

Index

- AAS *see* adaptive antenna system
ABR *see* area border router
ABRO *see* authoritative border router option
access control lists (ACLs) 254, 393–94
access networks 255, 288, 498
access router 162, 255, 284–85, 287, 547–50, 553–54, 557
access security 300–1
access security for SIP-based services 301
access service networks (ASNs) 403, 537–41, 555–56
access service provider 298
ACLs *see* access control lists
ad hoc networks 6, 267, 355, 357, 371–72
ad hoc wireless networks 175, 355
adaptation layer 11, 428–29, 436, 465, 471–72, 478
adaptive antenna system (AAS) 531
address registration option (ARO) 442, 477, 481
address resolution protocol (ARP) 35, 222, 251, 284, 392–93
administrative distance 60, 172, 177, 184–85, 200, 204
ADSL *see* asymmetric digital subscriber line
Advanced Research Projects Agency Network (ARPANET) 2, 187, 491
ALGs *see* application-level gateways
all-IP home network infrastructures 338–39, 341
all-IP optical burst switching networks 517, 519
AMPSs *see* analog mobile phone systems
analog mobile phone systems (AMPSs) 5
anycast messages 169
API *see* application programming interface
application layer 50–52, 65, 119–20, 271, 299, 367, 374, 399, 457, 493
application-level gateways (ALGs) 74
application programming interface (API) 66, 71, 148
application-specific integrated circuits (ASICs) 163, 180, 252
area border router (ABR) 88–89, 209, 212, 214–15, 240–41
ARO *see* address registration option
ARP *see* address resolution protocol
ARPANET *see* Advanced Research Projects Agency Network
ASBR *see* autonomous system boundary router
ASICs *see* application-specific integrated circuits
ASNs *see* access service networks
asymmetric digital subscriber line (ADSL) 314, 494
asynchronous transfer mode (ATM) 148, 152, 186, 254, 511, 534

- ATM *see* asynchronous transfer mode
- attribute value pairs (AVPs) 298
- authoritative border router option (ABRO) 478, 481
- autonomous system boundary router (ASBR) 88–89, 209, 212–15, 242
- AVPs *see* attribute value pairs

- backbone network 255
- backbone router 88–89, 214, 240
- BGP *see* border gateway protocol
- BGP4 internetwork 98
- Bluetooth 6, 317, 324–25
- border gateway protocol (BGP) 3, 82, 89, 98–103, 122, 125, 129, 153, 177, 215–19, 254–55, 259, 261
- broadcast storms 159–60
- burst assembly algorithms 510–11
- burst assembly queues 511, 516, 519

- CALM *see* communication access for land mobiles
- CALM architecture 366–67
- CALM-complaint systems 369
- CALM family of international standards 367, 369
- CALM Internet protocol version 367
- care-of address (CoA) 131, 133–38, 277, 558
- CBT *see* core-based tree
- CDMA *see* code division multiple access
- cellular radio networks 299, 373
- classless interdomain routing 15, 75, 155
- CMIP *see* common management information protocol
- CoA *see* care-of address
- code division multiple access (CDMA) 5, 7, 286
- common management information protocol (CMIP) 509
- Common Object Request Broker Architecture (CORBA) 270, 509
- communication access for land mobiles (CALM) 351, 365, 367–69, 378, 384
- communication application layer 375
- communication network layer 375–77
- communication network topology 355
- communication protocol layers 430
- communication transport layer 375–76
- converged networks 297, 299–301
- convergence sublayer 534, 549, 552–53
- CORBA *see* Common Object Request Broker Architecture
- core-based tree (CBT) 232, 237–39
- cryptographic algorithms 289–90, 292, 457

- DAC *see* destination address compression
- DAD *see* duplicate-address detection
- DAM *see* destination address mode
- data communication network (DCN) 323, 509–10

- data packet aggregation 491, 510
 database description packets 93,
 97
 datagram congestion control
 protocol (DCCP) 116–17
 DCCP *see* datagram congestion
 control protocol
 DCN *see* data communication
 network
 dedicated short-range
 communications (DSRC)
 366, 369, 378
 deep packet inspection (DPI) 11,
 187, 388, 410–11
 denial-of-service (DoS) 296, 390,
 392
 denial-of-service attacks 259, 261
 destination address compression
 (DAC) 448–50, 481
 destination address mode (DAM)
 448–49
 DHCP *see* dynamic host
 configuration protocol
 DIDS *see* distributed intrusion
 detection system
 differentiated services code point
 (DSCP) 447–48
 digital multimedia broadcasting
 (DMB) 313
 digital subscriber line (DSL) 152,
 162, 314
 DIPS *see* distributed intrusion
 prevention system
 distributed algorithms 166,
 181–82
 distributed intrusion detection
 system (DIDS) 402
 distributed intrusion prevention
 system (DIPS) 402
 distributed router architecture
 257
 DMB *see* digital multimedia
 broadcasting
 DNS *see* domain name service
 DNS infrastructure 46
 domain name service (DNS) 28,
 41, 44–46, 61–62, 74, 125,
 148, 220, 396, 429, 494, 539
 DoS *see* denial-of-service
 DPI *see* deep packet inspection
 DSCH *see* differentiated services
 code point
 DSL *see* digital subscriber line
 DSRC *see* dedicated short-range
 communications
 dual-stack routers 53, 56–57
 duplicate-address detection (DAD)
 42, 285, 441–42, 477,
 480–81, 544, 549–51, 557–58
 dynamic host configuration
 protocol (DHCP) 15, 22,
 43–44, 135, 206, 251, 278,
 281, 298–99, 392, 477, 537

 EAP *see* extensible authentication
 protocol
 EGP *see* exterior gateway protocol
 EGRP *see* exterior gateway routing
 protocol
 EIGRP *see* enhanced interior
 gateway routing protocol
 encapsulating security payload
 (ESP) 284, 290–91, 294–96,
 402
 end routing domains (ERD)
 111–12, 115, 122–24, 126–29
 enhanced interior gateway routing
 protocol (EIGRP) 34, 82,
 168, 170–73, 176, 186, 193,
 196–99, 202–6, 217, 244, 249
 ERD *see* end routing domains
 ESP *see* encapsulating security
 payload
 Ethernet networks 160, 186, 242,
 332–34, 461

- Ethernet protocol 496
- Ethernet switches 160, 555
- extended-home network
 - architecture 331
- extended-home networks 343
- extended Internet connectivity 455–56
- extensible authentication protocol (EAP) 536–37
- exterior gateway protocol (EGP) 82, 98, 167, 172, 184, 194, 215, 259
- exterior gateway routing protocol (EGRP) 76, 81, 84, 98

- FCS *see* frame check sequence
- FFD *see* full-function device
- FIB *see* forwarding information base(s)
- field-programmable gate array (FPGA) 252, 411
- file transfer protocol (FTP) 2–3, 74, 148, 245, 534
- fine-grained internetworks, internal 217
- firewalls 163, 186–87, 291–92, 394–96, 411, 456, 495
- forwarding information base(s) (FIB) 238, 249–51
- FPGA *see* field-programmable gate array
- frame check sequence (FCS) 495, 497
- FTP *see* file transfer protocol
- full-function device (FFD) 433–35, 452–53, 467–68

- general packet radio service (GPRS) 6–7, 152, 263, 366, 373, 378
- generic router encapsulation (GRE) 556

- global positioning system (GPS) 340, 353, 473
- GPRS *see* general packet radio service
- GPS *see* global positioning system
- GRE *see* generic router encapsulation

- hash-based addresses (HBAs) 119–20
- HBAs *see* hash-based addresses
- header compression 428, 436–37, 442–43, 471, 478–79
- context-based 443, 447
- header compression techniques 441, 443
- HIDS *see* host intrusion detection system
- high-speed circuit switched data (HSCSD) 6–7
- high-speed downlink packet access (HSDPA) 313, 373
- high-speed packet access (HSPA) 365
- high-speed routers 8, 77, 528
- high-speed uplink packet access (HSUPA) 313
- HIPS *see* host intrusion prevention system
- HLR *see* home location register
- home location register (HLR) 131, 276
- home networks 22, 132, 135–36, 276, 308–10, 314–16, 320–21, 329
- home subscriber server (HSS) 300–1
- host intrusion detection system (HIDS) 401–2
- host intrusion prevention system (HIPS) 401
- HSCSD *see* high-speed circuit switched data

- HSDPA *see* high-speed downlink packet access
- HSPA *see* high-speed packet access
- HSS *see* home subscriber server
- HSUPA *see* high-speed uplink packet access
- IANA *see* Internet Assigned Numbers Authority
- ICMP *see* Internet control message protocol
- IDS *see* intrusion detection system
- IGP *see* interior gateway protocol
- IGRP *see* interior gateway routing protocol
- IMEI *see* international mobile equipment identity
- IMP *see* interface message processor
- IMPI *see* international mobile private identity
- IMS *see* IP multimedia systems
- industrial Ethernet 322, 327, 343–44
- initial service flow (ISF) 556–57
- integrated services digital network (ISDN) 152, 262
- intelligent networks 10, 263, 387, 391, 397
- intelligent transportation systems (ITSs) 349, 369, 378, 384–86, 460
- interface message processor (IMP) 2
- interior gateway protocol (IGP) 34, 82, 125, 167, 172, 184, 206, 208, 217, 259
- interior gateway routing protocol (IGRP) 34, 76, 81–83, 86, 168, 170, 172–73, 185, 193–97, 204, 206, 208
- intermediate routers 225, 236, 482
- international mobile equipment identity (IMEI) 302
- international mobile private identity (IMPI) 301
- international subscriber dialing (ISD) 262
- Internet Assigned Numbers Authority (IANA) 27, 32, 40, 172
- Internet-based communications infrastructure 429
- Internet-based network services 263
- Internet control message protocol (ICMP) 63, 113, 236, 250, 280, 289, 392, 444–45, 479
- Internet-converged services 297
- Internet protocol convergence 534
- Internet protocol television 239, 312
- Internet-wide routing of multicast messages 225
- intrusion detection system (IDS) 393, 398–99, 401
- IP multimedia systems (IMS) 297–98, 300
- IPsec architecture 290, 292
- IPv4 applications 8, 66, 71–73
- IPv4 networks 25–26, 47–49, 54, 58, 60–62, 66–67, 69, 71, 246, 392, 397, 416
- IPv4 routing 54, 75, 82
- IPv4 to IPv6 transition 9, 46–47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73
- IPv6, addressing and routing in 9, 13, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40
- IPv6 applications 25, 58, 69, 550
- IPv6 deployment 11, 529, 547, 551–52, 555
- IPv6 interface ID 31, 42, 45
- IPv6 Internet routing hierarchy 27
- IPv6 network architecture 75–77

- IPv6 network prefix distribution 474
 IPv6 network security 412–13, 415
 IPv6 networks 25–26, 48, 54–57, 61, 65–66, 69, 71, 77–78, 135, 193, 387, 396–97, 416–17, 471
 IPv6 packet encapsulation 58–59
 IPv6 site multihoming 124–29
 ISD *see* international subscriber dialing
 ISDN *see* integrated services digital network
 ISF *see* initial service flow
 ITSS *see* intelligent transportation systems
- labeled optical burst switching (LOBS) 517
 least cost path algorithm 86
 Lightpath architecture 503–4
 link layer routing table 452
 link-state advertisements (LSAs) 86–88, 90, 94–97, 172, 208–15, 240–41, 259–60
 link-state algorithms 81, 86, 171–72, 175–76, 186, 207
 link-state routing algorithm 81, 206
 LLC *see* logical link control
 LOBS *see* labeled optical burst switching
 local area networks 6, 13, 52, 164, 225, 239, 357, 366, 392, 394–95, 496
 logical link control (LLC) 148, 223, 374, 380, 554
 long-term evolution (LTE) 313, 365, 423
 loop-free paths 203
 LSAs *see* link-state advertisements
 LTE *see* long-term evolution
- MAC *see* media access control
 management information base (MIB) 379, 403, 509
 maximum time delay (MTD) 511, 516
 maximum transmission unit (MTU) 55, 176, 194, 429, 471, 479, 497, 543
 media access control (MAC) 12, 29, 40–42, 148, 165–66, 222–24, 364, 431, 433, 464, 468–69, 528–29, 543–45, 548–49, 553
 media-independent handovers (MIHs) 339, 369
 mesh addressing 451–52
 mesh networking 478, 483
 mesh-routing 433
 MIB *see* management information base
 MIHs *see* media-independent handovers
 MIMO *see* multiple input multiple output
 MIPv4 130–35, 283–84
 MIPv6 121, 130–31, 133–36, 282–84, 286, 299, 542, 555, 559
 MIPv6 bootstrapping 298–99
 MIPv6 route optimizations 134, 283
 mobile Internet 421–22
 mobile prefix discovery 284
 mobile WiMAX 531–32, 545–46, 552
 mobile WiMAX architecture 546
 mobile WiMAX MAC layer 532, 534, 549
 mobile WiMAX network architecture 537
 mobile WiMAX technology 8, 528–29
 MOSPF *see* multicast open shortest path first
 OSPF routers 241

- MRP *see* multicast relaying part
 MSM *see* multiple-source multicast
 MTD *see* maximum time delay
 MTU *see* maximum transmission unit
 multicast open shortest path first (MOSPF) 97, 237–38, 240–42
 multicast relaying part (MRP) 552–53
 multicast routers 215, 225, 231–32, 236, 238
 multicast routing algorithms 169
 multicast routing topology 31
 multicast routing trees 221
 multihomed hosts 77, 113–14, 120
 multilink subnet problem 551
 multiple input multiple output (MIMO) 6, 325, 530–31
 multiple-source multicast (MSM) 236
- NAPs *see* network access points
 NAR *see* new access router
 NAS *see* network access server
 NAT *see* network address translation
 NCP *see* network control program
 NDP *see* neighbor discovery protocol
 NDS *see* network domain security
 near-field communication (NFC) 6
 neighbor discovery protocol (NDP) 23, 392, 542–43, 545, 547
 network access points (NAPs) 26, 90, 217, 254, 538
 network access server (NAS) 298–99
 network address translation (NAT) 15, 26, 63–64, 66, 73, 128–29, 187, 387, 392, 395–96, 412, 416, 495
 network congestion 117, 161, 175, 389–90
 network control program (NCP) 2
 network domain security (NDS) 300–1
 network generators 268
 network interface card (NIC) 29–30, 45, 69, 496–97
 network intrusion detection system (NIDS) 401–2
 network intrusion prevention system (NIPS) 401
 network latency 122, 175, 230
 network layer approaches 115, 118
 network layer security 73, 542
 network management system (NMS) 509
 network monitoring 402
 network reference model (NRM) 537–39
 network routing schemes, ad hoc 171
 network service access point (NSAP) 22, 26
 network warfare 422
 networks
 access provider 287
 access service 537–38
 application services 537
 cellular 5, 429
 circuit-switched 162, 504
 cluster tree 435
 connectivity service 539
 convergent 315, 342–43
 heterogeneous 340, 389, 508
 interconnected 87, 161
 international 262
 lossy 480
 low-power 480
 message-switched 169
 multicast routing 235
 multihop 443, 467
 packet-switched 158, 163, 373, 389, 504

- packet-switching 3, 331
- powerline 323
- public service 262
- telecommunications management 508
- new access router (NAR) 285, 287
- next-generation Internet 4
- next header compression (NHC) 447, 450
- NFC *see* near-field communication
- NHC *see* next header compression
- NIC *see* network interface card
- NIDS *see* network intrusion detection system
- NIPS *see* network intrusion prevention system
- NMS *see* network management system
- NRM *see* network reference model
- NSAP *see* network service access point
- OBS *see* optical burst switching
- OBS architecture 504, 518–20
- OBS networks 504, 509, 513, 517–18, 521
- OFDM *see* orthogonal frequency division multiplexing
- OFDMA *see* orthogonal frequency division multiple access
- Open Services Gateway Initiative (OSGI) 334
- open shortest-path-first (OSPF) 3, 34, 82, 86–90, 92, 168, 170–72, 205–10, 212–15, 217, 237–38, 240–42, 249, 259
- open system interconnection (OSI) 116, 147–49, 307, 344, 489–90
- operations support systems (OSS) 508
- optical burst switching (OBS) 11, 490–91, 501, 510, 517, 519–25
- optical fiber 11, 312, 333, 489–90, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512
- optical networks 11, 148, 489–90, 496, 500–1, 503, 505–6, 508, 510, 521–23
- optical transport network (OTN) 498
- orthogonal frequency division multiple access (OFDMA) 8, 528, 530
- orthogonal frequency division multiplexing (OFDM) 6, 326, 530
- OSGI *see* Open Services Gateway Initiative
- OSI *see* open system interconnection
- OSPF *see* open shortest-path-first
- OSPF for IPv6 88–89
- OSPF routing protocol 175
- OSS *see* operations support systems
- OTN *see* optical transport network
- packet aggregation 503, 510–13, 515
- packet delivery 200, 231, 246, 437
- packet filtering 250–51
- packet forwarding 74, 77, 118, 163, 166, 175, 183, 199, 203, 208, 250, 253, 255–57, 358, 475
- packet fragmentation 465, 471, 475, 483, 485
- packet inspection 187, 251, 254, 410, 415
- packet maximum transmission unit (PMTU) 71, 290
- packet sampling 405, 411

- packet scheduler 535, 541
 packet streams 246, 255
 packet-switched connection 265
 packet-switched network
 connections 263
 packet transmission 158, 220
 packets
 advertisement 44, 280
 aggregated 514–16
 beacon 377, 468
 hello 202
 link-state update 95
 unfragmented 441
 PAD *see* peer authorization database
 PAN *see* personal area network
 PAN coordinator 433–35, 442, 468
 PAN identifier 433–34
 PAR *see* previous access router
 PBR *see* policy-based routing
 PDUs *see* protocol data units
 peer authorization database (PAD) 151, 293–94
 personal area network (PAN) 6, 11, 324, 423, 429, 433, 436, 443, 461–62, 464, 468, 470, 477
 personal operating space (POS) 424, 433
 PHS *see* purpose header suppression
 PIM *see* protocol-independent multicasting
 PIO *see* prefix information option
 plain old telephone service (POTS) 262
 PLMNs *see* public land mobile networks
 PMTU *see* packet maximum transmission unit
 policy-based routing (PBR) 10, 244–49, 254–55
 POS *see* personal operating space
 POTS *see* plain old telephone service
 connections 263
 preferential packet routes 246
 prefix information option (PIO) 478
 previous access router (PAR) 285, 287
 protocol convergence 315, 334, 337
 protocol data units (PDUs) 436, 493, 495, 498, 535
 protocol encapsulation 49, 54
 protocol-independent multicasting (PIM) 34, 237–38
 protocol translation 49, 66, 73, 161
 protocols
 all-Internet 307
 application layer 454
 border gateway 3, 82, 153, 215
 communication 2–3, 380
 data communication 1, 3
 framing 497–98
 link-state 86, 175–76, 181, 186, 196, 198
 network 108, 289
 point-to-point 290, 547
 router renumbering 111
 stream control transmission 47, 116, 148, 296
 upper-layer 121, 365, 435
 PSTN *see* public switched telephone network
 public land mobile networks (PLMNs) 7
 public switched telephone network (PSTN) 4, 168–69, 182, 254, 262–64, 310
 purpose header suppression (PHS) 535
 radio access network 287
 radio resource management (RRM) 538, 540–41

- rapid spanning tree protocol (RSTP) 159
- read-only memory (ROM) 424, 454, 457
- real-time control protocol (RTCP) 332
- real-time streaming protocol (RTSP) 332
- reduced-function device (RFD) 433–35, 452–53, 467–68
- regional Internet registries (RIRs) 15, 27, 122–23
- remote job entry (RJE) 2–3
- rendezvous point (RP) 32, 228–30, 239, 539, 555
- request for comment (RFC) 1–4, 15–16, 43–45, 106–9, 138–43, 276–78, 285–86, 290, 297–98, 302–6, 403–5, 461–62
- reverse path broadcasting (RPB) 231, 233–34
- reverse path forwarding (RPF) 231–33, 238
- reverse path multicasting (RPM) 232, 235
- RFC *see* request for comment
- RFD *see* reduced-function device
- RIB *see* routing information base
- RIRs *see* regional Internet registries
- RJE *see* remote job entry
- ROM *see* read-only memory
- route analytics systems 179
- route-poisoning 83, 192
- router advertisement information, host-initiated refresh of 442
- router discovery messages 280
- router performance 252, 254, 258
- router protocols, host standby 206
- router solicitation 43, 148, 286, 481, 543, 545, 551, 557
- routers
 - default-free 27
 - ingress-filtering 134
- leaf 235, 247
- next-hop 105, 107–8
- primary 243
- receiving 191, 215, 259
- rogue 260
- standby 243
- upstream 235
- routing
 - flat-based 473
 - hierarchical-based 473
 - interdomain 3, 261
 - multipath 165, 173
 - source-based multicasting 232
 - static 83
 - triangular 132
- routing information base (RIB) 100–1, 103, 164, 218, 249, 251
- routing information flow 100
- routing information protocol (RIP) 34, 75, 81–83, 168, 170–73, 176, 185, 187–88, 190–98, 205–6, 208, 217–18, 238
- routing protocol algorithms 10
- routing protocols
 - adaptive 86
 - classless 98
 - dynamic IPv4 82
 - energy-aware 473
 - exterior gateway 76
 - hop-by-hop 475
 - interior gateway 76, 168, 193
 - IPv6 82
 - link-state 82, 185, 202
 - multicast 32, 236, 238
 - scalable 195
 - unicast 238
 - vehicular network 358
 - wired network 267
- routing table entry (RTE) 78–79, 85, 190
- RP *see* rendezvous point
- RPB *see* reverse path broadcasting
- RPF *see* reverse path forwarding

- RPM *see* reverse path multicasting
 RRM *see* radio resource management
 RSTP *see* rapid spanning tree protocol
 RTCP *see* real-time control protocol
 RTE *see* routing table entry
 RTSP *see* real-time streaming protocol
- SAC *see* source address compression
 SCTP *see* stream control transmission protocol
 SDH *see* synchronous digital hierarchy
 SDUs *see* service data units
 security parameters index (SPI) 281, 291–96, 410–11
 security policy database (SPD) 290, 292–95
 sensors 343, 353, 355, 388–89, 401–2, 423, 427, 458, 460, 464–67
 service data units (SDUs) 534–35
 service location protocol (SLP) 454
 session initiation protocol (SIP) 300, 312, 332, 340
 short message service (SMS) 6
 simple mail transfer protocol (SMTP) 7, 288, 511
 simple network management protocol (SNMP) 251–52, 288, 402–3, 454, 509
 simple object access protocol (SOAP) 454
 single-source multicast (SSM) 236, 238–39
 SIP *see* session initiation protocol
 SLP *see* service location protocol
 small office home office (SOHO) 162, 254
 smart grids 422, 427, 458
 SMS *see* short message service
 SMTP *see* simple mail transfer protocol
 SNA *see* system network architecture
 SNMP *see* simple network management protocol
 SOAP *see* simple object access protocol
 SOHO *see* small office home office
 source address compression (SAC) 448–49
 spanning tree protocol (STP) 159–60
 SPD *see* security policy database
 SPI *see* security parameters index
 SSM *see* single-source multicast
 star topology 433–34, 468–70
 stateless autoconfiguration 40–41, 44, 542, 544
 stateless header compression 443–45, 447
 STP *see* spanning tree protocol
 stream control transmission protocol (SCTP) 47, 116–17, 148, 296
 switched plane architecture 258
 synchronous digital hierarchy (SDH) 152, 490, 497–99, 503–4, 521
 system network architecture (SNA) 3
- TCP *see* transmission control protocol
 TDD *see* time division duplex
 TDMA *see* time division multiple access
 telecommunications management network (TMN) 508–9
 telephony network 262, 302
 telephony services 315

- Teredo 26, 62–64
 time division duplex (TDD)
 531–32
 time division multiple access
 (TDMA) 5, 326
 TLS *see* transport layer security
 TMN *see* telecommunications
 management network
 transit routing domains (TRD)
 111–12, 115, 122–24,
 126–29
 transmission control protocol (TCP)
 2–3, 46, 51, 67, 101, 116–17,
 148, 151, 209, 217, 362,
 392–93, 444–45, 453–55,
 471
 transmission control protocol/
 Internet protocol 277, 362,
 428, 528
 transport layer security (TLS) 292,
 302, 457
 TRD *see* transit routing domains
 TRPB *see* truncated reverse path
 broadcasting
 truncated reverse path
 broadcasting (TRPB) 231,
 234
 tunneled packets 61, 137
 tunneling techniques 25, 50, 55,
 58–60, 62, 64
 TV services 316
- UDP *see* user datagram protocol
 UMTS *see* universal mobile
 telecommunication systems
 unicast, aggregatable global 22,
 24, 26
 unicast routing 221, 231
 uniform resource identifier (URI)
 3, 455
 uniform resource locators (URLs)
 187
- universal mobile
 telecommunication systems
 (UMTS) 122, 313, 366,
 373–74, 378
 universal serial bus (USB) 323–24
 universal subscriber identity
 module (USIM) 300–2
 upper-layer protocol (ULP) 121,
 365, 435
 URI *see* uniform resource identifier
 URLs *see* uniform resource locators
 USB *see* universal serial bus
 user datagram protocol (UDP) 46,
 51, 67, 148, 174, 280, 375,
 393, 431, 444–46, 453, 455,
 471, 534
 USIM *see* universal subscriber
 identity module
- variable-length subnet masks
 (VLSM) 84, 154, 157–58,
 173, 198, 205
 vehicular communication 351–52,
 354, 381
 vehicular network architecture
 351–53, 355, 357
 virtual local area networks (VLANs)
 52–53, 239, 534
 virtual private networks (VPNs)
 61, 187, 395
 virtual router redundancy protocol
 206
 visitor location register (VLR) 131,
 276
 VLANs *see* virtual local area
 networks
 VLR *see* visitor location register
 VLSM *see* variable-length subnet
 masks
 VPNs *see* virtual private
 networks

- WAN *see* wide area network
- wavelength division multiplexing (WDM) 11, 490, 500–1, 503, 505, 508, 517
- WDM *see* wavelength division multiplexing
- WDM networks 491, 504, 506–9, 517, 521
- packet-switched 504
- wide area network (WAN) 243, 300
- wide wireless area network (WWAN) 356–57
- WiMAX 6–8, 11, 148, 152, 263, 313, 365, 373, 423, 429, 527–30, 532, 542–52, 554–56, 558–60
- WiMAX network architecture 529, 536–39, 541, 555
- wireless communication devices 353, 371
- wireless communications, broadband 7, 528
- wireless Internet 4
- wireless local area networks (WLANs) 6, 357
- wireless personal area networks (WPANs) 6, 423, 436, 461–62, 464, 470
- wireless sensor networks (WSNs) 319, 326, 336, 412, 434, 459, 463–66, 482–87
- wireless vehicular network architecture 350, 383
- WLANs *see* wireless local area networks
- WPANs *see* wireless personal area networks
- WSNs *see* wireless sensor networks
- WWAN *see* wide wireless area network
- ZigBee 317, 326, 340–41, 427, 431, 463, 467

