Index

Numerics
7200 Series routers, 15
800 Series routers, 11
8-N-1 connections, 91

A
AAA (authentication, authorization, and auditing), 36
access control management, 400–401
configuring
  access modes/interfaces, 404
  enabling, 407–418
CS-ACS, 405–407
protocols, 402
  RADIUS, 403
  TACACS, 402–403
servers, 404
AAL5 (ATM adaptation layer), 255
access
cable, WAN, 17
control, 400–401
DSLAM, 246
modes, AAA, 404
remote
  Cisco 1700 Series, 12
  Cisco 2500 Series, 13
  Cisco 2600 Series, 13
  Cisco 3600 Series, 13–15
  VPN 3000 Concentrator Series, 15
WAN, 37–40
requirements, 35
TACACS, 402
WAN, wireless, 18
Access Server lines, Cisco AS5000 Series router, 58–60
access-group command, 443
accountability, NAT, 366
accounting. See also AAA
  commands, 416
  security, 401
adaptation, rate, 168
adaptive-shaping been command, 303
additional information, defining interfaces, 164–168
Address field, PPP, 117
addresses
  definitions, 373
  IP
  characteristics of NAT, 366–373
  scaling with NAT, 361
  ISDN parameters, 162–164
  NAT, 372
  substitute, 368
administrative distances, 321
ADSL (asymmetric DSL), 245–250
aggregation
  BoD, 178
  Multilink PPP, 179
algorithms
  encryption, 431–433
  Diffie-Hellman key exchange, 434–435
  ESP, 436
  hashing, 433
  transport/tunnel modes, 436–439
  Van Jacobson, 350
analog calls, PRI incoming on digital modems, 202–203
analog modems, 40
ANSI LMIs, 278
applications, 34
architecture
  PPP, 115
  PPPoE, 252–255
arguments
  how-to-track, 417
  rotary, 379
  stop-only, 418
  wait-start, 417
assemblies
  connections, 66–68
  T1 framing, 196
asymmetric DSL (ADSL), 245–250
async dynamic address command, 118
async mode interactive command, 97
asynchronous configuration, 94
asynchronous dialup (analog modems), 40
asynchronous ports, 68
Asynchronous Transfer Mode (ATM), 37
AT commands, 98–99
ATM (Asynchronous Transfer Mode), 37
encapsulation, 255
PPPoE, 255. See also PPPoE
ATM adaptation layer 5 (AAL5), 255
authentication, 401. See also AAA
  commands, 409
    aaa authentication arap command, 411
    aaa authentication nasi command, 413
    aaa authentication ppp command, 412
LCP, 130
LEAP, 236
MAC, 236
PAP, 119–122
PPP, 119
  CHAP, 120–122
  PAP, 119
RADIUS, 402
wireless networks, 236
authentication, authorization, and accounting. See AAA
authorization, aaa authorization command, 414
authorization, 401. See also AAA
autoconfiguration, modems, 99–100
availability, of services, 33
B
  B channels, 39, 178
back office services, 222
backups, 35
delay 5 60 command, 319
dial, 318–320
  primary link failures, 318–319
  primary link overload, 319
Backward Explicit Congestion Notification (BECN), 300–301
bandwidth
  connections. See connections
equipment selection, 32
Multilink PPP, 179
bandwidth 38 command, 96
Bandwidth on Demand (BoD), 34, 178
Bandwidth Reservation Protocol (BRP), 20
Basic Rate Interface (BRI), 39, 146–162
Be (excessive burst), 300
bearer channel, 146
BECN (Backward Explicit Congestion Notification), 300, 301
BoD (Bandwidth on Demand), 34, 178
BRI (Basic Rate Interface), 39, 146–162
bridges, PPPoE, 252–255
broadband connections, 220–224
cable options, 221
CM initialization, 224–229
type of orbits, 230
BRP (Bandwidth Reservation Protocol), 20
Cable modem (CM), 39, 222
- broadband implementations, 221
- connection options, 68
- initialization, 224–229
- WAN, 17
Cable modem termination system (CMTS), 222
- cables, 66–68, 146
- call termination, 90
- callback
  - LCP, 131
  - PPP Callback configuration, 132
  - PPP Callback option, 131
CAP (Carrierless Amplitude Phase), 248
- cast type (subinterfaces), 282
CBWFQ (Class-Based Weighted Fair Queuing), 332, 338–339
- class-map command, 339–341
- link compression, 348
- LLQ verification, 345–347
- payload compression, 349
- policy-map command, 345
- service-policy command, 341–345
- TCP header compression, 350–351
Central-site installations, 18, 29–30
Central-site routers, selection of, 56–61
Channels, BRI, 146–162
CHAP (Challenge Handshake Access Protocol), 120, 122
Character-based access modes, 404
Characteristics of Frame Relay, configuring, 285, 286, 287
Chat scripts, 101–103
CIR (committed information rate), 38
Cisco 1700 Series router, 12, 62
Cisco 2500 Series router, 13, 63
Cisco 2600 Series router, 13, 64
Cisco 3600 Series router, 13–15, 57–58
Cisco 700 Series routers, PAT (Port Address Translation), 382–384
Cisco 7200 Series router, 60
Cisco 800 Series router, 65
Cisco Aironet 1200 WAP, 234
Cisco AS5000 Series router, 58–60
Cisco LMI, 276
Cisco Local Director, 371
Cisco Router Web Setup (CRWS), 257
Cisco Secure Access Control Server (CS-ACS), 405–407
Class command, 304
Class-Based Weighted Fair Queuing (CBWFQ), 332, 338–339
- class-map command, 339–341
- link compression, 348
- LLQ verification, 345–347
- payload compression, 349
- policy-map command, 345
- service-policy command, 341–345
- TCP header compression, 350–351
Classification, QoS, 20
Clearing, NAT translation, 382
Clients, VPNs, 41
CM (cable modem), 39, 222
- broadband implementations, 221
- connection options, 68
- initialization, 224–229
- WAN, 17
CMTS (cable modem termination system), 222
Coexistence, POTS DSL, 247
Commands
- access-group, 443
- adaptive-shaping, 303
- async dynamic address, 118
- async mode interactive, 97
- authentication, 409
  - aaa authentication arap, 411
  - aaa authentication nasi, 413
  - aaa authentication ppp, 412
- authorization, 414
- backup delay 5 60, 319
- bandwidth 38, 96
- class, 304
- class-map, 339–341
- controller t1 0/0, 201
- debug, 135
  - debug atm events, 263
  - debug dialer, 206
  - debug frame-relay lmi, 288
  - debug ip nat, 381
  - debug isdn q921, 207
  - debug isdn q931, 155, 208
  - debug ppp multilink, 206
configuration

**dialer**
- dialer callback-secure, 132
- dialer hold-queue, 133
- dialer idle-timeout, 164
- dialer load-threshold, 134, 179

**encapsulation ppp**, 96

**flowcontrol hardware**, 98

**frame-relay**
- frame-relay adaptive-shaping becn, 303
- frame-relay be, 303
- frame-relay bec, 304
- frame-relay minicir, 304
- frame-relay traffic-shaping, 300

**interface serial 0.1**, 284

**ip**
- ip nat inside, 375
- ip nat outside, 375
- ip porthandler, 383
- ip tcp header-compression passive, 96
- ip unnumbered, 118
- ip unnumbered Ethernet0, 96

**IPX routing**, 164

**isdn incoming-voice modem**, 202

**login local**, 98

**map-class**, 303

**modem**
- modem autoconfigure, 100
- modem InOut, 98

**no cdp enable**, 97

**peer default ip address pool remaddpool**, 97

**physical-layer async**, 95–96

**policy-map**, 345

**ppp**
- ppp authentication chap, 97
- ppp callback accept, 132
- ppp callback request, 132
- ppp context, 117
- ppp multilink, 134

**queuing**, 353

**service-policy**, 341–345

**set ip pat on**, 383

**show**, 69
- show atm interface 0, 263
- show cable modem, 224
- show controller t1, 198

**start-chap**, 102

**variance 4**, 320

**committed information rate (CIR)**, 38

**company sites, requirements**, 18

**components, PPP**, 116

**compression**, 20

- LCP, 131
- link, 348
- payloads, 349
- PPP, 133
- TCP header, 350–351

**configuration**

**AAA**
- access modes/interfaces, 404
- enabling, 407–418

**access**
- cable, WAN, 17
- control, 400–401
- DSLAM, 246
- modes, AAA, 404
- remote, 12–15, 37–40
- requirements, 35
- TACACS, 402
- WAN, wireless, 18

**addresses**
- definitions, 373
- IP, 361, 366–373
- ISDN parameters, 162–164
- NAT, 372
- substitute, 368

**autoconfiguration**, 99

**basic asynchronous**, 94

**cable modem (CM)**
configuration

broadband implementations, 221
connection options, 68
initialization, 224–229
CBWFQ, 332, 338–339
class-map command, 339–341
link compression, 348
LLQ verification, 345–347
payload compression, 349
policy-map command, 345
service-policy command, 341–345
TCP header compression, 350–351
WAN, 17
CRWS, 257
DDR, 178
dialer profiles, 181–184
ML-PPP, 180
optimizing, 178–180
rotary groups, 184–185
snapshot routing, 185–187
DSL
ADSL, 248–250
CAP modulation, 248
Cisco 827 Series routers, 256–260
connection options, 68
DMT, 249
limitations of, 247
overview of, 245–246
PPP, 225. See also PPPoE
POTS coexistence, 247
SDSL, 251–252
troubleshooting, 260–265
dial backup, 319
Frame Relay, 283–292
characteristics, 285, 286, 287
encapsulation, 284
interface selection, 284
protocol-specific parameters, 285
subinterfaces, 283
traffic shaping, 303–307
verifying, 287, 288, 289
IPSec, 439–447
layers, 200
modems (AT commands), 98–99
NAT, 259, 373–384
PPPoE, 225. See also PPPoE
POTS coexistence, 247
SDSL, 251–252
troubleshooting, 260–265
DLCI, 38
DSL, 39, 245–246
Cisco 827 Series routers, 256–260
troubleshooting, 260–265
ISDN
BRI, 146
E1 framing (PRI), 199
installing PRI, 194–195
Layer 2, 151
Layer 3, 153
layers (PRI), 200
PRI, 194
T1 framing (PRI), 195–198
troubleshooting Multilink PPP, 204–208
modems, 88–90
Multilink PPP, 179
PPP, components, 116
reverse Telnet, 90–91
security, technology assessment, 40–42
UTP, 146
WAN, 16–18. See also WAN
conservation, NAT, 367
Control field, PPP, 117
controller t1 0/0 command, 201
cost of services, 34
CQ (custom queuing), 300
CRWS (Cisco Router Web Setup), 257
crypto maps, 443
CS-ACS (Cisco Secure Access Control Server), 405–407

**customization**

AAA

- access modes/interfaces, 404
- enabling, 407–418

**access**

- cable, WAN, 17
- control, 400–401
- DSLAM, 246
- modes, AAA, 404
- remote, 12–15, 37–40
- requirements, 35
- TACACS, 402
- WAN, wireless, 18

**addresses**

- definitions, 373
- IP, 361, 366–373
- ISDN parameters, 162–164
- NAT, 372
- substitute, 368

**autoconfiguration**, 99

**basic asynchronous**, 94

**cable modem (CM)**

- broadband implementations, 221
- connection options, 68
- initialization, 224–229

**CBWFQ**, 332, 338–339

- class-map command, 339–341
- link compression, 348
- LLQ verification, 343–347
- payload compression, 349
- policy-map command, 345
- service-policy command, 341–345
- TCP header compression, 350–351
- WAN, 17

**CRWS**, 257

**DDR**, 178

- dialer profiles, 181–184
- ML-PPP, 180
- optimizing, 178–180
- rotary groups, 184–185
- snapshot routing, 185–187

**DSL**

- ADSL, 248–250
- CAP modulation, 248
- Cisco 827 Series routers, 256–260
- connection options, 68
- DMT, 249

**debug atm events command**

- limitations of, 247
- overview of, 245–246
- PPPoE, 225. See also PPPoE
- POTS coexistence, 247
- SDSL, 251–252
- troubleshooting, 260–265
- dial backup, 319
- Frame Relay, 283–292
- characteristics, 285, 286, 287
- encapsulation, 284
- interface selection, 284
- protocol-specific parameters, 285
- subinterfaces, 283
- traffic shaping, 303–307
- verifying, 287, 288, 289

**IPSec**, 439–447

- layers, 200
- modems (AT commands), 98–99
- NAT, 259, 373–384
- PPP callback, 132
- PRI, 194–202
- custom queuing (CQ), 300

**D**

- D channel, 146
- D4 framing (SuperFrame), 196
- Data Link layers, troubleshooting, 262
- Data Over Cable Service Interface Specification (DOCSIS), 221
- data traffic, splitting, 246
- databases
  - modemcap, 100–101
  - RDBMS, 401
- data-link connection identifier (DLCI), 38
- DCE (data circuit-terminating equipment), 88, 90, 275

**DDR** (dial-on-demand routing), 34

- configuring, 178
- dialer profiles, 181–184
- ML-PPP, 180
- optimizing, 178–180
- rotary groups, 184–185
- snapshot routing, 185–187

**DE** (Discard Eligible), 302

- debug atm events command, 263
debug commands

debug dialer command, 206
debug frame-relay lmi command, 290
debug ip nat command, 381
debug isdn q921 command, 207
debug isdn q931 command, 155, 208
debug ppp authentication command, 135
dedicated sessions, PPP, 117
definition
AAA, 401
interfaces, 162–168
detection, down conditions, 318
devices, Frame Relay, 278
dial backup, 318–320
primary link failures, 318–319
primary link overload, 319
dialer commands
dialer callback-secure command, 132
dialer hold-queue command, 133
dialer idle-timeout command, 164
dialer load-threshold command, 134, 179
dialer map statement, 181
dialer pools, 182
dialer profiles, 181–182, 184
dialer-map statement, 131
dial-on-demand routing (DDR), 34
dial-up connections, 117. See also connections
Diffie–Hellman key exchange, 434–435
digital modems, PRI incoming analog calls, 202–203. See also connections; modems
Digital Subscriber Line. See DSL
dialer profiles, DDR, 181–184
Discard Eligible (DE), 302
discovery
modems, 100
sessions (PPPoE), 253
Discrete MultiTone (DMT), 248, 249
displaying. See viewing
DLCI (data-link connection identifier), 38, 275
DMT (Discrete MultiTone), 248, 249
DOCSIS (Data Over Cable Service Interface Specification), 221
documents, MultiFrame, 199
down condition, detecting, 318
dynamic redundancy, 320
DSIR pins, 89
DSL (Digital Subscriber Line), 39, 241
ADSL, 248–250
CAP modulation, 248
Cisco 827 Series routers, 256–260
connection options, 68
DMT, 249
limitations of, 247
overview of, 245–246
PPPoE, 225. See also PPPoE
POTS coexistence, 247
SDSL, 251–252
troubleshooting, 260–265
DSLAM (DASL access multiplexer), 246, 264
DTE (data terminal equipment), 88, 90, 277
DTR pins, 89
duplex values, troubleshooting, 72
Dynamic Packet Transfer (DPT), 37
encryption, 36
algorithms, 431–433
Diffie–Hellman key exchange, 434–435
ESP, 436
hashing, 433
transport/tunnel modes, 436–439
equipment selection, 24, 32–36
cabling, 66–68
E1 framing, PRI, 199
dedicated sessions, PPP, 117
defining
AAA, 401
interaces, 162–168
detection, down conditions, 318
devices, Frame Relay, 278
dial backup, 318–320
primary link failures, 318–319
primary link overload, 319
dialer commands
dialer callback-secure command, 132
dialer hold-queue command, 133
dialer idle-timeout command, 164
dialer load-threshold command, 134, 179
dialer map statement, 181
dialer pools, 182
dialer profiles, 181–182, 184
dialer-map statement, 131
dial-on-demand routing (DDR), 34
dial-up connections, 117. See also connections
Diffie–Hellman key exchange, 434–435
digital modems, PRI incoming analog calls, 202–203. See also connections; modems
Digital Subscriber Line. See DSL
dialer profiles, DDR, 181–184
Discard Eligible (DE), 302
discovery
modems, 100
sessions (PPPoE), 253
Discrete MultiTone (DMT), 248, 249
displaying. See viewing
DLCI (data-link connection identifier), 38, 275
DMT (Discrete MultiTone), 248, 249
DOCSIS (Data Over Cable Service Interface Specification), 221
documents, MultiFrame, 199
down condition, detecting, 318
Dynamic Packet Transfer (DPT), 37
Product Selection Tool, 56
WAN, 55
   central-site routers, 56–61
   ROBO, 62–64
   SOHO, 65–66
ESF (Extended SuperFrame), 196
ESP (Encapsulating Security Payload), 436
Ethernet, PPPoE, 252–255
excessive burst (Be), 300
expanding networks, 400–401
Extended SuperFrame (ESF), 196

F

Fair Queuing, 334
fast-switching paths, Frame Relay traffic shaping, 300–302
FECN (Forward Explicit Congestion Notification), 301
fields, PPP, 117
first calls, 151
Flag field, PPP, 117
flexibility of NAT, 367
floating static routes, 321
flowcontrol hardware command, 98
formats, frames, 117
Forward Explicit Congestion Notification (FECN), 301
Frame Relay, 38
   commands. See frame-relay commands configuring, 283–292
      characteristics, 285, 286, 287
      encapsulation, 284
      interface, 284
      protocol-specific parameters, 285
      subinterfaces, 283
   connection options, 66
   DCE, 277
devices, 278
   DLCIs, 277
   DTE, 277
   LMI, 278
   subinterfaces, 282–283
topologies, 279
traffic shaping, 297, 300–307
verifying configuration, 287, 289–290
   show frame-relay lmi comm, 289
   show frame-relay map comm, 291

G

G.lite ADSL, 250
gateway-to-gatekeeper functionality, 257
geostationary orbit (GEO), 230
global addresses, NAT, 372
guidelines
   access, 35
   for equipment selection, 32–36

H

hardware, equipment selection, 32–36
hashing algorithms, 433
HDLC (High-Level Data Link Control), 38
HDSL (high-data-rate DSL), 251
HDSL2 (second-generation HDSL), 251
headers, packets, 366
HFC (hybrid fiber-coaxial) networks, 224
High-Level Data Link Control (HDLC), 38
highly elliptical orbit (HEO), 231
how-to-track argument, 417
hub-and-spoke topology, Frame Relay, 277
hybrid fiber-coaxial (HFC) networks, 224

I

IDBs (Interface Descriptor Blocks), 282
IDSL (ISDN DSL), 252
IEEE 802.11, 232
IEEE 802.11a, 232
IEEE 802.11b, 233
IEEE 802.11g, 233

implementation

AAA
  access modes/interfaces, 404
  enabling, 407–418
access
cable, WAN, 17
control, 400–401
DSLAM, 246
modes, AAA, 404
remote, 12–15, 37–40
requirements, 35
TACACS, 402
WAN, wireless, 18
addresses
definitions, 373
IP, 361, 366–373
ISDN parameters, 162–164
NAT, 372
substitute, 368
autoconfiguration, 99
basic asynchronous, 94
cable modem (CM)
  broadband implementations, 221
  connection options, 68
  initialization, 224–229
CBWFQ, 332, 338–339
  class-map command, 339–341
  link compression, 348
DDR, 178
dialer profiles, 181–184
  optimizing, 178–180
  rotary groups, 184–185
  snapshot routing, 185–187
DSL, SOHO, 246
QoS, 19
incoming calls, PRI, 202–203
initializing CM, 224–229
initiating PPPoE, 253
inside global addresses (NAT), 372
inside local addresses (NAT), 372
installation
central-site, 29–30
equipment selection, 32–36
PRI, 194–195
  E1 framing, 199
  layers, 200
  T1 framing, 195–198
ROBO, 30–31
SOHO, 31–32
  verifying, 68–74
Integrated Service Digital Network, 39
integrity assurance, hashing algorithms, 433
interactive sessions, PPP, 117
interface serial 0.1 command, 284
interfaces
  AAA, 404
  BRI, 39, 146–162
dialer, 181
  DOCSIS, 221
  encapsulation, 162–164
  logical configuration, 96–97
  passive, 166
  per-interface compression, 348
  physical, 182–185
PRI, 39, 492. See also PRI
status, 70
WIC, 64
Internal Signalling Utility Protocol (ISUP), 153
Internet Protocol Security (IPSec), 439–447
Internet service provider (ISP), 42
IP (Internet Protocol) addresses
  characteristics of NAT, 366–373
  overlapping networks, 370
  scaling with NAT, 361
ip commands
  ip nat inside command, 375
  ip nat outside command, 375
  ip porthandler command, 383
  ip tcp header-compression passive
    command, 96
  ip unnumbered command, 118
  ip unnumbered Ethernet0 command, 96
IPSec (Internet Protocol Security), 439–447
IPX routing command, 164
ISDN (Integrated Service Digital Network), 39
  addressing parameters, 162–164
  BRI, 67, 146–162
  DDR
dialer profiles, 181–184
  ML-PPP, 180
  rotary groups, 184
interfaces, 164–168
Layer 2, 151
Layer 3, 153
Multilink PPP, 204–208
PRI, 194
  configuring, 200–202
  E1 framing, 199
  incoming calls, 202–203
  installing, 194–195
  layers, 200
  T1 framing, 195–198
isdn incoming-voice modem command, 202
ISDN PRI, connection options, 67
ISP (Internet service provider), 42
ISUP (Internal Signalling Utility Protocol), 153

K
  keys, WEP, 235

L
  LAN (local area network), wireless, 233
  LAPD (Link Access Procedure on the D channel), 153
  latency, NAT, 366
  Layer 1, DSL, 262
  Layer 2, ISDN, 151
  Layer 3, ISDN, 153
  layers
    PPP layered model, 116
    PRI, 200
LCP (Link Control Protocol), 127, 162
  negotiation, 118
  options, 130–134
  troubleshooting, 134–135
LE (local exchange), 149
LEAP (Light Extensible Authentication Protocol), 236
leased lines
  connection options, 66
  WAN, 38
LED lights, 69
Light Extensible Authentication Protocol (LEAP), 236
limitations, of DSL, 247
line coding
  EI, 199
  PRI, 195–198
  line mode, physical configuration, 97–98
  line numbering (routers), 92, 94
  Link Access Procedure on the D channel (LAPD), 153
  Link Control Protocol. See LCP
  links
    compression, 348
    ISDN, 164–168
    WAN
      dial backup, 318–320
      primary link failures, 318–319
      primary link overload, 319
    LLQ (Low-Latency Queuing), 332, 345–347
    LMI (Local Management Interface), 278
    load distribution, TCP, 370
    load-balancing, Multilink PPP, 179
    local addresses, NAT, 372
    Local Director (Cisco), 371
    local exchange (LE), 149
    local loops, 38
    logical configuration, routers, 96–97
    logical parameters, asynchronous configuration, 94
    logical subinterfaces, Frame Relay, 280
    login
      AAA authentication, 409
      local command, 98
    loops, local, 38
    low earth orbit (LEO), 230
    Low-Latency Queuing (LLQ), 332, 345–347
M
  MAC (Media Access Control), 236
  management, 34
    access, 400–401
    databases, 401
  map-class command, 303
  maps
    crypto, 443
    dialer map statements, 181
  medium earth orbit (MEO), 230
  methods, WAN, remote access, 37–40
  MIC (Message Integrity Check), 236
  models, PPP layered, 116
  modem autoconfigure command, 100
  modem InOut command, 98
  modemcap, editing, 100–101
modems. See also connections
AT commands, 98–99
autoconfiguration, 99–100
cable, 39
call termination, 90
chat scripts, 101–103
CM, initialization, 224–229
discovery, 100
DSIR pins, 89
DTR pins, 89
PRI incoming analog calls, 202–203
signaling, 83, 88–90
modes (AAA), 404
modulation
ADSL, 248
CAP, 248
DMT, 249
MultiFrame, 199
Multilink PPP, 131–134, 179, 204–208
multiple B channels, BoD, 178
MULTIPLE_FRAME_ESTABLISHED state, 200
multipoint subinterfaces, 283

N
NAT (Network Address Translation)
configuration, 259, 373–384
inside global addresses, 372
inside local addresses, 372
IP addresses
characteristics of, 366–373
scaling with, 361
outside global addresses, 372
outside local addresses, 372
overlapping configuration, 369, 377
overloading, 368
PAT, 382–384
sessions, clearing, 382
simple dynamic configuration, 374–375
static configuration, 375–376
TCP load distribution, 370, 379
translation, 367
troubleshooting, 381
verifying translation, 380–381
NCP (Network Control Protocol), 162

networks. See also connections
expanding, managing, 400–401
HFC, 224
ISDN, 39
E1 framing, 199
installing PRI, 194–195
layers, 200
PRI, 194
T1 framing, 195–198
troubleshooting Multilink PPP, 204–208
overlapping, 370
WAN
central-site router selection, 56–61
connections, 16–18
equipment selection, 55
ROBO, 62–64
SOHO, 65–66
wireless, 232–236
no cdp enable command, 97

O
optimizing DDR, 178–180
options. See also customization
AAA servers, 404
cable, 221
PPP, 118, 130–134
QoS, 35
satellites, 229–232
orbits, types of (satellites), 230
output, Frame Relay traffic shaping, 300–302
outside global addresses (NAT), 372
outside local addresses (NAT), 372
overlapping, 369
address definitions, 373
configuring, 377
dysfunction, 367
NAT, 377
overloading
NAT, 368, 376
primary links, 319

P
Packet over SONET (POS), 37
packet-based access modes, 404
process-switching paths, Frame Relay traffic shaping

packets
  CBWFQ, 338–339
    class-map command, 339–341
    link compression, 348
    LLQ verification, 345–347
    payload compression, 349
    policy-map command, 345
    service-policy command, 341–345
    TCP header compression, 350–351
  Fair Queuing, 334
  headers, 366
  LCP, 162
  NCP, 162
  PPPoE, 252–255
  RST, 402
  switching, 38
  Weighted Fair Queuing, 335–337
  PAP (Password Authentication Protocol), 119–122
  parameters
    Frame Relay traffic, 300
    ISDN addressing, 162–164
    single-connection, 407
  partial-mesh t, 279
  passive interfaces, 166
  Password Authentication Protocol (PAP), 119–122
  PAT (port address translation), NAT, 382–384
  paths, Frame Relay traffic shaping, 300–302
  patterns, traffic, 34
  payloads
    compression, 349
    ESP, 436
  PCM (pulse code modulation), 146
  peer default ip address pool remaddpool command, 97
  performance, queuing. See queuing
  per-interface compression, 348
  permit statement, 374
  physical configuration, 97–98. See also configuration
  physical connections, assembling, 66–68
  physical interfaces, 182–185
  physical layer, troubleshooting, 95–96, 262
  physical parameters, 94
  ping, BRI, 155
  plain old telephone service (POTS), 247
  point-to-multipoint connections, Frame Relay, 285
  Point-to-Point Protocol (PPP), 38
  polar orbit (PO), 231
  pools, dialer, 182
  port address translation (PAT), NAT, 382–384
  port-handler assignments, PAT, 383
  ports
    asynchronous, connection options, 68
    line numbering, 92, 94
  POS (Packet over SONET), 37
  POTS (plain old telephone service), 247
  PPPoE (PPP over Ethernet), 252–255
  PPP (Point-to-Point Protocol), 38
    architecture, 115
    authentication, 119–122
    components, 116
    dedicated sessions, 117
    interactive sessions, 117
    LCP. See LCP
    multilink PPP, 134
    options, 118, 130–134
    troubleshooting, 134–135
  PPP Callback
    accept command, 132
    configuration, 132
    option, 131
    request command, 132
  ppp commands
    ppp authentication chap command, 97
    ppp context command, 117
    ppp multilink command, 134
  PPP Link Control Protocol. See LCP
  PPPoE (PPP over Ethernet), 259
  PQ (priority queuing), 300
  PRI (Primary Rate Interface), 39, 194
    configuring, 200–202
    E1 framing, 199
    incoming calls, 202–203
    installing, 194–195
    layers, 200
    T1 framing, 195–198
  primary links
    failures, 318
    overload, 319
  priority queuing (PQ), 300
  process-switching paths, Frame Relay traffic shaping, 300–302
Product Selection Tool

Product Selection Tool, 56
Protocol field, PPP, 117

Protocols
AAA, 402
RADIUS, 403
TACACS, 402–403
addressing, 164
BRI, 148
BRP, 20
IPSec, configuring, 439–447
ISUP, 153
LCP, 127, 162
LEAP, 236
NCP, 162
PAP, 119–122
PPP, 38
authentication, 119
components, 116
LCP, 127
options, 118, 130–134
troubleshooting, 134–135
protocol-specific parameter, 285
pulse code modulation (PCM), 146
PVCs, multipoint subinterfaces, 283

Q
Q933a LMIs, 278
QAM (Quadrature Amplitude Modulation), 249
QoS (quality of service), 19, 35
queuing, 300, 332–334
CBWFQ, 338–339

class-map command, 339–341
link compression, 348
LLQ verification, 345–347
payload compression, 349
policy-map command, 345
service-policy command, 341–345
TCP header compression, 350–351
Fair Queuing, 334
Weighted Fair Queuing, 335–337

R
rack unit (RU), 59
RADIUS (Remote Authentication Dial-In User Service), 402–404
RADSL (rate-adaptive DSL), 251
RAS (Registration, Admission, and Status), 257
reverse Telnet connections, 90
signaling, 83, 89–90
rate adaptation, 168
RDBMS (relational database management system), 401
receipt of a reset (RST) packet, 402
redundancy, 35
dial backup, 318–319
dialer profiles, 181–184
strategies, 320
dynamic, 320
static, 321–322
Registration, Admission, and Status (RAS), 257
reverse Telnet connections, 90
signaling, 83, 89–90
relational database management system (RDBMS), 401
reliability of services, 34
REMDEVICE chat script, 103
remote access
Cisco 1700 Series, 12
Cisco 2500 Series, 13
Cisco 2600 Series, 13
Cisco 3600 Series, 13–15
VPN 3000 Concentrator Series, 15
WAN, 37–40
Remote Authentication Dial-In User Service (RADIUS), 402–404
remote office (RO), 19
remote office/branch office. See ROBO
renumbering NAT, 367
requirements
access, 35
central site installations, 18
RO installations, 19
SOHO installations, 19
reverse Telnet connections, 90–91
SAR (segmentation and reassembly), 255
satellites
    option, 229–232
    type of orbits, 230
scaling
    access, 400–401
    IP addresses with NAT, 361, 366–373
SDSL (symmetric DSL), 251–252
security, 35
    AAA, 36. See also AAA
        protocols, 402
        RADIUS, 403
        TACACS, 402–403
        access, 400–401
        encryption, 36, 431–433
            Diffie-Hellman key exchange, 434–435
            ESP, 436
            hashing, 433
            transport/tunnel modes, 436–439
IPS, 439–447
    technology assessment, 40–42
    WEP, 235
    wireless networks, 235
segmentation and reassembly (SAR), 255
selecting, interface for Frame Relay
    configuration, 284
selection of equipment, 24
    cabling, 66–68
    central-site routers, 56–61
    Product Selection Tool, 56
    ROBO, 62–64
    SOHO, 65–66
    WAN, 55
serial interfaces, 73. See also interfaces
servers
    AAA, 404
    security, 402
    TACACS, 403
server-to-server VPNs, 41
services
    availability of, 33
    back office, 222
    cost of, 34
    QoS, 19
    reliability of, 34
rotary argument, 379
rotary groups, 184–185
router selection, 62–64
installing, 30–31
routes, static, 321–322
routers
    AAA, configuring, 407–418
    central-site, selection of, 56–61
    Cisco 3600, 57–58
    Cisco AS5000, 58–60
    Cisco 1700, 62
    Cisco 1700 Series, 12
    Cisco 2500, 63
    Cisco 2500 Series, 13
    Cisco 2600, 64
    Cisco 2600 Series, 13
    Cisco 3600 Series, 13–15
    Cisco 800, 65
    Cisco 827 Series, DSL, 256–260
    Cisco 7200, 60
    CRWS, 257
    installing, 68–74
    interfaces
        logical configuration, 96–97
        verifying, 69
        line numbering, 92, 94
        physical configuration, 97–98
        PPPoE, 253
        PRI, installing, 194–195
        ROBO, 62–64
        SOHO, 65–66
        uBR, 224
        VPN 3000 Concentrator Series, 15
routes, static, 321–322
routering
    DDR, 34
    snapshot, 185–187
    split horizon, 281
RST (receipt of a reset) packet, 402
RU (rack unit), 59
sessions, 253, 255. See also PPPoE
set ip pat on command, 383
SF (SuperFrame), 196
shaping traffic, 297. See also Frame Relay
SHDSL (symmetric high-data-rate DSL), 251
show atm interface atm 0 commands, 263
show cable modem command, 224
show commands, 69
  show controllers tl command, 198
  show dialer command, 134, 205
  show frame-relay lmi command, 289
  show frame-relay map command, 291
  show frame-relay pvc command, 288, 302, 305
  show interface atm 0 command, 262
  show interfaces ethernet command, 69
  show interfaces serial command, 72–74
  show ip nat statistics command, 381
  show ip nat translation command, 380
  show isdn status command, 153, 200, 204
  show line command, 92, 94
  show line output command, 92
  show modemcap command, 100
  show ppp multilink command, 204
  show traffic-shape command, 306
signal pins (modems), 89
signaling modems, 83, 88–90
Signalling System 7 (SS7), 153
simple dynamic NAT configuration, 374–375
simple NAT translation, 367
single-connection parameter, 407
site preparation. See also equipment selection
  assembling, 66–68
  central-site preparation, 29–30
  central-site router selection, 56–61
  ROBO, 30–31
  SOHO, 31–32
site-to-site VPNs, 41
small office/home office. See SOHO
snapshot routing, 185–187
sockets, NAT overloading, 368
software, Cisco Local Director, 371
SOHO (small office/home office), 24, 246
  installing, 31–32
  requirements, 19
  router selection, 65–66
SONET (Synchronous Optical Network), 37
  source ports, 368
  speed, troubleshooting, 72
  split horizon, 281–282
  splitting, traffic, 246
  spoofing, 162
SS7 (Signalling System 7), 153
  standard AT commands, 98–99
  star topology, Frame Relay, 279
  start-chap command, 102
  statements, dialer map, 131, 181
  static NAT configuration, 375–376
  static redundancy, 321–322
  status, interfaces, 70
  stop-only argument, 418
  strategies, redundancy, 320–322
subinterfaces. See also interfaces
  cast type, 284
  Frame Relay, 282
substitute addresses, overloading NAT, 368
sun-synchronous orbit (SSO), 231
SuperFrame (SF), 196
switches, PRI, 194–195
switching, 38
symmetric DSL (SDSL), 245, 251–252. See also DSL
  Synchronous Optical Network (SONET), 37
  syntax, chat scripts, 101–102
T
T1 framing, PRI, 195–198
TACACS (Terminal Access Control Access Control System), 402–403
TCP (Transmission Control Protocol)
  headers, compression, 350–351
  load distribution, 370
  NAT, 379
TDM (time division multiplexing), 196
  technological assessment of security, 40–42
TEI (Terminal Endpoint Identifier), 151, 200
Terminal Access Control Access Control System (TACACS), 402–403
Terminal Endpoint Identifier (TEI), 151, 200
time division multiplexing (TDM), 196
tools
  CRWS, 257
  Production Selection Tool, 56
topologies, Frame Relay, 277
traffic
Frame Relay, 297. See also Frame Relay patterns, 34
splitting, 246
translation, configuring NAT, 367, 373–384
transmissions
Fair Queuing, 334
Weighted Fair Queuing, 335–337
transport mode, 436–439
troubleshooting
congestion. See congestion debug commands
debug dialer command, 206
debug frame-relay lmi command, 290
debug ip nat command, 381
debug isdn q921 command, 207
debug isdn q931 command, 155, 208
debug ppp authentication command, 135
debug ppp multilink command, 206
debug ppp negotiation, 135
dial backup, 318–320
primary link failures, 318–319
primary link overload, 319
DSL, 260–265
duplex values, 72
installations, 68–74
LED lights, 69
modems, 88–90
Multilink PPP, 204–208
NAT, 381
PPP, 134–135
queuing. See queuing redundancy, 35
speed, 72
split horizon, 282
TACACS, 403
tunnels
IPSec, 439–447
mode, 436–439
types
of ADSL, 250
of connections, 66–68
of SDSL, 251–252
U
uBR (Universal Broadband Router), 224
unreachable DSLAM, 264. See also DSLAM
UTP (unshielded twisted pair), 146
V
Van Jacobson algorithm, 350
VAR (value-add reseller), 16
variance 4 command, 320
VCI (virtual circuit identifier), 255
VCs (virtual circuits), 38
VDSL (very-high-bit-rate DSL), 251
verification
installations, 68–74
Frame Relay configuration, 287, 289, 290
show frame-relay lmi command, 289
show frame-relay map command, 291
show frame-relay pvc command, 288
LLQ, 345–347
NAT translation, 380–381
viewing modemcap settings, 101
virtual circuit identifier (VCI), 255
virtual circuits (VCs), 38
voice, splitting, 246
VPI (virtual path identifier), 255
VPN 3000 Concentrator Series, 15
VPNs (virtual private networks), 24, 41
W
wait-start argument, 417
WAN (wide area network), 24
dial backup, 318–320
failures, 318–319
overloading, 319
connections, 16
cost of, 34
equipment selection, 55
central-site routers, 56–61
ROBO, 62–64
SOHO, 65–66
methods for remote access, 37–40
weighted fair queuing (WFC), 300, 335–337
well-known ports, 368