198, 199, 200, 203, 208, 210, 228, 250  
 translations 139  
 translator 180  
 translucent 161, 171, 172  
 transparency 298  
 tuple space manager 116, 279, 280, 281  
 tuple Sspace 158, 299

## U

undershooting 28  
 unreliability 4

## V

voting 68, 69, 71, 72, 73, 74, 76, 77, 78, 79, 81, 97, 107, 124, 127, 131, 179, 279, 282, 283, 285, 286, 287, 301, 302  
 voting farm 56  
 voting procedure 183

## W

watchdog timer 79, 81  
 watchdog timers 179, 181  
 weaver 243  
 weaving 246, 249

## Y

YACC 152, 158, 238, 240