

# Index

- active scanning, 255
  - Address Resolution Protocol, 18–19
  - addressing, 16
    - ANYCAST, 30
    - Bluetooth, 267
    - IEEE 802.11 family, 250–251
    - in cellular networks, 138–139
    - IP, 27, 139–141
    - IPv4 architecture, 27–28
    - IPv6 architecture, 29–31
    - Multicast, 30
    - overview, 137–138
    - subnetting, (see subnetting)
    - Unicast, 29–30
    - usage, 17
  - Advanced Mobile Phone Service, 50–51
  - Advanced Research Projects Agency, 3
  - All-IP NAM, 328–326
  - American Registry for Internet Numbers, 10
  - AMPS. See Advanced Mobile Phone Service; D-AMPS
  - APNIC. See Asia Pacific Network Information Centre
  - architecture, Internet
    - connectivity as goal, 5
    - features, original architecture, 6
    - features, present-day architecture, 6
    - organization, 6, 8
  - architecture, Universal Mobile Telecommunications System
    - GERAN, 199–200
    - overview, 196–198
    - packet switched core network, 200–201
    - user equipment, 198
    - UTRAN, 199–200
  - ARIN. See American Registry for Internet Numbers
  - ARP. See Address Resolution Protocol
  - ARPA. See Advanced Research Projects Agency
  - ARPANET, 3, 4, 5
  - Asia Pacific Network Information Centre, 10, 11
  - authentication, 152
  - authentication center, 45, 54
  - autonomous systems, 6
  - backbones, 6
  - Bell telephone company, 42, 43
  - Berners-Lee, Tim, 26
  - Bluetooth
    - adaptation protocol, 270–271
    - addressing, 267
    - authentication, 274
    - baseband protocol, 265
    - channels/links, physical, 266, 267
    - encryption, 274, 275
    - errors, correcting, 268–269
    - history, 262, 341–342
    - host control interface, 270
    - Infrared Data Association technology, 279–280
  - IP applications in, 279
  - LC control channel, 269
  - link types, 264
  - LM control channel, 269–270
  - logical link control, 270
  - OBEX, 272
  - overview, 261, 360
  - packet format, 267–268
  - packet types, 268
  - piconet, 265–266, 268
  - profiles, 275, 276
  - profiles, cordless telephony, 277
  - profiles, dialup networking, 277
  - profiles, fax, 278
  - profiles, generic access, 276
  - profiles, generic object exchange, 278
  - profiles, headset, 277
  - profiles, LAN access, 278
  - profiles, serial port, 277
  - profiles, service discovery, 276
  - profiles, synchronization, 278
  - radio protocol, 264–265
  - RFCOMM, 271
  - scatternet, 265–266
  - security, 272–275
  - service discovery protocol, 270–271
  - structure of membership, 360–362
  - system elements, 264
  - technology, 262–264
  - Telephony Control protocol, 272
  - UA user channel, 269
  - UI user channel, 269
  - US user channel, 269
  - vs. IEEE11b, 280
- Bolt Beranek and Newman, 3
  - Border Gateway Protocol, 33–34
  - CCITT. See Consultative Committee on International Telephony and Telegraphy
  - CDMA. See Code Division Multiple Access
  - cdma2000, 60
    - A1 interface, 222
    - A10/A11 interface, 221–222
    - A8/A9 interface, 222
    - AAA services, 214
    - All-IP NAM, 328–336
    - evolution, 326–328
    - home agent, 216
    - IP routing, 216–217
    - IP, application, 228–231
    - IP, mobile, 217–218, 220–221
    - IP, simple, 216–217, 219
    - link access control, 226
    - MAC, 227–228
    - mobility management, 222–225
    - network access development, 325–326
    - network, core, future predictions for, 336–338
    - overview, 213–214
    - packet control function, 216
    - packet data serving node, 215
  - QoS in the CN, 225
  - R-P interface (A10/A11 interface), 221–222
  - radio interface, 325
  - radio network, 216
  - cellular telephony
    - addressing, 138–139
    - core network, 45–46
    - frequency reuse, 47–48
    - handovers, 49
    - mobility, 49–50
    - multiple access, 46–47
    - radio access network, 43–45
    - speech and channel coding, 48–49
  - Cerf, Vincent, 4
  - charging gateway function, 164
  - cHTML, 295
  - CIDR. See Classless Internet Domain Routing
  - Clark, Dave, 4
  - Class field, 17
  - Classless Internet Domain Routing, 29
  - Code Division Multiple Access
    - 2000. (see cdma2000)
    - architecture, 57–58, 119, 121–122
    - async data, 123–125
    - bands, 117–118
    - Base Station, 121, 122
    - channels, 58–59
    - communication equipment, 121
    - data capabilities, 119
    - fax protocol, 123–125
    - functionalities, network, 118
    - inter-working function, 121
    - interfaces, 59
    - IS-41, 59, 60
    - IS-95-A, 119
    - IS-95-B, 119
    - link layer, 126
    - mobile switching center, 121
    - modem, 122
    - network layer, 126
    - overview, 117–119
    - protocol architecture, 122–126
    - protocol stack architecture, 125–126
    - relay layer, 126
    - spread spectrum, 56, 57
    - terminal equipment, 121
    - transport layer, 124
    - wireless Internet access, 127–129
  - confidentiality, 152
  - Consultative Committee on International Telephony and Telegraphy, 13
  - Crocker, Steve, 4
  - D-AMPS, 51–52. See also Advanced Mobile Phone Service
  - datagrams, IP, 17–18. See also routing
  - DHCP. See Dynamic Host Configuration Protocol
  - Diffserv, 17, 151
  - digital AMPS. See D-AMPS
  - direct sequence spread spectrum, 57

- DNS. See Domain Name System  
 Domain Name System, 6, 36. see also naming elements, 37  
 DS field. See Diffserv field  
 DSSS. See direct sequence spread spectrum  
 Dynamic Host Configuration Protocol, 38–39
- e-commerce, 1  
 e-mail, 9  
 EDGE, 60  
 EGPRS-136 HS, 114  
 encryption, 152  
 exchange points, 6, 8  
 exterior gateway protocols, 33–34
- fax transmission  
   GSM, using, 79–80  
   via CDMA, 131  
 Federal Communications Commission, 43  
 fragmentation, 16, 17–18  
 frequency hopping, 56  
 ftp, 25, 26
- gaming, 314  
 General Packet Radio Service, 60  
   architecture, network, 162, 163, 164, 165  
   architecture, protocol. (see protocol, architecture, GPRS)  
   border gateway, 164  
   charging gateway function, 164  
   gateway GPRS support note, 163  
   GRX, 187–188  
   home location register, 164  
   MM-STANDBY state, 181–182  
   mobility management, 169–171  
   overview, 161  
   packet control unit, 165  
   radio functions. (see radio functions, GPRS)  
   roaming architecture, 185–187  
   serving mode, 163  
   STANDBY state, 169  
   Tunneling Protocol, 166, 167–169  
   vs. GSM CS dataq, 161–162  
 Global System for Mobile Communications. See also IS-136 networks  
   architecture, 63–65  
   data services on signaling/broadcast channels. (see SMS)  
   fax transmission, 79–80  
   interfaces, 54, 55  
   Internet connection, 80–82  
   ISDN, relationship between, 76–77  
   mobile application part, 55  
   overview, 63  
   packet network access, 74–77, 79  
   standards, 52–53  
   subscriber identity module, 55  
   topology, 53–54  
   traffic channel data services. (see traffic channel data services, GSM)  
 GPRS. See General Packet Radio Service  
 GPRS roaming eXchange, 187–188  
 GPRS Tunneling Protocol, 166, 167–169  
   Universal Mobile Telecommunications System, use in, 205–207  
 GRX. See GPRS roaming eXchange  
 GSM. See Global System for Mobile Communications  
 GTP. See GPRS Tunneling Protocol
- handover, 146–148  
 healthcare industry, use of mobile technology in, 315  
 Hello packets, 33  
 high-speed circuit switched data  
   air interface, 84–85  
   call setup, 84  
   configuration change, 84  
   connection setup, 83  
   overview, 82–83  
   resource downgrading, 84  
   resource upgrading, 84  
 home location register, 45  
 HSCSD. See high-speed circuit switched data  
 HTTP. See Hypertext Transfer Protocol  
 Hypertext Transfer Protocol  
   overview, 26  
   properties, 26, 27  
   URI concept, 27  
   usage, 10, 27
- I-Mode  
   business objectives, 292–293  
   FOMA, 296  
   network architecture, 292  
   protocol stack, 293–294  
   security, 294–295  
   Wireless Application Protocol, relationship between, 292–296  
 ICMP. See Internet Control Message Protocol  
 IEEE 802.11  
   802.11a, 239–240, 247  
   802.11b, 238–239, 246–247  
   access points, 242  
   addressing, 250–251  
   association, 256  
   authentication, 256  
   compatibility, 247  
   contention resolution, 249–250  
   data transfer, 256  
   distributed station services, 253–254  
   distributed system, 243  
   entities, in family, 241  
   ESS, 243  
   ESS, relationship between, 257  
   family operations, 254–255  
   features, 237–238  
   layer, physical, 244, 245–246  
   medium access control layer, 248  
   overview of family, 233–235, 236  
   power management, 252–253  
   protocol model, 236–237  
   reassociation, 256–260  
   reliability, 251  
   roaming, 243  
   robustness, 251  
   scanning, 255–256  
   security, 251–252  
   service set, independent basic, 241–242  
   standards bodies, 357–360  
   station services, 253  
   synchronization, 255–256  
   vs. Bluetooth, 280  
   WLAN systems, developing, 257–259  
 IETF, 356–357  
 IMP. See Interface Message Processor  
 infotainment, 300  
 Infrared Data Association, 279  
 Inst-Serv, 151  
 integrity checking, 152  
 Inter System-Inter System, 33  
 Interface Message Processor, 3–4  
 international mobile equipment identity, 138  
 international mobile station identifier, 138  
 International Organization for Standardization, 13  
 Internet  
   applications, 8, 9  
   architecture. (see architecture, Internet)  
   as networks, collection of, 3  
   definition, 2  
   future predictions, 11  
   growth, 2–3, 5  
   history, 3–5  
   Internet2. (see Internet2)  
   mobile, surfing, 309–312  
   model. (see Internet model)  
   organization, 6, 8  
   origins, 2, 3–4  
   registries. (see registries)  
   speed, 5  
   wireless access, 127–129  
 Internet Control Message Protocol, 18  
 Internet model, 15–16, 16. See also Internet Protocol  
 Internet Protocol. See also IPv4; IPv6  
   addressing. (see addressing)  
   components of network, 1  
   datagram, relationship between, 17. (see also datagrams, IP)  
   economic impact, 1  
   fragmentation. (see fragmentation)  
   header compression, 197  
   in Universal Mobile Telecommunications System. (see Universal Mobile Telecommunications System)  
   infrastructure, 157, 158  
   location services, 311–312  
   mobility. (see mobility issues)  
   presence services, 309  
   radio links. (see radio links)  
   RFC definition, 16  
   services. (see services, IP)  
   session and transport, 154–157  
   transport example, 182, 184, 185  
   vs. LANs, (235)  
   wireless networks, role in, 135–137  
 Internet service providers, 6  
 Internet2, 11, 12  
 Interworking Function, 45  
 Intranets, 130  
 IP Payload Compression Protocol, 142

- IPComp. See IP Payload Compression Protocol
- IPv4
  - addressing architecture, 27–28
  - mobile hosts, 35
- IPv6
  - addressing architecture, 29–31
  - mobile hosts, 35
- IS-136 HS network, 113–114
- IS-136 networks
  - analog circuit switched data services, 106–107
  - circuit switched data services,
    - overview of, 105–106
  - data services model, 106
  - digital circuit switched data services, 107–109, 111, 113
  - digital standards, 93–94
  - EGPRS-136 HS, 114
  - IS-136 HS, 113–114
  - IS-136+, 113
  - layer 1, 97, 98–99
  - layer 2, 97, 99–100
  - layer 3, 97, 100–103
  - overview, 93–94, 95–97
  - protocol stack, 108–109
  - teleservices, definitions, 103–104
  - teleservices, delivery, 104–105
- IS-136+ network, 113
- ISPs. See Internet service providers
- Kahn, Robert, 4
- key management, 152
- Kirstein, Peter, 4
- Kleinrock, Leonard, 3
- L2R. See Layer 2 Relay protocol
- LANs. See local area networks
- Layer 2 Relay protocol, 71–73
- Length field, 17
- Licklider, J.C.R., 3
- lifestyle management, 300
- Lincoln Laboratory, 3
- Little-Endian format, 267
- local area networks
  - history of wireless, 235–236
  - IEEE family. (see IEEE 802.11)
  - origins, 4
  - secure corporate, 130, 313–314
  - vs. IP, 235
- localized mobility management mechanisms, 146
- M-commerce, 312
- MAP. See mobile application part
- Merrill, Thomas, 3
- MILNET, 5
- MM-STANDBY state, 181–182
- mobile application part, 55
- mobile hosts. See also IS-136 networks; wireless networks
  - first-generation networks, 50–52
  - GSM. (see Global System for Mobile Communications)
  - issues of mobility. (see mobility issues)
  - network requirements, 49
  - nomadic, 34
  - routing, 34, 35–36
  - seamless, 34
  - second-generation networks, 52–60
  - third-generation networks, 60–61
  - Universal Mobile Telecommunications System. (see Universal Mobile Telecommunications System)
- Mobile Station Application Environment, 304
- mobile station ISDN number, 138
- mobile switching centers, 45
- mobility issues
  - access independence, 148–149
  - dormancy, 149, 150
  - handover, 146–148
  - idleness, 145–146
  - overview, 144–145
  - paging, 149, 150
- multimedia messaging, 305–308, 308–309
- naming. See also Domain Name System
  - overview of principles, 36, 37
  - resolvers, 37
  - subdomains, 37
- National Science Foundation Network, 5
- network access points, 6
- network service access point identifier, 173
- non-repudiation, 152
- NSAPI. See network service access point identifier
- NSFNET. See National Science Foundation Network
- OBEX, 272
- Open Mobile Alliance, 363–363
- Open Systems Interconnection, 13–14, 15
- orthogonal frequency division multiplexing, 247
- OSI. See Open Systems Interconnection
- OSPF, 33
- packet control unit, 165
- passive scanning, 255
- PCS networks. See IS-136 networks
- personal area networks, 135–136
- personal communications service networks, 93. See also IS-136 networks
- Ping, 18
- presence services, 309
- protocol, architecture, GPRS
  - Gb interface, 174
  - LLC layer, 174–175
  - mobility management, 169–171
  - overview, 166
  - session management, 171–172
  - signaling plane, 167
  - subnetwork dependent convergence protocol, 172–174
  - Tunneling Protocol, 166, 167–169
  - user plane, 166–167
- QoS, 150–152
- radio functions, GPRS
  - channels, physical and logical, 175–177
  - coding schemes, channel, 177
  - MAC layer, 177, 178–182
  - overview, 175
  - RLC layer, 177, 178–182
- radio link protocol, 73–74
- radio links
  - delays, 143, 144
  - efficiency, 142–143
  - errors, 143, 144
  - GPRS. (see radio functions, GPRS)
  - overview, 141–142
- rate adaptation (RA) services, GSM. See traffic channel data services, GSM
- registries, 10, 11
- Reseaux IP Europeans, 10, 11
- residual excited linear coding, 48–49
- Resource Reservation Protocol, 151
- RFCOMM, 271
- RIP, 33
- RIPE. See Reseaux IP Europeans
- RIPv2, 33
- RLP. See radio link protocol
- roaming, 136
- Roberts, Lawrence, 3
- routing
  - distance vector, 32
  - dynamic protocols, 31
  - for mobile hosts. (see mobile hosts)
  - gateway protocols, 31
  - link state, 32–33
  - overview, 31
- RSVP. See Resource Reservation Protocol
- SAPI. See service access point identifier
- SCTP. See Stream Control Transmission Protocol
- security
  - in IEEE 802.11 family, 251–252
  - in Universal Mobile Telecommunications System, 209, 210
  - in wireless IP networks, 153–154
  - in wireless networks, 153
  - overview, 152, 153
  - terminology, 152
- security association, 152
- service access point identifier, 173
- services, IP, 157, 158
- session
  - control/ownership, 156–157
  - definition, 154
  - vs. transport, 155, 156
- Session Initiation Protocol, 136
- SGSN. See Subnetwork Dependent Data Convergence Protocol
- short message delivery point-to-point, 104, 303
- shortest path first algorithms, 32
- SIM. See subscriber identity module
- SIP. See Session Initiation Protocol
- SMS
  - applications, 85
  - cell broadcast, 88–89
  - overview, 85
  - point-to-point, 85–88
  - SGSN, connection to, 164
  - via CDMA, 129–130
- SMS-GMSC, 164
- SMS-IW MSC, 164

- SNDCP. See subnetwork dependent convergence protocol  
 SPF algorithms. See shortest path first algorithms  
 standards bodies  
   3GPP, 348–352  
   3GPP2, 352–354  
   Bluetooth. (see Bluetooth)  
   for Internet, 354–356  
   IEEE, 357–360  
   overview, 347  
 Stream Control Transmission Protocol  
   fields, 25  
   overview, 23  
   packet format, 24  
   transport service functions, 23, 24  
 subdomains, 37  
 subnetting, 6  
   addressing, 28  
   static, 28  
   variable-length, 28–29  
 subnetwork dependent convergence protocol, 172–174  
 Subnetwork Dependent Data Convergence Protocol, 166  
 subscriber identity module, 54, 55, 138  
  
 TCP. See Transmission Control Protocol  
 TCP/IP. See Transmission Control Protocol/Internet Protocol  
 TDMA networks. See IS-136 networks  
 telematics, 315  
 telemetry, 314–315  
 Teleservice Segmentation and Reassembly protocol, 104  
 Telnet, 25, 26  
 Time-to-live values, 18  
 TOS. See Type of Service field  
 Traceroute, 18  
 traffic channel data services, GSM  
   bearer services, 66–69  
   overview, 65–66  
   rate adaptation functions, 69–71  
 Transmission Control Protocol  
   basic data transfer, 20  
   connections, 20  
   design, 19–20  
   flow control, 20  
   header, 21, 22  
   multiplexing, 20  
   reliability, 20  
   RFC definition, 19  
   usage on Internet today, 22  
 Transmission Control Protocol/Internet Protocol, 4  
   adoption as defense standard, 5  
 transport  
   control/ownership, 156–157  
   definition, 155  
   vs. session, 155, 156  
 Type of Service field, 17  
  
 UDP. See User Datagram Protocol  
 Uniform Resource Locator  
   concept, 27  
 Universal Mobile Telecommunications System  
   architecture. (see architecture, Universal Mobile Telecommunications System)  
   attach procedures, 208  
   detach procedures, 208  
   features, 195–196  
   history, 193  
   Iu interface, 202–203  
   Iub interface, 203  
   Iur interface, 203  
   layers, 203  
   mobility management, 207–210  
   multimedia, 211  
   overview, 191–192  
   paging, 198  
   requirements, 195  
   roaming, 198  
   security, 209, 210  
   session management, 210–211  
   signaling plane, 205  
   spectrum, 193–195  
   tunneling protocol, 205–207  
   user plane, 204–205  
   vision, 192–193  
 User Data Protocol  
   destination port, 22  
   overview, 22  
   source port, 22  
   UDP checksum header, 23  
   UDP length header, 23  
 User Datagram Protocol, 4  
  
 visitor location center, 45  
  
 WMAP. See Wireless Application Protocol  
 WCDMA. See wideband code division multiple access  
 WECA. See Wireless Ethernet Compatibility Alliance  
 wideband code division multiple access, 60  
 Wireless Application Protocol, 131–132  
   architecture overview, 284–285  
   configurations, samples, 289  
   I-Mode, relationship between. (see I-Mode)  
   markup language, 290–291  
   multimedia messaging service, 291  
   network elements, 288–289  
   origins, 283  
   push services, 292  
   telephony applications, 291  
   transport layer security, 286  
   usage, 283, 284  
   version 2.0, 296  
  
 WDP, 285–286  
   wireless application environment, 287  
   wireless session protocol, 287  
   wireless transaction protocol, 286–287  
 Wireless Datagram Profile, 285–286  
 Wireless Ethernet Compatibility Alliance, 239  
 Wireless Markup Language, 131–132  
 wireless networks. See also cellular telephony; mobile hosts  
   3GPP RAN evolution, 320–322  
   3GPP Release 4 standard, 322–323  
   3GPP Release 5 standard, 323–324  
   3GPP2 Standard evolution, overview, 324–325  
   applications, 319–320  
   applications, future, 300–301  
   enhanced voice service, 302–303  
   evolution of, 318–319  
   gaming, 314  
   growth in commercial use, 41  
   historical overview, 42–43  
   Internet access, via CDMA, 127–129  
   IP, relationship between, 135–137  
   M-commerce, 312  
   messaging, evolution of, 303–304  
   mobile office, 312–313  
   mobility issues. (see mobility issues)  
   multimedia messaging. (see multimedia messaging)  
   multipurpose devices, 301–302  
   penetration rates, 41  
   roaming. (see roaming)  
   security issues. (see security)  
   services offered, 41–42  
   services, future, 300–301  
   telematics, 315  
   telemetry, 314–315  
   text messages, 303  
 Wireless Personal Area Network, 141–142  
 Wireless Wide Area Networks, 141  
 WLAN systems, 136  
   deployment of IEEE 802.11, 257–259  
   evolution, 338–340  
   in 3G, 341  
   operators, 340, 341  
 World Wide Web  
   concept, 9  
   growth in use, 9  
   overview, 9, 10  
   principles of design, 9, 10  
 WPAN. See Wireless Personal Area Network  
 WWAN. See Wireless Wide Area Networks  
  
 XHTML, 295