

Index

Symbols

3G networks 146, 148, 185
 3GPP 1, 2, 4, 5, 6, 7, 9, 10, 12, 18, 43, 50, 57, 60, 62, 77, 81, 82, 83, 84, 85, 86, 87, 88, 90, 91, 92, 93, 95, 96, 98, 101, 106, 123, 157, 159, 184, 186, 361, 362, 363, 364, 365, 373, 374, 375, 383, 405, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 423, 424, 426, 435, 436, 437, 438, 441, 444, 447, 448, 450
 3GPP2 1, 5, 6, 7, 12, 18, 57, 61, 76, 83, 88, 424, 426, 435, 438, 439, 447, 448
 3G system 2, 4, 12, 16, 17
 4G network 1, 10, 12, 13, 16, 17, 46, 48, 49, 57, 125, 126, 127, 128, 129, 131, 132, 143, 193, 194, 195, 199, 200, 212, 214, 219, 220, 221, 222
 4G nodes 194, 195
 4G readiness 181, 182, 183, 186, 187, 188, 190, 191
 4G receiver 627
 4G standards 149, 159, 181

A

access gateway function (AGWF) 91, 96
 adaptive antenna systems (AAS) 293
 adaptive modulation 152
 ad hoc network 316, 339, 459, 461, 462, 463, 494, 507, 509, 516
 ad-hoc on-demand distance vector (AODV) 197, 198, 225, 240, 241
 adjacent layers 454, 455, 456, 522
 advertisement, discovery and association (ADA) 21, 27, 32, 37, 38, 39

all-IP network (AIPN) 12, 21, 23, 46, 47, 48, 49, 50, 51, 53, 56, 57, 58, 59, 77, 81, 96, 314, 315, 317, 328, 350, 354, 356, 361
 amplify-and-forward 684, 708
 antenna beamwidths 254, 264
 ant model 202, 203, 221
 application controller 469, 472, 481, 482, 487, 488, 489
 application server layer (ASL) 92, 96
 ARPANET 195, 225
 assured forwarding (AF) 378

B

base-station backhaul 278
 BCJR algorithm 625, 626
 beam forming 152
 betweenness 205, 206, 207
 beyond-third generation (B3G) 270, 276, 277, 281, 282, 283
 bicasting 424, 426, 433, 440, 441, 442, 443, 444, 445, 446, 447, 449
 bicasting handover 424, 426, 441, 442, 447, 449
 bicasting threshold 424, 442, 443, 444, 445, 447
 birefringence 275
 bit error rate (BER) 281, 425, 428, 429, 531, 547, 548, 549, 565, 567, 568, 570, 572, 576, 577, 578, 579, 582, 584, 585, 586, 589, 590, 591, 592, 593
 Block Spread OFDM (BSOFDM) 582–595
 boarder gateway protocol (BGP) 64
 border gateway control function (BGCF) 89, 91, 96
 border gateway protocol (BGP) 197, 212, 221

boresight 253, 254, 255, 256, 257, 259, 262
 bottom-up approach 456
 broadcastcatching 494, 499, 515
 Bubble 194, 195, 206, 207, 224

C

call session control function (CSCF) 89, 90, 91, 96, 97
 care-of address (CoA) 129
 carrier to interference plus noise ratio (CINR) 251, 252, 257, 258, 259, 260, 261, 264
 carrier to noise ratio (CNR) 251, 252, 254
 Catenet 127, 143
 cell search 526, 527, 535, 544, 560, 563
 central processing unit (CPU) 65
 channel allocation 2, 11, 46, 57
 channel coding 684, 691, 693, 695, 698, 705
 channel equalization 594
 channel estimation 526, 527, 531, 544, 545, 546, 560, 562, 563
 channel quality indicator (CQI) 315, 319, 322, 331, 353, 355, 357
 circuit-switched (CS) 74, 81, 87, 96
 ClearCurve 274, 284
 cochannel cells 256, 257, 259, 261
 CODEC 3
 code division multiple access (CDMA) 2, 5, 6, 12, 14, 57, 61, 62, 64, 69, 75, 76, 83, 88, 96, 104, 105, 123, 149, 151, 152, 155, 156, 157, 158, 164, 176, 178, 184, 185, 529, 565, 566, 567, 568, 569, 570, 571, 572, 574, 576, 578, 579, 581, 583, 584, 585
 coexistence 222, 249, 251, 252, 258, 259, 261, 262, 264, 265
 common open policy service (COPS) 64, 89, 96
 complementary metal oxide semiconductor (CMOS) 160
 configured tunnels 79
 consumer-centric business model (CBM) 20, 22, 23, 24, 25, 26, 27, 28, 31, 32, 37, 39, 40, 44
 consumer identity module (CIM) 26, 41, 44
 cooperative groups 229, 235, 236, 243, 245
 cooperative network 228

cross layer 494, 496, 497, 498, 504, 505, 506, 508, 509, 510, 511, 512, 515, 516, 522
 cross layer approaches 46
 cross layer design 377, 400, 453, 454, 455, 457, 459, 460, 461, 463, 464, 466, 467, 469, 472, 473, 479, 490
 cross layer optimization 313, 321
 cumulative distribution function (CDF) 254, 261

D

decode-and-forward 684, 685, 706
 deep packet inspection (DPI) 83, 96
 default bearer 85
 delay tolerant networks (DTN) 201, 212, 223
 destination-sequence distance-vector (DSDV) 197, 198, 225
 differentiated services (DiffServ) 364, 369, 370, 371, 374, 378, 387, 389, 390, 394, 395, 402
 digital multimedia broadcasting (DMB) 270
 disruptive networks 199
 distance vector 197, 198, 225
 distance vector multicast routing protocol (DVMRP) 197
 distributed-antenna system (DAS) 268, 276, 278, 279, 283
 downlink 12, 13, 14, 15, 19, 57, 231, 251, 256, 257, 258, 261, 262, 264, 267
 duplex mode 12
 dynamic home agent discovery (DHAD) 87, 96
 dynamic networks 194, 199
 dynamic source routing (DSR) 198, 224, 240

E

edge of coverage (EOC) 254, 259, 261, 264
 electro-optic modulators (EOM) 272
 end-to-end delay 77, 108, 110
 enhanced data rates for GSM evolution (EDGE) 362, 363
 equilibrium 214, 242, 243, 244, 245
 Erbium-doped fibre based amplifiers (EDFA) 274
 error correction codes 624

European Telecommunications Standards Institute (ETSI) 2, 4, 5, 23, 40, 43
evolved packet core 362
evolved packet system (EPS) 62, 84, 85, 86, 354, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 374
expedited forwarding (EF) 377
extended addressing 77
extended packet core (EPC) 62, 81, 82, 83, 84, 95, 96

F

fading channel 684, 705, 706, 708
fast binding update (FBU) 407
fast handover for mobile IP (FMIP) 407
fast neighbor advertisement (FNA) 407
fiber-to-the-home (FTTH) 184, 281, 282, 283, 284, 285, 286, 287
forward error correction (FEC) 149
frame error rate (FER) 69
free space path loss (FSPL) 255
frequency division duplex (FDD) 6, 8, 9, 12, 15
frequency division multiple access (FDMA) 149, 152, 155, 176
frequency estimation 533
frequency-selective fading 315

G

game theory 316, 339, 340, 342
geodesic paths 205
geographical information systems (GIS) 153
GGSN 84, 94, 96
globalizing 1
global mobility 405, 406, 422
global mobility management 406
global positioning systems (GPS) 153, 154, 157
global system for mobile communications (GSM) 2, 3, 4, 5, 6, 9, 15, 17, 42, 47, 48, 49, 58, 362, 363, 365, 370
GPRS 2, 3, 4, 11, 16, 47
GPRS tunneling protocol (GTP) 84, 85, 96
graph theory 205, 206
group communication 230, 246
group velocity dispersion (GVD) 275, 276

H

Hadamard matrix 583, 585, 586, 590, 591, 593
half duplex constraint 686
handoff latency 46, 49, 53, 55
handover 67, 82, 100, 102, 103, 106, 107, 108, 109, 110, 113, 116, 117, 118, 119, 121
handover delay 382, 409, 424, 425, 426, 434, 440, 441, 447, 448
handover initiate (HI) 407
hard detection 644, 645, 646, 653
heterogeneous networks 381, 405, 429, 434, 449, 450
hierarchical cellular network 46, 53
high altitude platforms (HAPs) 249, 250, 251, 252, 255, 261, 262, 263, 264, 265, 266, 267
high handoff 46
high speed downlink packet access (HSDPA) 133, 134, 136, 138, 140, 146, 148, 152, 158, 188, 494, 497, 498, 499, 516
high speed uplink packet access (HSUPA) 146, 148, 158, 188
home agent 378, 380, 381, 406, 409, 420, 421, 430, 431
home location register (HLR) 63
Home Subscriber Server (HSS) 63, 82, 85, 89, 90, 91, 94, 96
horizontal handover 425, 426
host mobility 406, 409, 423
hybrid-fibre coaxial (HFC) 270, 284
hybrid fibre-radio (HFR) 270
hybrid protocols 201
hybrid system 17
hybrid wireless network (HWN) 101, 102, 103, 104

I

IEEE 802.16 standard 4, 7, 8, 9, 14, 15, 16, 51, 62, 292, 293, 308, 311, 312, 320, 344, 347, 353, 354, 356
integrated services (IntServ) 378, 389, 395
inter-call server 87
interleaver 622, 623, 624, 625, 626, 627, 633, 634, 635, 636, 639, 640, 647, 651, 652, 656

intersymbol interference (ISI) 315, 567, 570, 578
 intra-call server 87
 IP multimedia subsystem (IMS) 81, 86, 88, 89, 90, 91, 92, 93, 94, 95, 96, 98, 99
 IP protocol 86
 IP-triggered resource allocation strategy (ITRAS) 46, 56, 57, 58, 59
 IPv4 128
 IPv6 76, 77, 78, 79, 80, 81, 83, 84, 85, 86, 87, 88, 89, 92, 95, 96, 97, 98, 99, 128
 IPv6 versus IPv4 78, 80
 iterative receiver 647, 651

L

label switch paths (LSPs) 67, 71
 lattice decoding 644, 645, 650
 lightweight mobile routing (LMR) 198, 223
 line-of-sight (LOS) 250, 255, 292
 link layer 382, 387, 388, 396, 405, 407, 424, 426, 432, 433, 434, 435, 437, 438, 439, 440, 441, 447, 448
 link-state 197, 238
 list detection 653, 656, 663, 664
 localized mobility 405, 408, 409
 location association server (LAS) 461
 location based services (LBS) 186
 long term evolution (LTE) 1, 2, 7, 9, 10, 12, 46, 47, 49, 50, 51, 53, 59, 61, 62, 76, 77, 78, 81, 82, 83, 84, 85, 87, 90, 95, 96, 97, 98, 99, 101, 157, 181, 182, 183, 184, 185, 186, 187, 188, 189, 192, 194, 219, 266, 292, 313, 314, 315, 316, 317, 320, 323, 353, 354, 355, 356, 362, 373, 375, 383, 405, 411, 412, 413, 419, 420, 423, 424, 426, 435, 436, 437, 438, 441, 447, 450, 453, 464, 465, 466, 469, 495, 497, 499, 517, 518
 low-earth-orbit (LEO) satellite 250
 LTE-A 77, 96

M

macrocells 46, 52, 53
 m-algorithm 646, 651, 653, 654, 657, 658
 MAP algorithm 623, 625, 626, 627, 629, 636, 639

maritime communications 292, 308, 310
 maximum ratio combining 548
 mean opinion score (MOS) 130, 131, 139, 141
 media access control (MAC) 292, 293, 294, 295, 299, 300, 301, 305, 308, 310, 311, 314, 316, 318, 319, 320, 321, 327, 331, 353, 354, 355, 356, 369
 media gateway control function (MGCF) 89, 91, 97
 media gateway controller protocol (MGCP) 64
 media gateway (MGW) 63, 87, 89, 91, 97
 media resource function controller (MRFC) 91, 97
 media resource function (MRF) 91, 97
 media resource function processor (MRFP) 89, 91, 97
 medium access 668, 672
 medium access control 474
 megabits per second (MBPS) 4, 15
 mesh network 292, 293, 294, 295, 296, 298, 304, 305, 308, 309, 310, 311
 microcells 13, 46, 52, 53
 middleware 497, 509, 512, 522
 mobile ad hoc wireless network (MANET) 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 113, 114, 117, 118, 119, 120, 121, 122, 123
 mobile IP 127, 128, 131, 134, 135, 144, 173
 Mobile IPv6 (MIPv6) 403, 405, 406, 407, 408, 409, 420, 423, 433, 449, 450
 mobile network nodes (MNNs) 378, 380, 381, 382, 390, 392, 394, 397, 398, 399, 400
 mobile node 128, 129, 134
 mobile router 378, 380, 381, 422
 mobile-services switching centre (MSSC) 86
 mobile switching center (MSC) 62, 63, 64, 66, 72, 75, 92, 97
 mobile TV 644, 645
 mobility anchor point (MAP) 407, 408, 422
 mobility management entity (MME) 82, 83, 85, 97
 mobility management (MM) 46, 47, 48, 50, 51, 146, 390, 401, 405, 406, 408, 409, 415, 416, 420, 422, 426, 431, 438, 448, 449, 450
 Mobisense project 126, 127, 132, 133, 134, 135, 144, 145

modal dispersion 276, 280
motivation/ability framework 186
multi-antenna systems 151
multicast 644
multi-mode fibre (MMF) 272, 273, 276, 277, 280, 281, 286
multiple access interference (MAI) 566, 567, 568, 569, 570, 578
multiple input multiple output (MIMO) 8, 12, 13, 15, 16, 17, 51, 249, 251, 266, 293, 313, 314, 316, 317, 349, 350, 351, 352, 353, 356, 357, 358, 373
multiple-input multiple-output (MIMO) antenna 147, 155, 156, 157, 160, 173, 177, 184
multi-protocol label switching (MPLS) 62, 64, 66, 67, 70, 196, 206, 220
multiservice security gateways (MSG) 91, 97

N

NEMO 377, 378, 380, 381, 382, 383, 387, 388, 389, 390, 392, 393, 394, 397, 398, 399, 400, 402, 422, 423
network address translation (NAT) 79, 80, 81, 84, 87, 88, 91, 95, 97, 98, 134, 144, 152
network metric 194, 195
network throughput 565, 566, 567, 568, 579
network transparency 472
new radio spectrum 377
next generation mobile networks (NGMN) 126, 130, 131, 132, 136, 141, 142
next generation networking (NGN) 88, 97, 471, 477
noise levels 131
non-access stratum (NAS) 82, 86

O

object-oriented 66, 115
OFDMA 3, 7, 8, 9, 13, 46, 48, 52, 53, 57, 58, 59, 60, 315
OMNeT++ 377, 397, 398
open shortest path first (OSPF) 64
open system interconnection (OSI) 14, 17, 454, 472
open wireless architecture (OWA) 152, 157, 164, 180

optical communications 268, 285
optical line terminal (OLT) 281
optical links 274
optical signal to noise ratio (OSNR) 274
optic conversion 272
opto-electronic conversion 272, 274
orthogonal frequency code division (OFCD) 565, 567, 568, 571, 572, 573, 574, 575, 576, 577, 578, 579
orthogonal frequency division multiple access (OFDMA) 62, 147, 152, 155, 156
orthogonal frequency division multiplexing (OFDM) 249, 251
outage probability 687, 688, 690, 691, 693, 702, 705

P

packet-based networks 131
packet error rate (PER) 69, 115
packet loss 127, 131, 133, 134, 136, 137, 138, 139, 140, 141, 142, 163, 168
packet-switched (PS) 77, 81, 97
Pareto optimality 317, 340, 342
parity-check codes 562
partnership project 2, 5
PDC 2
PDP context 84, 86
performance evaluation 260
personalized services 228, 229, 232
personal ubiquitous environment 228, 234, 241, 242, 245
PESQ 125, 126, 129, 130, 131, 141, 142, 143, 144
photodetector (PD) 274
plastic optical fibre (POF) 272, 273
point-to-multipoint (PMP) 293, 299, 469, 471
polarization-mode dispersion (PMD) 275, 276, 283, 284
policy and charging rules function (PCRF) 83, 90, 92, 97
power allocation 667, 684, 685, 686, 699, 700, 701, 702, 705, 706, 708, 709
pre-coded OFDM 583, 585, 587, 588, 594
previous access router (PAR) 407
probabilistic analysis 201
probabilistic delivery 194

protocol stack 420, 424, 433
 Proxy MIPv6 405
 public land mobile network (PLMN) 82, 97

Q

quality of experience (QoE) 126, 127, 129, 130, 131, 143, 316
 quality of service (QoS) 61, 76, 77, 78, 79, 80, 83, 84, 89, 90, 91, 92, 93, 94, 97, 99, 100, 102, 103, 104, 106, 107, 108, 109, 110, 111, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 126, 143, 144, 147, 149, 150, 162, 164, 166, 168, 170, 174, 184

R

radio access network (RAN) 61, 62, 63, 64, 75, 76, 90, 95, 362, 373
 radio access technology (RAT) 420, 425, 426, 429
 radio network controller (RNC) 62, 97
 radio-over-fibre 268, 270, 271, 272, 273, 275, 276, 277, 279, 281, 282, 283, 284, 285, 286, 287, 288
 radio resource management 46, 47, 48, 57
 radio routing protocol (RRP) 64
 radio transmission technologies (RTTs) 5
 real-time response 129
 receiver design 526, 563
 relay node 103, 104, 105, 112, 122, 250
 residue number system (RNS) 459
 resource allocation 46, 47, 50, 56, 314, 315, 316, 317, 318, 321, 322, 327, 328, 339, 340, 341, 342, 343, 348, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 367
 reverse tunneling 134
 robust header compression (RoHC) 479, 481, 482, 483, 484, 486, 491
 round trip delay (RTD) 69
 round-trip time (RTT) 362, 372, 373
 route optimizing 406
 routing information protocol (RIP) 64, 197
 routing mechanisms 199, 200, 205, 213, 222, 240
 routing paradigms 193

R-scale 131
 R-values 131

S

scalability 77, 81, 82, 83, 103
 seamless mobility 77, 81
 selection and distribution unit (SDU) 65, 66
 sequential tree 653, 654
 service data flows (SDFs) 84
 service level agreement (SLA) 63
 session flows 90
 session initiation protocol (SIP) 461, 465, 466, 467, 520, 522
 session routing proxy (SRP) 91, 92, 97
 SGSN 82, 84, 97
 shared database 457, 458, 466, 472
 shared network knowledge 193
 shortest path routing 196
 signaling gateway (SGW) 63, 82, 83, 84, 85, 97
 signaling protocol (SP) 64
 SimBet 194, 207, 210
 SIM card 6, 25, 44
 smart antennas 152, 157
 social overlay 205, 209, 210, 211, 213, 221
 social routing 201, 205, 206, 209, 210, 221, 223
 socio-technical limits 228
 soft detection 644, 645, 651, 653
 soft handoff 66, 67, 68, 293
 software defined radio (SDR) 11, 12, 147, 152, 157, 179, 184
 SOLAR 194, 208, 209, 210, 211, 220, 224
 space-time codes 644, 650
 spatial diversity 671, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 698, 700, 703, 704, 705
 spectrum efficiency 160
 sphere decoding 551, 563, 644, 650, 651, 662, 663, 664
 spreading matrices 583, 585, 587, 590, 595
 standards development organization (SDO) 2, 4, 5, 6
 standard single-mode fibre (SSMF) 272, 273, 274, 278, 281, 286

Index

sub-platform point (SPP) 252, 253, 259, 262, 263
super layer 456
system architecture evolution (SAE) 62, 82, 87, 90, 91, 92, 95, 97, 99
system description document (SDD) 8

T

tele-medicine 153
telephonometry 131
telephony application server (TAS) 92, 97
Teralight 272
third-party authentication, authorization and accounting (3P-AAA) 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 37, 38, 39, 40
third-party charging and billing (3P-C&B) 28, 31, 37, 38
time division duplex (TDD) 6, 7, 8, 9, 12, 13, 15
time division multiple access (TDMA) 2, 6, 15, 149, 151, 152, 176
top-down approach 456
topology hiding internetwork gateway (THIG) 91, 92, 97
traffic routing 77, 81, 110
traffic shaper 338
traffic splitting 395, 396, 397
transitivity 201, 206
transmitted speech 125, 130
tree search 527, 552, 553, 554, 563
triangular routing 406
tunnel broker 79
tunnel ID (TEID) 84, 97
tunneling protocol 405, 412
turbo codes 557, 562, 642
turbo coding 527, 529
turbo decoder 656
turbo decoding 527, 556, 557, 560, 562, 563

U

ubiquitous computing 228, 231
ubiquitous consumer wireless world (UCWW) 20, 22, 24, 25, 32, 37, 38, 39, 40, 41
ubiquitous environment 228, 234, 241, 242, 245

UDP-Lite 474, 477, 478, 483, 485, 486, 492, 493
ultra mobile broadband (UMB) 156, 184, 292
ultra-wideband (UWB) radio 271, 272, 274, 276, 277, 279, 280, 281, 282, 283, 284, 286, 287, 288, 289
universal mobile telecommunications system (UMTS) 2, 4, 6, 7, 9, 14, 31, 42, 59, 62, 77, 81, 88, 97, 133, 134, 147, 157, 158, 163, 164, 166, 177, 184, 192, 362, 365
universal modeling language (UML) 66
uplink 12, 13, 14, 15, 57, 231, 251, 256, 257, 258, 259, 261, 264
user decoupling 77
user equipment (UE) 82, 83, 84, 85, 89, 90, 97
user perception 125, 126, 127, 128, 129, 131, 132, 143
user profile server function (UPSF) 91
USIM card 6

V

variable time-fraction 685, 693, 695, 697, 698, 701, 703, 706, 709
vertical calibration 457, 458, 466, 472
vertical-cavity surface emitting lasers (VCSEL) 273, 277, 281, 288
vertical handover 128, 129, 132, 136, 392, 425, 426, 434, 435, 449, 450
video on demand (VoD) 494, 495, 496, 499, 500, 506, 507, 509, 514
video streaming 143, 149, 464, 471, 488, 494, 498, 505, 507, 509, 512, 514, 519
virtual navigation 153
virtual presence 153
virtual private network (VPN) 149, 154
voice core network (VCN) 86
voice over IP (VoIP) 81, 89, 94, 95, 96, 97, 126, 131, 132, 133, 134, 135, 145, 148, 149, 185, 328, 353, 361, 362, 364, 367, 369, 370, 371, 373, 374

W

Wasp model 194, 203, 204, 219, 222
WiBro 158, 186
wideband code division multiple access (WCDMA) 146, 149, 157, 160

Wiener filter 548
wireless application protocol (WAP) 64
wireless billboard channels (WBCs) 21, 22, 26,
27, 28, 32, 33, 36, 37, 39
wireless broadband 1, 3, 4, 10, 16, 17, 18
wireless grids 171
wireless mesh networks 565, 570, 579, 580,
581
wireless metropolitan area networks (WMAN)
7
wireless network card interfaces (WNIC) 494,
495, 499
wireless routing protocol (WRP) 198
wireless signal extractor (WSE) 274
workarounds 79
Worldwide Interoperability for Microwave Ac-
cess (WiMAX) 1, 3, 4, 6, 7, 8, 9, 13, 14,
15, 16, 17, 18, 19, 46, 47, 49, 50, 51, 52,
53, 59, 60, 62, 76, 83, 90, 97, 133, 147,
156, 160, 181, 182, 183, 184, 185, 186,
187, 192, 249, 251, 253, 256, 258, 259,
261, 264, 265, 266, 267, 269, 271, 272,
276, 278, 279, 280, 281, 283, 287, 288,
289, 292, 293, 294, 295, 296, 297, 298,
299, 300, 301, 305, 307, 308, 309, 310,
311, 312, 313, 314, 315, 316, 317, 323,
327, 331, 353, 354, 355, 356, 357, 359,
363