

Index

- Abstract Syntax Notation, 37
- Access Category (AC), 330, 332
- Access Point (AP), 4, 15, 31, 34, 94, 140, 174–5, 206, 208, 218, 270, 309, 311, 318–19, 322–5
- Access Router (AR), 135–6, 191–2, 314–15, 323, 326
- Access Service Network (ASN), 13–14, 29, 89, 172, 181, 311
- Access Service Network Gateway (ASN-GW), 14, 16, 20, 29–31, 89, 91, 95, 104, 172, 181–2, 311–12
- Adaptive Coding and Modulation (ACM), 125, 133–4
- Adaptive Modulation and Coding (AMC), 164, 244–7, 249–50, 253, 257–8
- Adaptive Multi Rate (AMR), 265
- Additive White Gaussian Noise (AWGN), 251
- Admission Control, 14, 30, 128, 132, 171, 173, 176, 182, 270, 273, 282, 330–1, 338
- Advanced Antenna Technology (AAT), 18
- Advanced Encryption Standard (AES), 7, 19, 28, 32, 37, 42, 47–8, 51, 84, 319–20
- Advertisement Message, 54, 338
- Air Interfaces, 113, 124–5, 133
- Anchor BS, 54, 166, 167, 183, 187–9, 226, 325
- Anticipation Factor, 234
- Application Service Provider (ASP), 13–14, 29, 88, 181, 312
- Arbitration Inter-frame Space (AIFS), 174, 334
- ASN Profile, 20–1, 91
- Association Procedure, 215, 220–1
- Asynchronous Transfer Mode (ATM), 18, 31, 113, 154–5, 319, 327
- Attack
 - Attack on Authentication, 44
 - Attack on Authorization, 54
 - Attack on Availability, 47
 - Attack on De-authentication, 34
 - Attack on Impersonation, 37, 55
 - Attack on Interleaving, 54, 56, 76
 - Attack on Jamming, 43–4, 75, 321
 - Attack on Man in the Middle (MIM), 44, 50, 63, 69, 81, 98, 320
 - Attack on Privacy, 47
 - Attack on Replay, 35, 44–56, 63, 68–78
 - Attack on Rogue Base Station, 34, 55–7, 321
 - Attack on Scrambling, 43–4, 321
 - Attack on Water Torture, 43–4, 57
- Authentication
 - Authentication and Key Agreement (AKA), 49, 82–3, 94
 - Authentication Key Identifier (AKID), 46, 50–1, 72–3
 - Authentication Server (AS), 69, 80, 87, 94, 203, 317–18, 331
 - Authentication Token, 84
 - Authentication Vector (AV), 84

- Authenticator, 30, 69, 80–1, 94, 96, 98–9, 101, 103–4, 107, 317
- Authorization Key (AK), 31, 35–6, 38–40, 49–50, 53, 64–78, 80–2
- Authorization Security Association, 32, 36, 39
- Authorization, Authentication and
 - Accounting (AAA), 13–16, 21, 30–1, 48–9, 53, 55, 69, 75, 88–107, 172, 181–2, 204, 206, 311–35
- Automatic Repeat Request (ARQ), 114, 242

- Back-end, 49, 87–8, 96
- Backhaul, 8–10, 16, 19, 22, 25–7, 175, 179, 180, 205, 262, 304–5
- Back-off Exponent, 333–4
- Bandwidth Request/Allocation, 31, 111, 115–18, 122, 129–34, 137, 146, 154, 156, 158, 160–1, 171, 175–6, 217, 273, 310, 334
- Base Station Identity (BSID), 50, 55, 71–2, 76, 186
- Basic Connection Identity (BCID), 49
- Best Effort (BE), 118, 120, 149, 151–2, 160–1, 164–5, 243, 248, 273–5, 329, 332–3, 339–56
- Binary Phase Shift Keying (BPSK), 7, 17, 125
- Bit Error Rate (BER), 112, 125, 127, 199, 223, 247, 252
- Block Error Rate (BLER), 250, 252
- Broadband
 - Broadband Access Server (BRAS), 21
 - Broadband wireless, 5–7, 16–17, 25, 28, 63, 126, 141, 160, 176, 214, 238, 241, 251, 337
- Broadcast, 32, 34, 53–4, 56, 72, 75, 115, 118, 120, 122, 156–8, 166, 187–8, 217–19, 245, 252, 265, 358, 361
- Burst, 33, 56–7, 148–58, 187–8, 216–19, 245–7, 252, 257, 334, 357–8
- Burst profile, 56–7, 157, 216, 245–6, 250–2

- Call Admission Control (CAC), 128, 132–3, 149, 338
- Capacity, 250, 280, 357–8, 360
- Care-of-Address (COA), 99–100
- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), 7, 270, 333
- Carrier to Interference plus Noise Ratio (CINR), 166–7, 170, 188–90, 219, 222, 224, 232, 235, 359
- Cell Re-selection, 168, 186, 219, 221, 232
- Cell Selection, 325, 337–63
- Centralized scheduling, 122, 130–1, 162
- Certificate
 - Certificate Authority (CA), 38, 94
 - Certificate Revocation, 38
 - Certificate Revocation List (CRL), 38
 - Certificate Status, 38, 94
 - Certificates, 37–8, 49, 60, 63–7, 76, 93–5, 320–1
 - Certification Authority, 37–8, 94
- Challenges, 95
- Channel
 - Channel Aware, 148, 253–5
 - Channel Aware Class Based Queue (CACBQ), 253–5, 258
 - Channel Quality Indicator (CQI), 247–50, 252, 255
 - Channel Quality Indicator Channel (CQICH), 152, 167, 245, 249, 325
- Cipher
 - Cipher Block Chaining (CBC), 37, 42–3, 47, 51, 67, 83, 319
 - Cipher key (CK), 83
 - Cipher Message Authentication Code (CMAC), 50–2, 57–8, 68, 70–5, 105, 320
- Client-Mobile IP, 100
- Code Division Multiple Access (CDMA), 5, 10–12, 163, 200, 221, 225, 237
- Code Excited Linear Prediction (CELP), 264–5
- Codecs, 263–5, 267
- Collision Avoidance, 270, 333
- Commercial Off-The-Shelf (COTS), 16

- Common Part Sub-layer (CPS), 18–19, 31, 116, 154, 270–1, 338
- Common Part Sub-layer (CSP), 32
- Connection
 - Connection Identifier (CID), 33, 39, 40, 49, 65–6 118, 120, 150–9, 170, 189, 231, 243, 271
 - Connection Oriented, 19, 65, 99, 118–19, 145–6, 154–5, 171, 175, 243, 271
- Connectivity Service Controllers (CSC), 173
- Connectivity Service Network (CSN), 13–16, 20, 29–31, 88–106, 172–3, 181–2, 311–14
- Constant Bit Rate (CBR), 243, 267, 272
- Consumer Premises Equipment (CPE), 6, 170
- Contention, 33, 57, 129, 148, 151–4, 157–8, 169–70, 174, 185–6, 221, 230, 235–7, 242, 245, 263, 270, 273, 333–4, 357, 360
- Contention Window (CW), 174, 333–4
- Conventional scheduling, 276–7, 290, 294
- Convergence Sub-layer (CS), 18, 31–2, 115–16, 154, 172, 198, 264, 271, 338
- Coordinator, 130–1, 255–58, 330–1
- Correction, 18, 32, 148, 246, 272, 279, 285
- Cost Adjusted Proportional Fair (CAPF), 301–4
- Counter with CBC-MAC (CCM), 37, 47–8, 51, 53, 84
- Countermeasures, 43, 64, 75, 84
- Coverage Tree, 131
- Cross Layer architecture, 114, 125–8
- Cyclic Redundancy Check (CRC), 42–3, 116–17, 153, 305
- Data Encryption, 28, 37, 39, 42–3, 49, 51, 66, 84, 320
- Data Encryption Standard (DES), 19, 28, 32, 37, 42–3, 47, 51, 64, 67, 83
- Data over Cable Service Interface Specification (DOCSIS), 64, 213–14
- DCD/UCD Message Broadcast, 183, 216, 218–19, 222, 226, 232
- Decode and Forward Relay (DFR), 289, 294
- Decode-and-Forward Mode, 285
- Decryption, 31, 47, 52
- Dedicated Allocation, 225
- Dedicated Initial Ranging, 225
- Deficit Fair Priority Queue, 274
- Denial of Service (DoS), 76, 82, 321
- Department of Defence (DoD), 264–5
- Detection, 135, 194, 267, 277, 285
- DIAMETER, 69, 92, 107, 312, 315–35
- Differentiated Service (DiffServ), 135
- Diffie-Hellman, 57, 79, 319, 329
- Digital Subscriber Line (DSL), 3, 9–10, 12, 14, 20, 241, 244, 281
- Direct Sequence Spread Spectrum (DSSS), 43
- Discrete Event Simulation, 338
- Distinguished Encoding Rule (DER), 37
- Distributed
 - Distributed Coordinated Scheduling, 122
 - Distributed Coordination Function, 173–4, 270, 333
 - Distributed Coordination Function (DCF), 173–4, 263, 270, 333–4
- Diversity Set, 54, 166–8, 187–9, 207, 227, 325
- Downlink
 - Downlink Channel Descriptor (DCD), 11, 32, 166, 169, 183, 186, 188, 199, 216–19, 222, 226, 231–3, 358–9
 - Downlink scheduling, 161, 263, 274, 276
 - Downlink Sub-frame, 162, 216, 244–5
- Duplicate Address Detection (DAD), 194
- Dynamic
 - Dynamic Frequency Selection (DFS), 27

- Dynamic (*continued*)
 - Dynamic Host Configuration Protocol (DHCP), 14, 30–1, 33, 65, 89–106, 155, 313
 - Dynamic SA, 35–40, 65–6
 - Dynamic Service Addition, 156, 217–8, 236, 332
 - Dynamical Hierarchical Mobility Management (DHMM), 205
- EAP Integrity Key (EIK), 71
- EAP over LAN (EAPOL), 82
- EAP-Authentication and Key Agreement (EAP-AKA), 49, 69, 84
- EAP-Tunneled Transport Layer Security (EAP-TTLS), 69, 82, 105–6
- Earliest Deadline First (EDF), 129, 163, 305
- Effective Capacity, 338, 357–61
- Encryption, 28, 31, 36, 41–2, 51, 117, 272
- Encryption Control (EC), 42, 51, 117, 272
- Encryption Key Sequence (EKS), 42, 272
- End-to-End
 - End-to-end Delay, 112, 124, 132, 214, 220
 - End-to-end QoS, 149, 171, 214, 270, 311, 330–1
- Enhanced Distributed Channel Access (EDCA), 269–70, 334
- Enhanced Distributed Coordination Function (EDCF), 174
- Enhanced Full Rate (EFR), 265
- Error, 6, 10, 18, 27, 69, 112, 146–8, 196, 199, 216, 223, 246, 250, 269, 272, 279, 285–6
- Ethernet, 4, 18, 21, 31, 94, 174–5, 180
- European Telecommunications Standards Institute (ETSI), 17, 322
- Evolved High Speed Packet Access (E-HSPA), 175
- Evolved UMTS Terrestrial Radio Access Network (E-UTRAN), 12
- Expected Response (XRES), 83
- Extended Real Time Polling Service (ertPS), 149, 151–2, 243, 248, 254, 257, 273, 332–3, 339
- Extended rtPS, 277–8, 283
- Extensible Authentication Protocol (EAP), 30, 49, 64, 67–77, 80–4
- Extensible Markup Language (XML), 266
- Fairness, 129, 147–8, 161, 163, 253–4, 257–8, 279, 281–3, 289–304
- Fast Base Station Switching Handover (FBSS), 11, 53–4, 165, 167–8, 183, 187–8, 207, 225–7, 325
- Fast Binding Update (FBU), 192–5
- Fast Handover, 87, 169, 170, 191–5, 207, 232–3, 324
- Fast Power Control (FPC), 56–7
- Fast Ranging, 170, 190, 230
- File Transfer Protocol (FTP), 120, 152, 155, 169, 203, 243, 271, 332–3
- First In First Out (FIFO), 161, 274
- Fixed Subscriber, 27, 241, 344–8, 352
- Foreign Agent (FA), 30, 92–3, 96, 99–106, 312
- Foreign Network, 97, 100–1
- Forward Error Correction (FEC), 7, 32, 114, 246, 272, 279
- Fourth Generation Mobile Networks (4G), 10, 175, 195, 263, 270, 309
- Frame Control Header (FCH), 216, 244–5, 357–8
- Frequency
 - Frequency Division Duplex (FDD), 9–10, 27, 33, 124, 244
 - Frequency Division Multiple Access (FDMA, OFDMA, SOFDMA), 12, 17, 43, 124, 140, 160, 236, 237, 241–58
 - Frequency Hopping Spread Spectrum (FHSS), 43
 - Frequency-time domain, 250
- Full Mobility, 21, 165, 214–15, 243
- Full Rate GSM (GSM FR), 265
- Full Usage of Sub-channel (FUSC), 244–5
- Fuzzy Logic, 136, 138–41, 225, 238

- Games Theory, 137, 141
- GenArgMax scheduling, 294–6, 300–4
- General Packet Radio Service (GPRS), 261
- Generic MAC Frame Header (GMH), 272
- Global System for Mobile Communications (GSM), 5, 12, 29, 63, 81–2, 200, 228, 264–5, 314
- Grant per Connection (GPC), 119
- Group Key Encryption Key (GKEK), 51–3, 58, 72–5, 79–80
- Group Key Management Protocol (GKMP), 79
- Group SAID (GSAID), 73–4
- Group Security Association (GSA, MBSGSA), 52–3, 72
- Group Traffic Encryption Key (GTEK), 51–3, 58, 70, 72–5, 79–80, 82
- Group Transient Key (GTK), 82, 84
- Group-based Key Distribution Algorithm (GKDA), 58
- G-series, 264

- H.261, 266
- H.264, 266
- Handover (HO), 169, 183–99, 221–5, 230, 233
 - Handover Acknowledgment (HACK), 192–5
 - Handover Execution method, 193, 195–6, 221, 225, 227, 230–6
 - Handover Initiation (HI), 192–6, 214, 221, 224, 227, 230, 232, 234
 - Handover Keying (Group) (HOKEY), 84
 - Handover Performance, 214, 219, 221–2, 230, 233, 238, 323
 - Handover Policies, 222, 224, 230, 234, 238
 - Handover Scheduling, 233, 238
 - Handover Stages, 221, 230
 - Handover Trigger, 230, 238, 359, 363
 - Handshake, 49–56, 68, 72–7, 81–4, 105, 122, 188, 320
- Hard Handover (HHO), 53–4, 165–8, 170, 225, 227, 234–6
- Hash, 37, 67, 72, 78, 80, 328
 - Hash Function, 36, 320
 - Hash Message Authentication Code, 34, 320
- HCF Controlled Channel Access (HCCA), 174, 269–70, 334
- Head of Line (HOL), 253–54, 280–1
- Header Check Sequence (HCS), 117, 272
- Header Type (HT), 117, 272
- Heuristic, 247, 294–5, 299, 301–5
- High Altitude Platform (HAP), 127
- High Data Rate (HDR), 163
- High Performance Radio Metropolitan Area Network (HIPERMAN), 17
- High-definition TV (HDTV), 337
- Highest Urgency First (HUF), 160
- High-speed, 5, 8, 21–2, 26, 106, 147, 165, 213–15, 243, 291, 310, 337
- High-Speed Packet Access (HSPA), 175
- Hold-off Interval, 123
- Home Agent (HA), 31, 99–106, 312
- Home Network, 83, 89–90, 99–101, 200–1, 208
- Home Network Service Provider (H-NSP), 88–96, 101, 107, 330
- Home-of-Address (HOA), 101, 103
- Hop specific, 296, 300, 303, 304
- Horizontal Handoff, 139, 179, 207, 325
- Horizontal Handover, 183, 196–7, 228–30
- Hybrid Automatic Repeat Request (HARQ), 18
- Hybrid Coordination Function (HCF), 174, 269, 334

- Idle Capacity, 338, 357–60
- IEEE Institute of Electrical & Electronics Engineers, Inc. Standards
 - IEEE 802.11, 6, 173–5, 261, 309–35
 - IEEE 802.11e, 174, 269–70, 331–4
 - IEEE 802.11i, 64, 81–2, 84, 318–19
 - IEEE 802.16 amendments, 146, 171
 - IEEE 802.16 2001, 63
 - IEEE 802.16 2004, 10, 17, 27–8, 35, 37–8, 42–3, 48, 51, 60, 64, 78, 237, 241, 339

- IEEE Institute of Electrical & Electronics Engineers, Inc. Standards
(*continued*)
- IEEE 802.16a, 7, 17, 27, 35, 60, 141
 - IEEE 802.16c, 17, 27, 60, 141
 - IEEE 802.16d, 17, 26–8, 60, 162, 170, 213, 332, 338, 357–8
 - IEEE 802.16e, 7, 12, 17
 - IEEE 802.16f, 28
 - IEEE 802.16g, 28, 229, 332
 - IEEE 802.16h, 28
 - IEEE 802.16i, 28
 - IEEE 802.16j, 28, 236, 284, 303, 305
 - IEEE 802.16m, 28, 213, 229, 261
 - IEEE 802.1x, 94, 96, 101, 107, 318
 - IEEE 802.21, 195, 197–8, 207, 214, 227–30, 310, 324, 326, 335
- Information Element (IE), 151, 157–9, 170, 230, 233
- Integrity Checking Value (ICV), 51
- Integrity Key (IK), 83
- Interconnection, 201–2, 310
- Inter-domain Handover, 227, 238
- Interleaving Interval, 183–4, 219–20, 235
- International Mobile Telecommunications, 213, 270
- International Standard Organization (ISO), 266, 329
- International Telecommunication Union (ITU), 50, 213, 264, 266
- Internet Engineering Task Force (IETF), 82, 99, 191, 203, 207, 311–30
- Internet Key Exchange (protocol) (IKE), 65
- Internet Low Bit rate Codec (ILBC), 264
- Internet Protocol (IP), 10, 113, 155, 326
- Internet Protocol Version 6 (IPv6), 13, 135, 191–5, 207, 326, 328
- Internet Service Provider (ISP), 7, 25, 27, 180, 201, 322–3, 328
- Interoperability, 3, 10, 19, 21, 25, 113, 170, 179, 281
- Inter-subnet Handover, 227
- Inter-symbol Interference (ISI), 18
- Inter-technology Handover, 227
- Intra-domain Handover, 227
- Intra-RAT Handover, 228
- IP Security (IPSec), 65, 317
- IP-addressing, 88, 107
- Jitter, 146–65, 267–79, 344–56
- Key
- Key Derivation Function (KDF), 70–2, 82
 - Key Encryption Key (KEK), 36, 40, 44, 51–5, 58–9, 67, 70–5, 79, 81–2, 105
 - Key Management Protocol, 39, 64, 79, 107, 116, 320
 - Key-agreement, 49, 57, 82, 94
- Keyed-Hash MAC, 67, 320
- Layer 2 (L2), 181, 190–1, 193–4, 196, 198–9, 207, 229, 231
- Layer 3 (L3), 181, 190–1, 193–4, 196, 198, 207
- Lee’s Algorithm, 276–8, 283
- Line-of-Sight (LOS), 17, 27, 179–80, 262, 270, 297, 302
- Link Establishment, 156, 262
- Link Identifier (Link ID), 123, 156
- Link-down Trigger, 233
- Link-going-down Trigger, 230, 233
- Liveness, 51
- Local Area Network (LAN), 4, 6–8, 17, 63, 105, 218, 263, 269
- Long Term Evolution (LTE), 9, 12, 228
- Low Density Parity Check (LDPC), 246, 250
- Low Runtime Complexity (LRC), 290, 294–5, 297
- MAC Frame Format, 269, 272
- MAC Protocol Data Unit (MPDU), 38, 42, 48, 53, 271, 335
- MAC Service Data Unit (MSDU), 271
- Macro Diversity Handover (MDHO), 11, 53–4, 165–6, 168, 183, 187–8, 207, 225–7, 325
- Management Connections, 33, 52–3, 57, 65, 68, 72, 74, 78–9, 116, 119, 155–7, 271

- Management Information Base (MIB), 28
- Master Session Key (MSK), 49, 64, 69–71, 75, 81–2, 84, 96, 101, 104–6
- Maximum Sustained Rate (MSR), 121
- Max-SINR scheduling, 291
- MBS Traffic Key (MTK), 53, 72
- Mean Opinion Score (MOS), 268
- Mean Square Error (MSE), 269
- Media
 - Media Access Control (MAC), 17–18, 33, 65, 319
 - Media Access Protocol, 7, 11
 - Media Independent Command Service, 228
 - Media Independent Event Service (MIES), 228
 - Media Independent Handover (MIH), 195, 197–8, 214, 227–30, 310
 - Media Independent Information Service (MIIS), 199, 228
- Medium Access Control layer, 18, 116, 242
- Mesh
 - Mesh Access Point, 205
 - Mesh BS, 156, 206
 - Mesh Mobility Management (M3), 206
 - Mesh Mode, 10, 27, 59, 80–1, 115–18, 121–4, 128–35, 140, 146, 148–9, 156, 171, 205, 207–8
 - Mesh Networks, 59, 180, 204–8
 - Mesh Point (MP), 205
 - Mesh Portal Point (MPP), 205
- Message Authentication Code, 34, 50, 68, 320
- Message Integrity Code (MIC), 72
- Metropolitan Area Network (MAN), 11, 17, 19, 27–8, 63, 241
- Minimum Reserved Rate (MRR), 121
- Mobile
 - Mobile IP (MIP), 13, 91–7, 100–6, 191–4, 198, 207, 326
 - Mobile Multi-hop Relay (MMR), 261–305
 - Mobile Node (MN), 99–106, 192–9, 311, 326, 329
 - Mobile Station (MS), 11, 28–31, 57–9, 64, 87, 89, 95, 140, 147, 170, 172, 181, 190, 205–6, 216, 221, 225, 234, 242, 253, 262, 270, 283, 321, 363
 - Mobile Station Identifier (MSID), 49, 55
 - Mobile Stream Control Transmission Protocol (mSCTP), 198
 - Mobile Subscriber Station (MSS), 115, 126, 135–6, 140–1
 - Mobile Virtual Network Operator (MVNO), 20
- Modulation
 - Modulation and Coding Scheme (MCS), 160
 - Modulation Technique, 124–5, 133
- Most Significant Bit (MSB), 117, 277
- Moving Picture Expert Group (MPEG), 120, 151, 243, 266–7, 273, 333
- MPEG, 120 151, 243, 266–7, 273, 333
- Multicast, 14, 35, 36, 51–60, 65, 70–83, 135, 157–8, 205, 208, 279, 282, 334
- Multicast and Broadcast Re-keying Algorithm (MBRA), 52, 58, 74, 79, 80, 82, 84
- Multicast and Broadcast Service (MBS), 52–3, 70, 72, 74, 79
- Multi-hop Communication, 146, 204, 288, 304–6
- Multimedia, 3, 10, 52, 82, 87, 111–12, 131, 135, 146, 176, 243, 263, 266–70, 274, 282, 305, 311–12, 327–8, 332–4
- Multimedia Messaging Service (MMS), 4
- Multiple Input Multiple Output (MIMO), 18, 125, 270
- Multi-Services Operator (MSO), 12
- Multi-tap, 278–9, 283
- Multi-user Diversity, 244, 247, 249, 258, 279
- Mutual Authentication, 28, 34, 44, 48–9, 54, 67–9, 77, 81–2

- Nash Equilibrium, 137–8
- National Television System Committee (NTSC), 265
- Needham Schroeder Secret Key Protocol (NSSK), 56
- Negotiation, 50–1, 65, 68, 70, 72–4, 78, 97, 105, 146, 150, 169, 176, 186, 196, 262
- Neighbor (NBR), 56, 168, 183–94, 218–23, 232, 238, 257, 259
- Neighborhood, 121–2, 156, 218–19
- Neighboring Advertising, 218
- Network
 - Network Access Point, 15, 90
 - Network Access Provider, 29, 201, 311
 - Network entry procedure, 32, 56, 78, 193, 195, 215, 230
 - Network Management System (NMS), 49–50, 55, 172–3
 - Network Reference Model (NRM), 15, 29, 88–90, 101–2, 180–1, 233
 - Network Service Provider (NSP), 14–5, 29–31, 88–93, 96, 99, 101, 107, 181, 201–3, 311, 330
 - Network Working Group (NWG), 12, 14, 20, 28–9, 179, 182, 207
- New Access Router (NAR), 192–5
- New Care of Address (NCoA), 192–5
- Next Transmission Instant, 123
- Node Identifier (Node ID), 59, 156
- Noise, 43–4, 125, 148, 166–7, 190, 219–23, 244, 249–51, 268–9, 281–2, 291
- Non Line-of-Sight (NLOS), 17–18, 27, 179–80, 262, 283, 297, 339
- Nonce, 45–56, 72–82
- Non-Real-Time Polling Service (nrtPS), 118, 120, 129, 137–8, 149–52, 160–5, 243, 248, 254–7, 273–5, 282, 332–3, 339–56
- Non-transparent Relay Stations, 285
- NS-2, 19, 338 360
- Objective Method, 268
- Online Certificate Status Protocol (OCSP), 38, 94
- Operator Shared Secret (OSS), 13, 80
- Opportunistic Deficit Round Robin (O-DRR), 281–3
- Optimized Hard Handover (OHHO), 149, 225, 231
- Optimum Threshold Value, 234
- Orthogonal Frequency Division
 - Orthogonal Frequency Division frame structure, 357–61
 - Orthogonal Frequency Division Multi-hop Multi-Access (OFDM2A), 288
 - Orthogonal Frequency Division Multiple Access (OFDMA), 17, 124, 160, 236–7, 258–341
 - Orthogonal Frequency Division Multiplex (OFDM), 12, 17–18, 43, 133, 174, 241, 287–9, 303–4, 339, 357–61
- Overhead Symbol, 358
- Over-the-Air (OTA), 16
- Packet Error Rate (PER), 112, 127
- Packet Header Suppression (PHS), 31
- Packet Loss, 147, 196, 205, 214–15, 264–8, 279, 359–62
- Packet Mobility Management (PMM), 83
- Packet Number (PN), 68
- Packet Scheduling, 162, 171, 221–3, 273
- Pair-wise Master Key (PMK), 49, 70–84, 105
- Pair-wise Transient Key (PTK), 81–4
- Partial Usage of Sub-channels (PUSC), 244–5
- Peak Signal to Noise Ratio (PSNR), 268–9
- Perceptual Evaluation of Audio Quality (PEAQ), 268
- Perceptual Evaluation of Speech Quality (PESQ), 268
- Performance
 - Performance comparison, 129, 293, 339, 342, 346
 - Performance evaluation, 127, 302, 361
- Permutation, 244–57

- Personal Computer Memory Card
 - International Association (PCMCIA), 7–8
- Personal Digital Assistants (PDA), 5, 241
- Physical Layer (PHY), 17, 31, 124, 133, 243
- Piggyback, 118–20, 152–7, 242, 273–9, 335
- Point Coordination Function (PCF), 174, 270
- Point of Attachment (PoA), 191–3, 227, 313
- Point to Multi-Point (P2MP), 27, 59
- Point to Multipoint (PMP), 10–11, 80, 111–41, 180, 204–8, 242, 253, 338–9, 358
- Point-to-Point Protocol (PPP), 31, 316
- Point-to-Point Protocol over Ethernet (PPPoE), 21
- Pre-primary Authorization Key (Pre-PAK), 2, 7–9, 16
- Pre-shared Key (PSK), 82–4, 318
- Previous Access Router (PAR), 191–5
- Previous Care of Address (PCoA), 192
- Privacy
 - Privacy Key Management (PKM), 32–48, 116, 169, 187, 226
 - Privacy Key Management (PKM), 32–60, 64–85
 - Privacy Key Management (PKMv1), 49–59, 64–76, 93–4
 - Privacy Key Management (PKMv2), 48–59, 64–84, 94, 107
 - Privacy Key Management Poll Me Bit (PM), 118, 157
 - Privacy Sub-layer (PS), 154, 270
- Profile, 7–20
- Proportional Fair Scheduling, 292–304
- Proportional Fair with
 - Minimum/Maximum Rate Constraints (PFMR), 293–4
- Proportionate Fair (PF), 163, 293
- Proportionate Fair Scheduling for OFDMA Relay Networks (PSOR), 294–5
- Protected EAP (PEAP), 69
- Protocol data unit (PDU), 42, 51, 116–35, 154, 157, 174, 183, 199, 242, 357–61
- Protocol for Carrying Authentication for Network Access (PANA), 315–17
- Provider, 10–15
- Proxy Router Advertisement (PrRtAdv), 191–4
- Proxy-MIP (PMIP), 92–106, 326
- Public Key Certificates (PKC), 42, 64, 85
- Public Switched Telephone Network (PSTN), 13–15, 31, 266, 314
- Pulse Code Modulation (PCM), 264
- Quadrature Amplitude Modulation (QAM), 7, 17, 125–6, 246–51, 179, 341, 358–60
- Quadrature Phase Shift Keying (QPSK), 7, 17, 126, 246–51, 277
- Quality of Service (QoS)
 - Quality of Service Mechanisms, 112–40, 149, 171–5, 214
 - Quality of Service Provisioning, 173, 325
 - Quality of Service Simulation of WiMAX Network, 337–63
- Quality of Signal, 227, 282–3
- Radio
 - Radio Frequency (RF), 19, 27, 253
 - Radio Layer Latency, 235
 - Radio Link Control (RLC), 262
 - Radio Resource Agent (RRA), 20
 - Radio Resource Control (RRC), 20, 182
 - Radio Resource Management (RRM), 20–1, 181, 223
- Random Number (RAND), 84
- Ranging (RNG), 11, 33, 48, 53–9, 78–81, 166–70, 185, 191, 216–38, 225, 230, 233, 237, 245, 262, 267, 341, 355–8
- Reachability, 4, 122, 328
- Real-time Polling Service (rtPS), 152, 273
- Real-time traffic, 87, 170, 188, 207, 263–9, 305

- Receive/Transmit Transition Gap (RTG), 357–8
- Received Signal Strength (RSS), 140, 219, 223–4
- Received Signal Strength Indication (RSSI), 219, 223, 225, 234, 247, 359
- Reference Network Model (RNM), 20
- Reference Point (RP), 90
- Registration, 11, 33, 54, 59, 79, 97, 100–4, 141, 149, 156, 170, 187, 199–205, 217–18, 226, 233, 236, 262, 327–9
- Relay Station (RS), 26, 28, 263, 282–306
- Remote Authentication Dial-In User Service (RADIUS), 49, 69, 91–107, 203–9, 315–18, 335–6
- Re-routing, 205–9
- Resource Allocation, 141–3, 171, 241–59, 288, 293, 306
- Resource Controller (RC), 20, 172–3
- RFC, 49, 75, 85, 86, 99–102, 107–8, 176, 191–2, 209, 311, 326, 355–6
- Rivest, Shamir, and Adelman (RSA), 37–52, 64–85, 320
- Roaming, 4, 8, 13–15, 28–33, 87, 90–100, 126, 180, 200–9, 310–15, 335
- Rollover Counter (ROC), 53
- Round Robin (RR), 129, 161, 274, 290–3, 301–4
- Router, 8, 15, 80, 135–6, 182, 191–4, 206, 300, 310, 314–15, 322–6
- Router Solicitation for Proxy (RtSolPr), 191
- Routing, 14, 30, 35, 96, 100, 129–32, 143–4, 149, 168, 181, 205–9, 288, 295–305, 311–12, 338
- R-score, 268, 307
- Scalable Orthogonal Frequency Division Multiple Access (SOFDMA), 43, 140
- Scanning
 - Scanning Interval, 168, 183–5, 219–226
 - Scanning Threshold, 230
- Scheduling
 - Scheduling Algorithm, 128–30, 143, 148, 161–4, 171, 177, 259, 263, 274, 276, 277, 281, 283, 288–95, 299–307, 339
 - Scheduling Service Class, 272
- Seamless Handover, 13, 91, 100, 107, 143, 165, 196, 231–2, 239
- Second Generation Mobile Networks (2G), 81–2, 318
- Secure Hash Algorithm (SHA), 36–7, 48, 67, 70, 77
- Security
 - Security Association (SA), 32, 35–7, 50–3, 56, 65–8, 72–4, 78–81, 84
 - Security Association Identifier (SAID), 32, 36, 39–49, 65–9, 73–7
 - Security Requirements, 26, 34, 48, 60
 - Security Sub-layer (SeS), 18–19, 26–62, 116, 155
- Segment Data Units (SDU), 31, 115–16, 119, 124, 148, 153–4, 158–9, 242, 271
- Service
 - Service Access Point (SAP), 31–2, 116, 154–5, 198, 270–1
 - Service Class, 104, 118–24, 129, 130, 132–5, 146, 149, 151, 153, 160, 164, 171, 234–5, 272–6
 - Service Class Name (SCN), 121, 183–5, 219–22, 226
 - Service Flow (SF), 30, 33, 35, 64–5, 92, 104, 118–23, 129, 143, 149–60, 170–6, 187, 217, 235–6, 243, 253, 259, 272–5, 330–3, 340, 355–6, 363
 - Service Flow Identifier (SFID), 118, 120, 150, 243
 - Service Set Identifier (SSID), 5
 - Service Specific Convergence, 31–2, 116, 154, 198, 242, 270–1, 338
 - Service Specific Convergence Sub-layer (SSCS), 154–5

- Serving BS, 30, 50, 59, 73, 81, 166–70, 183–95, 206, 219–25, 230–2, 234–5, 243, 253, 325, 358–60
- Session Initiation Protocol (SIP), 58
- Shannon Formula, 250–1, 258
- Short Message Service (SMS), 4
- Signal
 - Signal to Interference Ratio (SIR), 27
 - Signal to Interference-plus-Noise Ratio (SINR), 196, 223, 244, 247, 252–3, 281, 291
 - Signal to Noise Ratio (SNR), 190, 199, 219, 223, 231, 249–52, 268–9, 282–3
- Simple Mobility, 215, 243
- Simple Network Management Protocol (SNMP), 172, 271
- Simulation, 19, 131, 170–1, 232, 278, 307, 337–64
- Single Carrier (SC), 17, 124, 142
- Slot Allocator, 245–57
- Soft Handover, 11, 53, 149, 178, 188, 207, 225–7
- Spectral efficiency, 223, 247, 251
- Spectrum, 9
- Spectrum Profiles, 9, 22
- Spectrum Sharing, 290
- SS Basic Capability (SBC), 51, 68, 73, 74, 169, 186, 217–18, 236, 328
- Stream Control Transmission Protocol (SCTP), 198, 278
- Sub-carrier, 287
- Sub-channel, 235, 237, 244–53, 258, 287–302
- Sub-channels of a Time Slot (STS), 290, 295, 297–8, 300, 303
- Sub-frame, 122–24, 160–2, 176, 216, 244–5, 265, 301–2, 357–8
- Sub-Group Key Encryption Key (SGKEK), 58
- Subscriber Identity Module (SIM), 49, 83, 86
- Super Frame, 174, 301–4
- Superior Router (SR), 206
- System Model, 248–9, 253, 276, 338, 356–7
- Target BS, 11–12, 50, 54, 57, 59, 78, 81, 166–70, 183–95, 219–26, 230–6, 325
- Target Cell, 170, 338, 357–63
- Third Generation Mobile Networks (3G), 10, 64, 175, 195, 228
- Third Generation Partnership Project (3GPP), 12–13, 197, 228–9, 335
- Third Generation Partnership Project 2 (3GPP2), 12–13, 197, 228–9
- Throughput, 9, 16, 25, 47, 112, 125, 128, 132, 138, 140, 142, 146–8, 163–4, 168, 177, 196, 232, 247, 249–52, 255–6, 270–94, 302–5, 324, 342–62
- Time Division Duplex (TDD), 9–10, 27, 122, 124, 160, 244–5
- Time Slot, 44, 163, 273–304
- Time Stamp, 35, 44–6, 54, 56, 76
- Topology, 4, 21, 26, 59, 80, 111, 130–2, 149, 153, 170, 185, 215, 218, 232, 287, 294, 303, 305, 339–40
- Traffic
 - Traffic Encryption Key (TEK), 36, 39, 40–59, 64–84, 169, 187, 226
 - Traffic Policing, 160–2, 273
 - Traffic Scheduling, 163, 276, 279, 305–6
 - Traffic Shaping, 146–7, 160, 171, 273–4, 282
- Transition, 135, 139, 188, 276, 329, 362
- Transmission Control Protocol (TCP), 31, 114, 164, 177, 278, 319, 327–8, 339
- Transmission Opportunities (TXOP), 269, 334
- Transmit/Receive Transition Gap (TTG), 245, 357–8
- Transparent Relay Station, 285
- Transport Layer Security (TLS), 49, 67, 69, 82, 86, 94–5, 105–6, 108, 321
- Tree Traversing, 294–5, 297

- Triangular Routing, 100
- Trigger, 14, 42, 56, 76, 78, 81, 97,
 - 105–6, 127, 140, 151, 156, 173,
 - 183–4, 192–3, 195, 199, 200,
 - 216–39, 313, 316, 324, 331, 337,
 - 338, 359, 362–3
- Trivial File Transfer Protocol (TFTP),
 - 155, 169, 271
- Trust, 38, 66, 84, 98, 106, 146, 199, 329
- Trusted Third Party (TTP), 37, 66, 201
- Tunneled Transport Layer Security (TTLS), 69, 82, 94–5, 105–6, 108
- Two-level Hierarchical Bandwidth
 - Allocation scheme (THBA), 175
- Two-Phase Proportionating (TPP), 160
- Type Length Value (TLV), 73, 169, 231

- Unicast, 52–3, 56, 65–6, 72–3, 77,
 - 79–82, 118–20, 151–8, 187, 273,
 - 334
- Universal Mobile Telecommunications System (UMTS), 12, 29, 81–9, 175, 178, 191, 197, 209, 228
- Unsolicited Grant Service (UGS),
 - 118–19, 129, 149, 151–2, 157,
 - 161, 163, 243, 248, 254, 272–9,
 - 283, 332–3, 339–42, 344, 346–8,
 - 350, 355–6
- Unsolicited Grant Service-Activity
 - Detection (UGS-AD), 277–8, 283
- Unsolicited Neighbor Advertisement (UNA), 193–5
- Uplink (UL)
 - Uplink Channel Descriptor (UCD), 11,
 - 32, 169, 183, 186, 199, 216–19,
 - 222, 226, 232–3, 358–9
 - Uplink MAP (UL-MAP), 32–3, 57–8,
 - 157–9, 161–2, 187–9, 216, 219,
 - 222, 230, 237, 245, 252, 274,
 - 357
 - Uplink Parameter, 11, 217
 - Uplink Scheduling, 31, 160–2, 164,
 - 177, 263, 274, 276, 279, 281,
 - 305–6
 - Uplink Sub-frame, 160, 245, 357–8
 - Uplink Synchronization, 217, 233
- User Datagram Protocol (UDP), 18, 114,
 - 278, 316, 327, 360
- Variable Bit Rate (VBR), 267, 273,
 - 277
- Vehicular, 8, 13, 28, 91, 126–7,
 - 213–15
- Vertical Handoff Decision Algorithm (VHDA), 196, 209
- Vertical Handover (VHO), 196, 228, 312,
 - 322–3, 332
- Video Coding Experts Group (VCEG),
 - 266
- Video on Demand (VoD), 146
- Visited Network Service Provider (VNSP), 200–4
- Voice-over-Internet Protocol (VoIP), 10,
 - 14–15, 22, 31, 113, 119, 131, 133,
 - 146, 149, 152, 166, 173, 243, 264,
 - 267, 276–9, 306–9, 326, 332, 333,
 - 339
- Vulnerabilities, 25, 28, 43, 58–64, 75,
 - 84–6

- Weighted Fair Allocation, 274
- Weighted Fair Priority Queuing (WFPQ),
 - 275
- Weighted Fair Queuing (WFQ), 161,
 - 274–5, 305
- Weighted Round Robin (WRR), 129, 161,
 - 274
- Weighted Target Cell, 360
- Worldwide Interoperability for Microwave Access (WiMAX)
 - WiMAX Extension to Isolated Research Data networks (WEIRD), 171–3,
 - 177
 - WiMax Forum, 3–20, 26–29, 87–107,
 - 176, 179–209, 231, 241, 244,
 - 258, 261–2, 307
 - WiMAX Mesh (WiMESH), 144,
 - 204–7
 - WiMAX Network Architecture, 3–22,
 - 30, 141, 171, 262
 - WiMax Profiles, 9–10

- WiMAX Roaming Exchange (WRX),
201
- WiMAX Roaming Interface (WRI),
201, 203, 208
- WiMAX/WiFi Access Point (W2-AP),
174–5
- Wired Equivalent Privacy (WEP), 5, 84,
318
- Wireless
 - Wireless Broadband (WiBro),
175, 178
 - Wireless Broadband Access (WBA), 5
 - Wireless Fidelity (WiFi), 5–12, 20, 84,
94, 140, 171–80, 195–6, 200,
202, 205, 241, 244, 261–3, 269,
301, 310–36
 - Wireless LAN technologies (WLAN),
5, 9, 25, 140, 144, 228, 238, 312,
322–5, 331
 - Wireless Metropolitan Area Network
(WMAN), 5, 25–6, 33, 140, 143,
312, 319, 322
 - Wireless Personal Area Network
(WPAN), 5
 - Wireless Wide Area Network
(WWAN), 5, 134
- X Digital Subscriber Line (XDSL),
135
- X.509, 32, 36–8, 40, 49, 60, 63, 65–9,
108, 320–1