



Numerics

3DES encryption, 600
 10-GigE (10-Gigabit Ethernet), 492
 10GBASE-ER, 493
 10GBASE-EW, 493
 10GBASE-LR, 493
 10GBASE-LW, 493
 10GBASE-LX4, 493
 10GBASE-SR, 493
 10GBASE-SW, 493
 100BASE-FX, 489
 100BASE-T. *See* Fast Ethernet, 489
 100BASE-TX, 489
 400 status codes (HTTP), 56
 500 error codes (HTTP), 56
 802.1Q tag all, 187
 802.1s, 516

- configuring, 519–520

 802.3ad, 33
 1000BASE-LX, 491
 1000BASE-SX, 491
 1000BASE-T, 491
 4096 VLANs, 514

A

A (Address) records, 403
 AAA (Authentication, Authorization, and Accounting)

- RADIUS, 646
- security, 197
- TACACS+, 645

 ABRs (Area Border Routers), 543

- summarization, 550

 absolute URIs, 312
 absolute URLs, 316
 Accept field (HTTP request header), 353

Accept-Charset field (HTTP request header), 353
 Accept-Encoding field (HTTP request header), 354
 Accept-Language field (HTTP header), 979–980
 access layer

- application segment, 17
- back-end segment, 18
- front-end segment, 16

 access ports, 32, 520, 839–840
 access switches, 141
 acknowledgment number field (TCP), 263
 ACKs (TCP), 48, 666
 ACLs (access control lists), 25, 170, 873

- dynamic, 171
- extended, 170
- reflexive, 172–173
- router, 170
- standard, 169

 active-active firewall configuration, 906
 active-active load balancing, 229–230
 active-backup algorithm, 437
 active-standby firewalls, 904
 active-standby load balancing, 228
 ActiveX controls, 86, 1017–1018

- server-side, 89

 addresses

- formatting (Ethernet), 485–487
- MAC address table, 499

 advertisement interval, 535
 advertising local subnets (OSPF), 854
 AES-Rijndael, 601
 aggregation layer, 15
 aggregation routers, connecting to core routers, 846–849
 aggregation switches, 141
 algorithms

- cache farm load-balancing, 683–685
- hashing, 607
 - message digest, 607
 - SHA, 608

- load balancing, 673
 - fastest, 680
 - hash address, 681
 - least connections, 678
 - round-robin, 676
 - server farm, 673–675
 - source IP, 681
 - URL and hash URL, 681
 - weighted least connections, 679
 - weighted round-robin, 677
- alternate Layer 3/Layer 2 designs, 133
- alternate ports, 829
- analog video streaming, 447
 - codecs, 448
- analyzing SSL traces, 391–393
- anomaly-based IDSs, 181
- antireplay protection, 190
- antispoofing filtering, 870
 - uRPF, 873
- Apache web servers, 330
 - virtual hosting configuration, 58–59
 - IP-based, 59
 - name-based, 61
 - port-based, 60
- APIs (application programming interfaces),
 - server-specific, 88
- applets, 86
 - Java, 1014–1015
- application architecture trends, 150–151
- application layer, 244
 - probes, 713
 - DNS probes, 717
 - FTP probes, 717
 - HTTP probes, 714
 - IMAP4 probes, 718
 - POP3 probes, 718
 - SMTP probes, 718
 - SSL probes, 715
 - security, 21
- application segment (access layer), 17
- application services, 24
- application tier, 77
- applications
 - Data Center architecture models
 - client/server, 9–10
 - multitier, 12
 - n-Tier, 11
 - enterprise, 71
 - integration, 75
 - EAI, 75–77
 - multitier design (case study), 108–111
 - network architecture implications, 97
 - clustering, 99–102, 104
 - load balancing, 97–98
 - security, 104–105, 107
 - n-Tier model, 77
 - database access, 95–96
 - markup languages, 79–83
 - middleware, 91–95
 - server-side programming, 87–91
 - user agents, 84–85
 - web servers, 86
- portal, 72
- TCP, 41
 - ACKs, 48
 - data processing, 41
 - HTTP, 47, 55–56
 - maximum burst size on high-speed
 - networks, 49–50
 - segments, 42
 - Telnet, 43–46
 - windows, 47–48
- UDP, 50–51
- upgrades, 71
- APPN (advanced peer-to-peer networking), 572
 - node types, 579–580

- architectures
 - MLS, 809
 - of Data Centers
 - flexibility, 118
 - high availability, 118
 - scalability, 117
 - of load balancers, 232–235
 - critical components, 234–235
 - generic components, 232–234
- Area Border Routers (ABRs), 543
- ARP (Address Resolution Protocol), 525–526
 - ARP inspection, 184, 895
 - ARP spoofing, 167
 - timeout values compared with CAM tables, 526
- ASBR (autonomous system border router)
 - summarization, 550
- ASCII character sets
 - extended, 965–966
 - nonprintable, 963–964
 - printable, 964–965
- ASPs (active server pages), 88, 1022
- asymmetric cryptography, 602
 - D-H, 606
 - DSS, 605
 - RSA, 603–604
- asymmetric encryption, 191
- attachment options for mainframes, 573
 - channel attachments, 573–574
 - LAN attachments, 575
- attacks
 - buffer overflow, 167
 - DDoS, 164
 - DoS, 163
 - eavesdropping, 165
 - Internet infrastructure attacks, 166
 - Layer 2, 167–168
 - mitigation, 202
 - scanning/probing, 162
 - session hijacking, 167
 - smurf, 163
 - trust exploitation, 166
 - unauthorized access, 165
 - viruses and worms, 165
- attributes of cookies, 729–731
- audio streaming
 - transport formats, 442, 454
 - RTCP, 457–459
 - RTP, 454
- authentication, 640, 876
 - AAA protocols
 - RADIUS, 646
 - TACACS+, 645
 - challenge/response schemes, 642
 - digital certificates, 642
 - HTTP, 364
 - Kerberos, 644
 - management network, 911–913
 - OTPs, 641
 - SSL, 385–387
 - PKI, 388–389
- authenticity tags, 194
- authoritative name servers, zone transfers, 418–420
- Authorization field (HTTP request header), 354
- autonegotiation
 - Gigabit Ethernet, 492
 - NICs, 490
- autostate, 810, 814
- auto-unfail, 706
- availability, optimizing with load balancing, 65

B

- baby giant frames, 496
- BackboneFast, 827–828
- back-end segment (access layer), 18
- backup designated routers (BDRs), 542
- backup ports, 829
- bandwidth, 444
 - scaling with Etherchannels, 815
- baseline testing, performance metrics, 950
- basic data transfer, 256
- BDP (Bandwidth Delay Product), 50
- BDRs (backup designated routers), 542
- B-frames, 451, 991
- BIND (Berkeley Internet Name Domain), 408
- binding, 94
- black-hole problem, 287–288
- blade chassis, 152–156
- blade servers, 21
- bottlenecks, performance metrics, 933
- BPDU (bridge protocol data units), TCN (Topology Change Notification), 527
- bridge identifiers, 510
- bridging, 654
- broadcast suppression, 487
- browsers, 84
 - cookies, 731–732
 - multiple, 733
 - session cookies, 769
 - storage of, 734–735
 - HTTP compression, 343
- buffer overflow attacks, 167
- bulk transfer traffic, 47
 - ACKs, 48
 - maximum burst size on high-speed networks, 49–50
 - TCP windows, 47–48
- bus and tag technology, 574

- bus architecture
 - PCI, 34
 - PCI-X, 35
- business continuance infrastructure services, 26
- business continuance services, 27
- BXN (branch extender node), 583

C

- CA servers, 74
- cabling, Ethernet, 481
- cache load balancing, 210–211
 - server farms, 683–685
- Cache-Control field (HTTP general header), 344–345
- caching, 25
 - cache hits, 681
 - cacheable objects, 683
 - DNS, 420
 - client applications, 422–423
 - TTL values, 421
 - hit rate, 673
 - in site-selection architecture, 436–437
 - on-demand, 472
 - RPC, 683
 - transparent, 684
- caching-only servers (DNS), 411
- campus core, security, 884
- CAs (certificate authorities), 619
 - certificates, 621
 - deployment options, 623
 - enrollment, 624
 - key exchange, 620
 - revocation, 625
- CC metric, 933
 - load balancers, 942–943
 - SSL offloaders, 948
- CDP (Cisco Discovery Protocol), 500

- CEF (Cisco Express Forwarding), 807–809
 - MLS, 821
- certificates, SSL, 629
- CF channels, 585
- CGI, 88–89, 1018–1019
- challenge response schemes, 642
- channel link-layer protocols, 576
- channeling, 507
- channel-protocol lacp command, 508
- channels, 569
 - connecting mainframes to peripheral devices, 573–574
- character sets, 326
 - ASCII
 - extended, 965–966
 - nonprintable, 963–964
 - printable, 964–965
 - ISO-8859-1, 969
- checksum field (TCP), 266
- chroma subsampling, 989
- ciphers, 188
 - export-grade, 611
 - overview, 608
 - RCs, 602
 - SSL cipher suites, 632–633
- ciphersuites, 371, 389–390
- Cisco IOS Software
 - internal redundancy, 835
 - switching paths, 807–808
- Cisco IPTV, 442
- CISCO-SLB-MIB, 698–699
- CLASSID, 1017
- client error status codes (HTTP response header), 360
- client NAT (load balancers), 662
 - performance, 672
- client tier, 77
- client/server application model, 9–10
- client/server architecture
 - network attachment options, 32
 - NICs, 32–33
 - PCI, 34
 - PCI-X, 35
 - server multihoming, 33
 - NICs, Ethernet driver, 36
 - packet processing, 35–36
 - sockets, 39
 - system calls (UNIX), 39–40
 - TCP/IP processing, 37–39
- clients
 - browsers, 84
 - thick, 83
 - thin, 83
- client-side programming, 85
 - ActiveX controls, 1017–1018
 - Java applets, 1014–1015
 - JavaScript, 1013
- cluster controllers, 570
- clustered proxy servers, persistence, 759
- clustering, 97, 382
 - cluster modules, 100
 - geographical, 101
 - implications for application integration, 99–104
 - Sysplex, 585–589
- CNAME (Canonical Name) records, 404
- codecs, 441, 448, 473
 - comparison of, 452
 - video encoding, 987
- coded character sets, 327
- CodeRed, 165
- collaborative applications, 72
- collapsed multitier design, 137–138
- collapsed server-farm design, 898–900
- collision domains, diameter, 487
- commands, netstat -a, 37
- communications controller, 570
- components of IBM Data Centers, 570–573
- compression
 - HTTP, 342–343
 - redundancy (video), 448

- confidentiality, 189
- configuring
 - 802.1s, 519–520
 - cookie active, 775
 - cookie match, 772
 - cookie passive, 770
 - HTTP redirection stickiness, 783
 - Layer 2 features
 - access ports, 839–840
 - overview, 844
 - spanning trees, 841–843
 - trunks, 840
 - VLANs, 837–839
 - Layer 3 features, 846
 - default gateway redundancy, 849–851
 - EIGRP, 858–862
 - OSPF, 852–857
 - routing options, 846–849
 - load balancers for given applications, 98
 - loopback interfaces, 995
 - Linux, 1005–1006
 - Windows 2000, 996–998
 - Windows NT, 1002
 - NAT on routers and firewalls, 558
 - preemption, 851
 - rapid PVST+, 518
 - routing on servers, 524
 - server farms on a load balancer, 691
 - source IP stickiness, 765
 - mega proxies, 766–767
 - source IP hash, 768
 - SSL stickiness, 786
 - URL cookies, 779
 - web servers, 57
 - directories, 58
 - inserting cookies, 1010
 - server processes, 57
 - TCP parameters, 57
 - virtual hosting, 58–60
 - congestion avoidance, 279
 - congestion control, 278
 - congestion window (TCP), 47
 - CONNECT method (request header), 351
 - connection establishment, Telnet sessions, 43–44
 - Connection field (HTTP general header), 345
 - connections, 257
 - embryonic, 564
 - failover, 231
 - HTTP, 335, 337
 - persistent connections, 339
 - pipelining, 340
 - load balancing, 674
 - long-lived, 929–931
 - maxconns, 678
 - performance metrics, 935
 - persistence, 219
 - reassigning, 704
 - remapping, 667
 - short-lived, 925–927
 - spoofing (load balancers), 664–667
 - connection remapping, 667–669
 - performance, 672
 - TCP, 267
 - establishment phase, 268–270
 - monitoring, 67
 - termination phase, 46, 272, 275
 - TCP/UDP, stickiness, 674
 - tracking, 219
 - connectivity, blade chassis options, 152–156
 - content switching, 205. *See also* server
 - load balancing
 - horizontal scaling, 206
 - versus DNS round-robin, 207–209
 - vertical scaling, 206
 - Content-Encoding headers, 343
 - control flags (TCP), 264–266
 - control protocols, 466
 - RTSP, 467–470
 - control units, 574

- controllers, 493
- convergence, 827
 - MST, 831
 - OSPF, 856
 - PVST+, 828
 - Rapid PVST+, 829–830
- cookies, 221–223, 728
 - browser storage, 734–735
 - browser treatment of, 731–732
 - browser treatment of multiple cookies, 733
 - format, 729–730
 - inserting, 1010
 - load balancers
 - cookie active, 775
 - cookie match, 771–773
 - cookie passive, 769
 - persistent, 728–729
 - session, 728–729
 - specifications and standards, 735
 - stickiness, 222
 - tracking user sessions, 739
 - URL, 776–778
- CORBA, 92, 95
- core routers, connecting to aggregation routers, 846–849
- corporate Data Centers, 126
- CPS metric, 933
 - load balancers, 942
 - SSL offloaders, 948
- cryptology, 188–189
 - asymmetric, 602
 - D-H, 606
 - DSS, 605
 - RSA, 603
 - RSA key exchange, 604
 - asymmetric encryption, 191
 - ciphers, 608
 - export-grade, 611
 - digital signatures, 195
 - FIPS, 609

- hashing algorithms, 193, 607
 - message digests, 607
 - SHA, 608
- HMACs, 194
- NIST, 609
- PKI, 612
 - CAs, 619–625
 - digital certificates, 615–619
 - standards, 614
- symmetric, 190, 597
 - 3DES, 600
 - DES, 598–600
 - RCs, 602

D

- dark fiber, 104
- data, 452
 - encoding, 448–451
 - multimedia transport formats, 454
 - RTP, 454, 457–459
 - UDP versus TCP, 445–446
 - packetization, 453
 - replication, 103
 - TCP, 463
 - transport security, 626
 - IPSec, 633–634, 637–638
 - SGC, 631
 - SSL, 626, 628–629
 - SSL cipher suites, 632–633
 - VPNs, 639
- Data Centers
 - application architecture
 - client/server model, 9–10
 - multitier, 12
 - n-Tier model, 11
 - applications
 - EAI, 75–77
 - integration, 75

- multitier design (case study), 108, 111
- network architecture implications, 97–107
- n-Tier model, 77–96
- portal, 72
- architecture, 13–14
 - access layer, 16–18
 - aggregation layer, 15
 - layers, 14
 - storage layer, 19
 - transport layer, 20–21
- design criteria, 6
- facilities, 7
- goals, 6
- high availability, 109
- infrastructures, 801–805
 - spanning trees, 822
 - virtualizing with VLANs, 804, 810, 813–814
- Layer 2 design
 - access ports, 839–840
 - configuration overview, 844
 - spanning trees, 841–843
 - trunk configuration, 840
 - VLAN configuration, 837–839
- Layer 3 design, 846
 - default gateway redundancy, 849–851
 - EIGRP, 858–862
 - OSPF, 852–857
 - routing considerations, 846–849
- overview, 5
- performance metrics, 934–935
 - firewalls, 938
 - load balancers, 939–945
 - multilayer switches, 936–937
 - SSL offloaders, 946–949
 - testing, 950–957
- redundancy, 833
 - NSF, 835–837
 - supervisor redundancy, 834–835
- redundant links, 815–817
- roles
 - enterprise, 7
 - SP environment, 9
- security framework
 - incident response and attack mitigation, 202
 - secure management framework, 200–201
 - security life cycle, 198
 - security policies, 198
 - zones, 866
- server failure detection, 700
 - probes, 701
 - SNMP, 701
- server management, 689–690
 - CISCO-SLB-MIB, 698–699
 - DFP, 708
 - graceful shutdown feature, 691
 - HTTP and HTTPS (case study), 722–723
 - in-band probes, 703–706
 - load balancing overview, 690
 - Max/Min Connections, 694–695
 - out-of-band probes, 707–708, 711, 713–714, 716–718
 - probe comparison, 709
 - slowstart feature, 693
 - SNMP, 697–698
 - virtual hosting (case study), 718–720
 - XML, 696–697
- services, 22
 - application, 24
 - business continuance, 26–27
 - IP infrastructure, 23
 - security, 25
 - storage, 26
- static routing, 527
- traffic patterns, 924
 - long-lived traffic, 929–931
 - performance metrics, 933
 - short-lived traffic, 925–927
- VLANs, 502

- data processing on TCP applications, 41
- database access, 95–96
- database middleware, 91
- database servers, 73
- database tier, 77
- datagrams, 245
- Date field (HTTP general header), 346
- DBMSs (database management systems), 96
- DCOM objects, 93–95
 - passing through firewalls, 95, 106
- DCT (discrete cosine transform), 988
- DDoS (distributed denial-of-service) attacks, 164
- debounce feature, 831
- decryption, 188
- dedicated Internet server farms, 120
- defining
 - security zones, 865–868
 - VTP domains, 504
- delayed ACKs, 45, 280
- delegated name servers, 428
- DELETE method (request header), 351
- deploying
 - antispoofing filtering, 870
 - services in redundant Layer 2/Layer 3 Data Centers, 148
- DES encryption, 598–600
- designated ports (DPs), 512, 829
- designing
 - Data Centers
 - bus architecture, 34–35
 - client/server architecture, 35–39
 - criteria, 6
 - flexibility, 118
 - fully redundant Layer 2/Layer 3 designs, 139–157
 - high availability, 118
 - optimizing performance, 62–67
 - scalability, 117
 - server multihoming, 33
 - EAI networks, 76–77
 - high availability, 51
 - management network security, 914
 - NICs, 32–33
 - server farms
 - alternate Layer 2/Layer 3 designs, 133
 - collapsed server-farm design, 898–900
 - expanded server-farm design, 900–902
 - generic Layer 2/Layer 3 designs, 126–131
 - multiple-tier designs, 133–138
 - redundant firewall designs, 904–906
 - VLANs, 505–506
- devices, codecs, 987
- DFP (Dynamic Feedback Protocol), 675, 708
- D-H, 606
- DHCP servers, 74
- diameter, 487
- diffusing DUAL, 553
- digital certificates, 615, 642
 - extensions, 619
 - formats, 617
 - generating, 616
 - SSL authentication, 385–387
- digital signatures, 195
- Digital Video Compression (DVC), 450
- digital video streaming, 447
- Direct Server Return (DSR), 669–670
- directed mode (load balancers), 654, 660–661
 - performance, 672
- directories, configuring on web servers, 58
- directory servers, 74
- directory services (APPN), 579
- discarding ports, 511
- disk replication, 102
- dispatch mode (load balancers), 654, 657–659
 - performance, 672
- distributed DVIPAs, 588
- distributing multiple records
 - A records, 425
 - client applications, 426
 - NS records, 423–424

- distribution servers, 471
 - DivX, 451
 - DLSw (Data Link Switching), 580–581
 - DLUR/DLUS (dependent LU requesters/dependent LU servers), 583
 - DMA (Direct Memory Access), 33
 - DMZ server farms, 120
 - DNS (domain naming system), 397
 - A records, 425
 - caching, 420
 - client applications, 422–423
 - TTL values, 421
 - forwarders, placement of, 427–428
 - FQDNs, 399–400
 - hierarchical name structure, 398–399
 - name resolution process, 404–406
 - name servers, 418
 - NS records, 423–424
 - probes, 713
 - queries, communication flows, 420
 - resolution process, 411
 - iterative queries, 417
 - queries, 412
 - recursive queries, 417
 - referrals, 414–417
 - root hints, 413–414
 - resource records, 402–403
 - servers, 74, 407
 - signatures, 881
 - site-selection architecture, 430–433
 - caching, 436–437
 - proximity, 435
 - referrals to site selectors, 433–435
 - stickiness, 437–438
 - split namespace, 428–430
 - TLDs, 399
 - zone transfers, 418–420
 - zones, 400–402
 - DNS proxy, 409
 - caching-only servers, 411
 - forwarders, 410
 - DNS round-robin, 207–209
 - domain hash predictor, 685
 - DoS attacks, 163
 - preventing with traffic rate limiting, 874
 - smurf, 163
 - download-and-play, 442–444
 - download rate (streaming traffic), 466
 - DP (designated port), 512
 - DSR (Direct Server Return), 669–672
 - DSS (Digital Signature Standard), 605
 - DTP (Dynamic Trunking Protocol), 501
 - dual-attached servers, 821
 - dummy unicast MAC addresses, 98
 - DV (Digital Video Compression), 450
 - DVIPA (dynamic VIPA), 587
 - distributed DVIPAs, 588
 - dynamic ACLs, 171
 - Dynamic Feedback Protocol (DFP), 675, 708
-
- ## E
- EAI, 75
 - network design implications, 76–77
 - eavesdropping, 165
 - ECB (electronic code book), 600
 - e-commerce applications, 727
 - session persistence, 757, 790
 - e-commerce applications, 72
 - edge ports, 829, 840
 - EEs (enterprise extenders), 582–583
 - EIGRP (Enhanced IGRP), 551, 858
 - configuration overview, 862
 - default advertisement, 555
 - default routers, 860
 - failure detection, 552
 - metric tuning, 553–554
 - redistribution, 554
 - summarization, 860

- summarization and filtering, 555
- topology, 859
- EJBs, 93
- electronic code book (ECB), 600
- e-mail servers, 73
- e-mail signatures, 881
- embryonic connections, 564
- encoding, 448, 473
 - formats, 450–451
 - HTTP, MIME comparison, 326
 - MIME, 323–324
 - character sets, 326
 - HTTP comparison, 326
 - media types, 327–328
 - transport rate, 452
 - URLs, 316
 - reserved characters, 318
 - unsafe characters, 318
 - URNs, 320
- encoding video, 987
- encryption, 910
 - 3DES, 600
 - asymmetric, 191
 - control data, 201
 - cryptology, 188–189
 - DES, 598, 600
 - symmetric, 190
- ENs (end nodes), 572
- enterprise networks
 - applications, 71
 - Data Center roles, 7
 - Data Centers, 126
 - architecture, 13–21
 - services, 22–27
- entity header, 365
- Entity header fields (HTTP), 985
- ephemeral RSA, 631
- ESCD (ESCON directors), 574
- ESCON (enterprise system connections), 574
- establishing TCP connections, 268, 270
- establishment controllers, 570
- Etherchannels, 507
 - creating channels, 507
 - scaling bandwidth, 815
- Ethernet
 - 10-GigE, 492
 - physical layers, 495
 - 10GBASE-ER, 493
 - 10GBASE-EW, 493
 - 10GBASE-LR, 493
 - 10GBASE-LW, 493
 - 10GBASE-LX4, 493
 - 10GBASE-SR, 493
 - 10GBASE-SW, 493
 - 100BASE-FX, 489
 - 100BASE-TX, 489
 - 1000BASE-LX, 491
 - 1000BASE-SX, 491
 - 1000BASE-T, 491
 - address format, 485–487
 - EtherChannels, 507
 - creating channels, 507
 - Fast Ethernet, 489
 - autonegotiation, 490
 - frame size, 488
 - physical layers, 494
 - frames
 - baby giant, 496
 - format, 482–484
 - jumbo, 496
 - size, 487–488
 - Gigabit Ethernet, 491
 - autonegotiation, 492
 - flow control, 492
 - physical layers, 495

- Layer 2 protocols, 500–501
- overview, 481
- physical layers, 493
- switching, 498–500
- examples of SSL applications
 - HTTPS, 372–374
- expanded multitier design, 135–136
- expanded server-farm design, 900–902
- Expect field (HTTP header), 980
- export-grade ciphers, 611
- extended ACLs, 170
- extended ASCII character sets, 965–966
- Extensible Markup Language. *See* XML
- external redundancy, 833
- extranet server farms, 124

F

- failure detection
 - EIGRP, 552
 - HSRP, 531
 - OSPF, 545
 - redundant firewalls, 906
- failure recovery, spanning trees, 842
- Fast Ethernet, 489
 - autonegotiation, 490
 - frame size, 488
 - transceivers, 495
- fast paths, 933
- fast recovery, 280
- fast retransmission, 446
- fast switching, 807
- FastCGI, 89
- fastest predictor, 680
- FCIP (Fibre Channel over IP), 103
- FEPs (front-end processors), 570
- FICON (fiber connectivity), 574
- fields
 - HTTP entity headers, 365
 - HTTP general headers, 344–347
 - HTTP messages, 334
 - HTTP response headers, 362–363
- IP headers
 - flags field, 251
 - fragment offset field, 251
 - header checksum field, 254
 - header length field, 248
 - identifier field, 250–251
 - options field, 255–256
 - protocol field, 252–254
 - TOS field, 248–250
 - total length field, 250
 - TTL field, 251–252
 - Version field, 247
- request headers, 352
 - Accept field, 353
 - Accept-Charset field, 353
 - Accept-Encoding field, 354
 - Authorization field, 354
 - Host field, 354
 - If-Modified-Since field, 355
 - Max-Forwards field, 355
 - Range field, 355
 - Referer field, 355
 - User-Agent field, 356
- TCP headers
 - acknowledgment number field, 263
 - checksum field, 266
 - control flags, 264, 266
 - options field, 266–267
 - sequence number field, 262
 - TCP header length field, 264
 - urgent pointer field, 266
 - window size field, 266
- UDP headers, 299–301
- file servers, 73
- filtering
 - ACLs, 873
 - antispoofing, 870
 - EIGRP, 555

- OSPF, 550
 - packet filters, 890
 - RFC 1918, 870
 - RFC 2817, 870
 - route filters, 876
 - final permutation, 600
 - FIPS, 609
 - firewall load balancing, 212–213
 - Firewall Service Module (FWSM), 887
 - firewalls, 173
 - hybrid, 176–177
 - Internet traffic patterns, 921
 - limitations, 178
 - NAT, 557
 - packet-filtering, 174
 - passing DCOM through, 95, 106
 - performance metrics, 938
 - PIX, NAT, 563–564
 - proxy, 175
 - redundant
 - active-active (clusters), 906
 - redundant firewall server-farm design, 904
 - server farm design, 905–906
 - stateful, 175, 878–879
 - flags field, 251
 - flexibility in Data Center design, 118
 - flooding, 98, 831
 - unicast, 499
 - flow control, 257
 - congestion avoidance, 279
 - congestion control, 278
 - delayed ACKs, 280
 - fast recovery, 280
 - immediate ACKs, 280
 - Nagle algorithm, 281–282
 - retransmission, 276
 - sliding windows, 277
 - slow start, 279
 - flow-based forwarding, 809
 - flow-based MSL, 820
 - forking servers, 51
 - versus threaded servers, 53
 - form fields, 91
 - form hidden fields, 737
 - formal namespaces, 322
 - forward zones, 402
 - forwarders (DNS), 410
 - placement of, 427–428
 - forwarding delay, 520
 - forwarding links, failure, 843
 - forwarding ports, 511
 - FQDN (fully qualified domain name), 399–400
 - fragment offset field, 251
 - frame/packet loss, 937
 - frames, 42, 245, 487–488
 - defining nonstandard size, 497
 - Ethernet
 - baby giant frames, 496
 - jumbo frames, 496
 - formatting (Ethernet), 482–484
 - jumbo, 33
 - From field (HTTP header), 980
 - front-end segment (access layer), 16
 - FTP (File Transfer Protocol)
 - probes, 717
 - session persistence, 755–756
 - full NAT, 662
 - full URIs, 312
 - fully switched topology, 804
 - FWSM (Firewall Service Module), 887
 - election process, 905
 - failure detection, 906
- ## G
-
- gateway redundancy, 849–851
 - GDPS (geographically dispersed parallel Sysplex), 589

- general header (HTTP), 344
 - Cache-Control field, 344–345
 - Connection field, 345
 - Date field, 346
 - Pragma field, 346
 - Transfer-Encoding field, 347
- generic Layer 3/Layer 2 designs, 126–130
 - Layer 2 access switches, 130–131
- geographical clustering, 101
- GET method (request header), 349
- Gigabit Ethernet, 491
 - 10-GigE, 492
 - autonegotiation, 492
 - flow control, 492
- GLBP, 527, 536, 818
 - active/standby election, 537
 - failure detection, 538–539
 - load distribution, 540
- glean adjacencies, 808
- glue records, 415
- GOP (Group of Pictures), 450
- graceful shutdown feature, 691
- gratuitous ARP, 526
- grid computing, 151
- Group of Pictures (GOP), 450

H

- H.261, 450
- H.263, 450
- half-closed connections, 282
- handshakes (SSL), 374–375
 - session negotiation phases, 376–378
 - session resumption, 380–382
- hard failures, 117
- hardware
 - load balancing, 98
 - performance metric testing, 953

- hash address predictor, 681
- hashing algorithms, 607
 - message digests, 607
 - SHA, 608
- HEAD method (request header), 349
- header checksum field, 254
- header compression, 296–298
 - UDP, 305
- header fields of IPv4, 246
 - flags field, 251
 - fragment offset field, 251
 - header checksum field, 254
 - header length field, 248
 - identifier field, 250–251
 - options field, 255–256
 - protocol field, 252–254
 - TOS field, 248–250
 - total length field, 250
 - TTL field, 251–252
 - Version field, 247
- header length field, 248
- health checks, 690
- hierarchical DNS name structure, 398–399
 - FQDN, 400
 - resource records, 402–403
 - zones, 400–402
- high availability, 51, 109, 227
 - in Data Center design, 118
 - redundancy protocol, 226, 228
 - active-active environments, 229–230
 - active-standby environments, 228
 - server failures, 54
 - SYN retransmission, 55
 - TCP timeouts, 54
- hint-tracks, 453
- hit rate, 673
- HMACs (hash method authentication codes),
 - cryptographic, 194
- horizontal scaling, 206

- Host field (HTTP request header), 354
- host replication, 102
- host-based IDSs, 180, 880–882, 893
- host-route adjacencies, 808
- HSRP (Hot Standby Routing Protocol), 527–528
 - failure detection, 531
 - groups, 530
 - preempt option, 529
 - tracking, 533
- HTML (Hypertext Markup Language), 79–80
 - form fields, 91
- HTTP (HyperText Transfer Protocol), 47
 - applications, 55–56
 - authentication, 364
 - character sets, 327
 - configuring on web servers, 57
 - connection remapping, 667–669
 - connections, 335–337
 - cookies, 728
 - entity header, 365
 - Entity header fields, 985
 - functionality, 329–330
 - general header, 344
 - Cache-Control field, 344–345
 - Connection field, 345
 - Date field, 346
 - Pragma field, 346
 - Transfer-Encoding field, 347
 - header fields
 - Accept-Language, 979–980
 - Expect, 980
 - From, 980
 - If-Match, 981
 - If-Modified-Since, 982
 - If-None-Match, 981
 - If-Range, 981
 - Proxy-Authorization, 982
 - TE, 982
 - Trailer, 977
 - Upgrade, 978
 - Via, 978
 - Warning, 978
 - HTTP redirection, 782–784, 792
 - message format, 332
 - components, 334
 - fields, 333
 - methods, 309
 - MIME comparison, 326
 - overview, 328
 - performance
 - attribute comparison, 341
 - compression, 342–343
 - version differences, 340
 - persistent connections, 339
 - pipelining, 340
 - probes, 714
 - RDT, 466
 - redirection, 782–784, 792
 - request header, 347
 - CONNECT method, 351
 - DELETE method, 351
 - fields, 352–356
 - GET method, 349
 - HEAD method, 349
 - methods, 348
 - OPTION method, 348
 - POST method, 349
 - PUT method, 350
 - request URI, 351
 - TRACE method, 351
 - request/response, 333
 - fields, 362–363
 - Status-Codes, 356–362
 - servers, 87
 - health management (case study), 722–723
 - virtual hosting, 58–61
 - session persistence, 754–755, 757
 - signatures, FTP signatures, 881
 - status codes, 983–985
 - streaming, 442–444

- tunneling, 461, 466
 - URIs, 310
 - versions, 330
 - HTTPS (HTTP over SSL), 372–374
 - server health (case study), 722–723
 - hybrid firewalls, 176–177
 - hybrid servers, 53
-
- I/O handling, 35–36
- IANA, language tags, 980
- IBM Data Centers, 570–573, 590–591
- IBM networking, 577
 - APPN, 572
 - mainframes, 569–575
 - SNA
 - APPN, 579–580
 - over TCP/IP, 580–585
 - subnetwork SNA, 577–579
 - VTAM, 571
 - Sysplex, 585–588
 - GDPS, 589
- ICANN (Internet Corporation for Assigned Names and Numbers), 399
- ICMP (Internet Control Message Protocol)
 - probes, 711
- IDCs (Internet Data Centers), 9, 125
- identifier field, 250–251
- IDSs (intrusion detection systems), 178
 - anomaly-based versus signature-based, 181
 - host-based, 180
 - Internet edge, 880–882
 - intranet server farms, 891–893
 - network-based, 179, 891
 - responses, 182
 - signatures, 107, 181, 891
- IEE 802.1D, 501
- IEEE 802, 479
- IEEE 802.1Q, 501
- IEEE 802.3ad, 33, 501
- If-Match field (HTTP header), 981
- If-Modified-Since field (HTTP header), 982
- If-Modified-Since field (HTTP request header), 355
- If-None-Match field (HTTP header), 981
- I-frames, 450, 990
- If-Range field (HTTP header), 981
- IKE (Internet Key Exchange), 637
- IMAP4 probes, 718
- immediate ACKs, 280
- in-band health verification, 67
- in-band probes, 703–705
 - HTTP return code checks, 706
 - server recovery, 706
- incomplete adjacencies, 808
- informational status codes (HTTP response header), 357
- infrastructure (Data Centers), 801–805
- inserting cookies, 1010
- inside global addresses, 558
- inside local addresses, 558
- integrating applications, 75
 - EAI, 75–77
 - network architecture implications, 97
- integrity, 189
- Internet infrastructure security attacks, 166
- interactive traffic, 41–43
 - connection termination, 46
 - delayed ACKs, 45
 - MSS, 44
 - Nagle algorithm, 46
 - TCP retransmission, 44
- interfaces
 - database access, 96
 - SVIs, 813
- interleaving, 470
- internal redundancy, 833
 - NSF, 835, 837
 - supervisor redundancy, 834–835

- Internet
 - HTTP, 328
 - traffic patterns, 919–921
 - long-lived traffic, 931
 - protocols, 922
 - short-lived traffic, 926
 - Internet Data Centers, 9, 125
 - Internet edge security, 869
 - ACLs, 873
 - antispoofing filtering, 870
 - IDSs, 880–882
 - Internet edge design, 882
 - securing routing protocols, 875–876
 - stateful firewalls, 878–879
 - traffic rate limiting, 874
 - uRPF, 872–873
 - Internet server farms, 120
 - dedicated, 120
 - DMZ server farms, 120
 - interrupt coalescing, 33, 63
 - interrupt processing, optimizing, 62–63
 - intranet server farms, 122–124
 - security, 885–886
 - ARP inspection, 895
 - IDSs, 891–893
 - packet filters, 890
 - port security, 894
 - server-farm design alternatives, 896–906
 - stateful firewalls, 887–888
 - VLAN features, 895
 - intranets
 - traffic patterns, 919–920, 923
 - long-lived, 931
 - short-lived, 926
 - IOS NAT, 561–562
 - IP addressing, DVIAs, 587–588
 - IP header compression, enabling on Cisco
 - routers, 298
 - IP infrastructure services, 23
 - IP spoofing, 167
 - IP-based virtual web hosting, 59
 - IPSec, 633
 - IKE, 637
 - security parameters, 638
 - TCP/IP layers, 634
 - VPNs, 639
 - IPTV, 442
 - IPv4 header, 246
 - flags field, 251
 - fragment offset field, 251
 - header checksum field, 254
 - header length field, 248
 - identifier field, 250–251
 - options field, 255–256
 - protocol field, 252–254
 - TOS field, 248–250
 - total length field, 250
 - TTL field, 251–252
 - Version field, 247
 - ISAPI, 88
 - iSCSI, 103
 - ISL (InterSwitch Link), 501–503
 - ISO-8859-1 character set, 969
 - isolation, 910
 - iterative queries (DNS), resolution process, 417
- ## J
-
- J2EE (Java 2 Enterprise Edition), 92
 - Java
 - applets, 86, 1014–1015
 - database access, 96
 - J2EE, 92
 - servlets
 - case study, 90–91
 - user session tracking, 743
 - Java Virtual Machine (JVM), 1014–1015
 - JavaScript, 86, 1013
 - server-side, 88

- JSPs, 88, 1021
- jumbo frames, 33, 496
 - optimizing interrupt processing, 63
- JVM (Java Virtual Machine), 86, 1014–1015

K–L

- Keep-Alive field (HTTP messages), 334
- keepalives, TCP, 55
- Kerberos, 644
- kernel mode, 35–36

- language tags, IANA, 980
- LANs
 - 10-GigE, 492
 - physical layers, 495
 - connecting mainframes to peripheral devices, 575
 - Ethernet
 - addresses, 485–487
 - baby giant frames, 496
 - frame size, 487–488
 - frames, 482–484
 - jumbo frames, 496
 - Layer 2 protocols, 500–501
 - overview, 481
 - physical layers, 493
 - switching, 498–500
 - Fast Ethernet, 489
 - autonegotiation, 490
 - physical layers, 494
 - Gigabit Ethernet, 491
 - autonegotiation, 492
 - flow control, 492
 - physical layers, 495
 - IEEE 802, 479
 - VLANs. *See* VLANs

- latency
 - load balancers, 942, 944
 - multilayer switch metrics, 937
 - SSL offloaders, 949
- Layer 2
 - access ports, 839–840
 - attacks, 167–168
 - configuration overview, 844
 - convergence, 827
 - MST, 831
 - PVST+, 828
 - Rapid PVST+, 829–830
 - dual-attached servers, 821
 - Ethernet. *See* Ethernet
 - security, 183
 - 802.1Q tag all, 187
 - ARP inspection, 184
 - port security, 183
 - private VLANs, 185–187
 - spanning trees, 841, 843
 - STP, 508–520
 - traffic distribution, 818
 - trunk configuration, 840
 - VLAN configuration, 837–839
- Layer 2/Layer 3 designs, redundancy, 139
 - access layer, 141–146
 - application architecture trends, 150–151
 - network infrastructure trends, 152–157
 - services, 146–150
- Layer 3
 - design options, 846
 - default gateway redundancy, 849–851
 - EIGRP, 858, 860, 862
 - OSPF, 852–854, 856–857
 - routing considerations, 846, 849
 - links, 805
 - protocols, 523
 - ARP, 525–526
 - EIGRP, 551–555
 - GLBP, 536–540

- HSRP, 528–533
- NAT, 556–566
- OSPF, 541–551
- VRRP, 534–535
- redundant paths, 814
- switches, 807
- traffic distribution, 819–820
- Layer 4 load balancing, 216
- Layer 5 load balancing, 217
 - persistence, 754
- layers of OSI reference model, 241–243
 - application layer, 244
- learning ports, 511
- least connections predictor, 678
- LEN (low-entry networking) nodes, 579
- links
 - EtherChannels, 816
 - Layer 3, 805
 - load distribution, 815, 817
 - Layer 2, 818
 - Layer 3, 819–820
 - redundant, 815–817
- Linux
 - configuring loopback interfaces, 1005–1006
 - enabling PMTUD, 291–292
- load balancers
 - HTTP redirection, 782–784
 - Internet traffic patterns, 921
 - NAT, 557
 - performance metrics, 939–941
 - CC metric, 943
 - CPS metric, 942
 - latency, 942, 944
 - PPS metric, 944
 - response time, 945
 - persistence, 754
 - comparing mechanisms, 789
 - cookies, 769–775
 - predictors, 761
 - SSL persistence, 791
 - sticky groups, 764
 - sticky methods, 762
 - URL cookies, 794
- PIX, NAT, 565–566
- reassigning connections, 705
- server failure detection, 700
 - probes, 701
 - SNMP, 701
- server health management, 690
 - CISCO-SLB-MIB, 698–699
 - DFP, 708
 - graceful shutdown feature, 691
 - in-band probes, 703–706
 - Max/Min Connections, 694–695
 - out-of-band probes, 707–708, 711–718
 - probe comparison, 709
 - slowstart feature, 693
 - SNMP, 697–698
 - XML, 696–697
- source IP hash, 768
- source IP stickiness, 765–767
- SSL stickiness, 785
 - challenges and concerns, 787–788
 - configuring, 786
- traffic patterns, 939
- URL cookies, 776–778
- URL hash, 780–781
- URL match, 779
- load balancing, 24, 97, 205
 - algorithms, 673
 - cache farm load-balancing, 683–685
 - fastest, 680
 - hash address, 681
 - least connections, 678
 - round-robin, 676
 - server farm, 673–675
 - source IP, 681
 - URL and hash URL, 681
 - weighted least connections, 679
 - weighted round-robin, 677

- architecture, 232–235
 - critical components, 234–235
 - generic components, 232–234
- cache load balancing, 210–211
- client NAT, 662
- connection failover, 231
- connection persistence, 219
- connection spoofing, 664–669
- connection tracking, 219
- directed mode, 660–661
- dispatch mode, 657–659
- DSR, 669–670
- firewall load balancing, 212–213
- flexibility, 659
- hardware, 98
- high availability, redundancy protocol, 226, 228–230
- horizontal scaling, 206
- implications for application integration, 97–98
- Layer 4 load balancing, 216
- Layer 5 load balancing, 217
- modes of operation overview, 653
- optimizing server availability, 65
- overview, 690
- performance, 671–672
- process description, 215–216
- proxy servers, 760
- RTP, 472
- server health, 224
 - in-band server health tracking, 224
 - out-of-band server health tracking, 225
- server load balancing, 209–210
- server-selection mechanism, 654
- session persistence, 219
 - cookies, 222–223
 - session-sharing servers, 761
- SSL traffic, 382, 384
- stateful failover, 231
- stateless failover, 231
- sticky failover, 231
- unicast streaming, 472
- versus DNS round-robin, 207–209
- vertical scaling, 206
- VPN/IPSec load balancing, 211
- load distribution, 815, 817
 - dual-attached servers, 821
 - EtherChannels, 816
 - Layer 2, 818
 - Layer 3, 819–820
 - looped topologies, 819
 - loop-free topologies, 818
- load-share adjacencies, 808
- local DUAL, 552
- lock and key, 171
- logical ports, 517–518
- long-lived traffic, 929–931
 - performance metrics, 933
- loop-free topology, 818
- loopback interfaces. configuring, 995
 - Linux, 1005–1006
 - Windows 2000, 996–998
 - Windows NT, 1002
- looped topologies, 818–819
- loop-free topologies, 832–833
 - load distribution, 818
 - spanning trees, 822–825
- Loopguard, 832–833
- LPAR (logical partitions), 570, 576
- LSAs, 544
- LU Type 6.2, 579
- LUs (logical units), 571

M

- MAC address tables, 499
- MAC addresses, 486
 - flooding, 168
 - Layer 2 protocols, 501
 - reducing, 514
 - redundant firewalls, 905

- mac-address-table aging-time command, 500
- macroblocks, 991
- mainframes, 569
 - attachment options, 573
 - channel attachments, 573–574
 - LAN attachments, 575
 - FEP, 570
 - LPAR, IP addressing, 576
 - operating systems, 570
- Management Information Bases. *See* MIBs
- management networks, security, 908
 - authentication, 911–913
 - encryption, 910
 - isolation, 908–910
 - secure design, 914
- man-in-the-middle attacks, 184
- MANs, IEEE 802, 479
- markup languages
 - HTML, 79–80
 - WML, 83
 - XML, 79, 82–83
- master-down interval, 535
- Max Connections parameter, 694–695
- maxconns, 678
- Max-Forwards field (HTTP request header), 355
- maximum connections, 682
- Maximum Transmission Unit, 488
- MD5 (Message Digest-5), 607
- media types, 327–328
- mega proxies, 766–767
- messages
 - HTTP, 309, 332
 - components, 334
 - fields, 333
 - MIME, 323–324
 - character sets, 326
 - HTTP comparison, 326
 - media types, 327–328
- messaging middleware, 91
- META tag, configuring web servers to insert
 - cookies, 1010
- methods
 - HTTP, 309
 - request header, 347–348
 - CONNECT, 351
 - DELETE, 351
 - GET, 349
 - HEAD, 349
 - OPTION, 348
 - POST, 349
 - PUT, 350
 - TRACE, 351
 - URLs, 316
- metrics
 - performance, 934–935
 - firewalls, 938
 - load balancers, 939–945
 - multilayer switches, 936–937
 - SSL offloaders, 946, 948–949
 - testing, 950–957
 - tuning
 - EIGRP, 553–554
 - OSPF, 547, 856
- MHSRP, 818
- MIBs (Management Information Bases), 698
 - platform flexibility, 702
 - RMON, 699
- Microsoft .NET, 92
- middleware, 76, 91–92
 - components, 93
 - traffic patterns, 94–95
- MIME format, 323–324
 - character sets, 326
 - HTTP comparison, 326
 - media types, 327–328
- Min Connections parameter, 694–695
- MJPEG (Motion JPEG), 450

- MLS (Multilayer Switching)
 - architectures, 809
 - CEF-based, 821
 - flow-based, 820
 - switching paths, 809
- mod_session, session-tracking case study, 740–741
- modifying TCP keepalive defaults, 55
- monitoring TCP connections, 67
- motion estimation, 989
- MPEG (Motion Pictures Experts Group), 990–991
 - macroblocks, 991
 - MPEG1, 450
 - MPEG2, 450
 - slices, 991
- MSS (maximum segment size), 44, 283–284
- MST, 823, 831
- MTU (Maximum Transmission Unit), 488
- mtu command, defining nonstandard frame size, 497
- multicast addresses, mapping, 486
- multicast packets, 471
- multicast streaming, 24
- multilayer switches, performance metrics, 936–937
 - latency, 937
 - throughput, 936
- multimedia streaming, TCP versus UDP, 445–446
- multimedia transport formats, 454
 - RTCP, 457–459
 - RTP, 454
- multiple-tier designs, 133, 135
 - collapsed multitier design, 137–138
 - expanded multitier design, 135–136
- multiplexing, 257
- multiprocess application servers, 53
- multiprocess servers, 53
- multitier architecture application environment, 12
- MX (Mail Exchange) records, 404

N

- Nagle algorithm, 46, 281–282
- name servers, 418
- name-based virtual hosting, 61
- namespace, URNs, 321
- naming relative URIs, 314–315
- NAT (Network Address Translation), 556–558, 663
 - application support, 559–560
 - IOS NAT, 561–562
 - load balancers, 565–566
 - PIX firewalls, 563–564
- native VLANs, 503
- NAU (network addressable unit), 571
- NBMA (nonbroadcast multiaccess), 542
- NCP (Network Control Program), 570
- negative caching, 421
- neighbor router authentication, 876
- Netscape
 - introduction of cookies, 735
 - JavaScript, 1013
- netstat -a command, 37
- network infrastructure trends, 152–157
- network management security
 - SNMPv3, 649
 - SSH, 647
- network security infrastructure, 169
 - ACLs, 169–171
 - firewalls, 173
 - hybrid, 176–177
 - limitations, 178
 - packet-filtering, 174
 - proxy, 175
 - statefull, 175
- IDSs, 178
 - anomaly-based versus signature-based, 181

- host-based, 180
 - network-based, 179
 - responses, 182
 - signatures, 181
 - Layer 2, 183
 - 802.1Q tag all, 187
 - ARP inspection, 184
 - port security, 183
 - private VLANs, 185
 - private VLANs with firewalls, 187
 - network-based IDSs, 179, 891
 - networks
 - campus core, security, 884
 - Data Centers
 - roles of, 7
 - SP environment, 9
 - designing, multitier design (case study), 108–111
 - Internet edge security, 869–882
 - intranet server farms
 - design alternatives, 896–906
 - security, 885–895
 - management network security, 908–914
 - security, implications for application
 - integration, 104–107
 - traffic patterns, 923
 - VLANs, 502
 - access ports, 520
 - creating trunks, 505–506
 - designing, 505
 - PVIDs, 503
 - trunks, 503
 - NICs (network interface cards), 32–33
 - autonegotiation, 490
 - Ethernet driver, 36
 - interrupt coalescing, 63
 - server multihoming, 33
 - NIDs (namespace IDs), 321
 - Nimda, 165
 - NIST (National Institute of Standards and Technology), 609
 - NNs (network nodes), 572
 - node types (APPN), 579–580
 - nonbroadcast multiaccess (NBMA), 542
 - nonedge ports, 829, 840
 - nonprintable ASCII character sets, 963–964
 - nonrepudiation, 189
 - NS (Name Server) records, 403, 423–425
 - NSAPI, 88
 - NSF, 835–837
 - NSSAs (not-so-stubby areas), 543
 - n-Tier model, 11, 77
 - database access, 95–96
 - Java, 96
 - markup languages, 79–83
 - middleware, 91–92
 - components, 93
 - traffic patterns, 94–95
 - server-side programming, 87–89
 - case study, 90–91
 - user agents, 84
 - browsers, 84
 - client-side programming, 85
 - helpers and plug-ins, 85
 - web servers, 86
-
- ## O
-
- object middleware, 91
 - OIDs (object identifiers), 697
 - on-demand caching, 472
 - operating systems
 - LPAR, 570
 - mainframe-based, 570
 - UNIX, system calls, 39–40

- optimizing server performance, 62
 - interrupt processing, 62–63
 - load balancing, 65
 - preventing server overload, 65–67
 - reverse proxy caching, 63
 - SSL, 384–385
- OPTION method (request header), 348
- options field, 255–256
 - TCP header, 266–267
- OSA (open system adapters), 576
- OSI reference model, 241–243
 - application layer, 244
- OSPF, 541–542, 852
 - advertising the local subnets, 854
 - area assignment and summarization, 853
 - areas, 543
 - convergence time, 856
 - default advertisement, 551
 - failure detection, 545
 - LSAs, 544
 - metric tuning, 547, 856
 - neighbor states, 542
 - redistribution, 547–549
 - stub areas, 854
 - summarization and filtering, 550
 - topology, 852
- OTPs (one-time passwords), 641
- OUI (organizationally unique identifier) format, 486
- out-of-band probes, 707–708
 - application layer, 713
 - DNS probes, 717
 - FTP probes, 717
 - HTTP probes, 714
 - IMAP4 probes, 718
 - POP3 probes, 718
 - SMTP probes, 718
 - SSL probes, 716
 - ICMP, 711
 - TCP, 711
 - UDP, 712

- outside global addresses, 558
- outside local addresses, 558
- overloaded servers, 65–67

P

- packet filters, 890
- packet processing, 35–36
- packet-filtering firewalls, 174
- packetization, 453
- packets
 - directed mode processing, 661
 - Ethernet, 482
 - filtering, ACLs, 25
 - header rewrites, 656
 - multicast, 471
 - RMI, 94
 - unicast, 471
- PAGP (Port Aggregation Protocol), 501
- parallel Sysplex, 585–588
- partial URIs, 311
- passive state, 552
- passwords, OTPs, 641
- paths, switching, 806
- PAUSE frames, 492
- PAWS, 295
- PCI (Peripheral Component Interface), 34
- PCI-X bus architecture, 35
- performance metrics, 934–935
 - firewalls, 938
- HTTP
 - attribute comparison, 341
 - compression, 342–343
 - version differences, 340
- implications of SSL, 379–380
- improving in SSL transactions, 384–385
- load balancers, 671–672, 939–941
 - CC metric, 943
 - CPS metric, 942

- latency, 942–944
- PPS metric, 944
- response time, 945
- multilayer switches, 936–937
- SSL offloaders, 946
 - CPS metric, 948
 - latency, 949
 - PPS metric, 949
- testing, 950
 - hardware, 953
 - selecting data mix, 956–957
 - software, 952
 - test environment, 954–955
 - tools, 951
- persistence, 749
 - cookies, 728–729
 - active, 775
 - match, 771–773
 - passive, 769
 - HTTP sessions, 339, 374, 754, 757
 - redirection, 784
 - load balancers, 754, 789
 - multi-port protocols, 755–756
 - proxy servers, 758
 - clustered proxies, 759
 - session sharing servers, 761
 - source IP hash, 768
 - source IP stickiness, 765
 - mega proxies, 766–767
 - SSL, 755, 790–791
 - stickiness, 785–789
 - streaming protocols, 757
 - URL cookies, 776–778, 794–796
 - URL hash, 780–781
 - URL match, 779
- P-frames, 451, 991
- PHP, 88
- physical layers
 - 10-GigE, 495
 - Ethernet, 493
 - Fast Ethernet, 494
 - Gigabit Ethernet, 495
- ping of death (PoD) attacks, 163
- pipelining, 340
- PIX Firewalls
 - election process, 905
 - failure detection, 906
 - NAT, 563–564
- pixels
 - chroma subsampling, 989
 - DCT, 988
- PKCS (Public Key Cryptography Standards), 388
- PKI (public key infrastructure), 388–389, 612
 - CAs, 619
 - certificates, 621
 - deployment options, 623
 - enrollment, 624
 - key exchange, 620
 - revocation, 625
 - digital certificates, 615
 - extensions, 619
 - formats, 617
 - standards, 614
- placement
 - of DNS servers
 - forwarders, 427–428
 - split namespace, 428, 430
 - of switches in redundant Data Centers with services, 148
- plug-ins, 85
- PMTUD (path MTU discovery), 284–287
 - black-hole problem, 287–288
 - enabling on Linux, 291–292
 - enabling on Solaris 2, 291
 - enabling on Windows 2000/Windows NT, 289–290
 - enabling on Windows 95/98, 290
- point-to-point links, 829
- POP3 probes, 718
- port mappings, 105

- port remapping, 667
- port security, 183, 894
- Port VLAN IDs (PVIDs), 503
- portal applications, 72
- port-based virtual hosting, 60
- PortFast, 828, 839
- portmapper, 94
- ports
 - 802.1w, 829
 - logical ports, 517–518
 - putting into a permanent trunk, 841
 - roles and states, 511
 - switch ports, 505
- POST method (request header), 349
- PPS metric, 933
 - load balancers, 944
 - SSL offloaders, 949
- Pragma field (HTTP general header), 346
- precedence bits, 249
- predictors, 761
 - cache farm load-balancing, 683–685
 - fastest, 680
 - hash address, 681
 - least connections, 678
 - round-robin, 676
 - source IP, 681
 - URL and hash URL, 681
 - URL hash, 780–781
 - weighted least connections, 679
 - weighted round-robin, 677
- preemption, 851
- presentation tier, 77
- preventing server overload, 65–67
- printable ASCII character sets, 964–965
- private VLANs
 - in conjunction with firewalls, 187
 - security, 185
- probes, 690
 - comparing and selecting, 709
 - DNS, 713
 - in-band health checks, 703–705
 - HTTP return code checks, 706
 - server recovery, 706
 - out-of-band probes, 707–708
 - application layer, 713–718
 - ICMP, 711
 - TCP, 711
 - UDP, 712
 - server failure detection, 700–701
- probing, 162
- process switching, 807
- processes, 51–53
 - channels, 569
 - configuring on web servers, 57
 - multiprocess application servers, 53
- programming
 - client-side, 85
 - server-side, 87–91
- progressive playback. *See* HTTP streaming
- protocol field, 252–254
- protocols
 - ARP, 525–526
 - authentication, 640
 - control, 466
 - EIGRP, 551
 - default advertisement, 555
 - failure detection, 552
 - metric tuning, 553–554
 - redistribution, 554
 - summarization and filtering, 555
 - GLBP, 536
 - active/standby election, 537
 - failure detection, 538–539
 - load distribution, 540
 - HSRP, 528
 - failure detection, 531
 - groups, 530
 - preempt option, 529
 - tracking, 533
 - Internet traffic patterns, 922

- Layer 2, STP, 508–520
- NAT, 556–558
 - application support, 559–560
 - IOS NAT on routers, 561–562
 - load balancers, 565–566
 - PIX firewalls, 563–564
- OSPF, 541–542
 - areas, 543
 - default advertisement, 551
 - failure detection, 545
 - LSAs, 544
 - metric tuning, 547
 - neighbor states, 542
 - redistribution, 547–549
 - summarization and filtering, 550
- routing, securing, 875–876
- streaming, 441–442
- VRRP
 - failure detection, 535
 - master/backup election, 534
- wire format, 474
- proxies, mega proxies, 766
- proxy firewalls, 175
- proxy servers
 - load balancing, 760
 - persistence, 758–759
- Proxy-Authorization field (HTTP header), 982
- PTR (Pointer Resource Records) records, 404, 408
- PU Type 2.1, 579
- public key encryption, 191, 379. *See also*
 - asymmetric cryptography
- punt adjacencies, 808
- PIUs (physical units), 571
- PUT method (request header), 350
- PVID (Port VLAN ID), 503
- PVST+ (Per VLAN Spanning-Tree Plus), 501
 - convergence, 828
 - rapid PVST+, 514
 - configuring, 518
 - VLAN support, 518

Q

- QoS policies, 24
- quantization, 988
- queries (DNS)
 - communication flows, 420
 - resolution process, 412
- QuickTime, 460, 474
 - Real Video, 451

R

- RADIUS servers, 74
- Range field (HTTP request header), 355
- Rapid PVST+, 823–825
 - convergence, 829–830
- rapid PVST+, 514
 - configuring, 518
- RCs, 602
- RDT stream delivered on HTTP, 466
- real-time streaming, 442–444
 - bandwidth, 444
 - HTTP tunneling, 461
- Real-Time Streaming Protocol, 467–470
- realtime-streaming, 443
- RealVideo, 460, 474
- reassembler module, 453
- reassigning connections, 704
- receive window (TCP), 47
- records, 375
 - A records, 425
 - glue records, 415
 - NS records, 423–424
- recursive queries, 404, 409
- recursive queries (DNS), resolution process, 417
- redirection status codes (HTTP response header), 359

- redistribution
 - EIGRP, 554
 - OSPF, 547–549
- redundancy, 448, 833
 - EtherChannels, 507
 - gateways, 849–851
 - high availability, 226–228
 - active-active load balancing, 229–230
 - active-standby load balancing, 228
 - NSF, 835–837
 - spanning trees, 842
 - supervisor redundancy, 834–835
- redundant firewall server-farm design, 905–906
- redundant Layer 2/Layer 3 designs, 139
 - access layer, 141–146
 - application architecture trends, 150–151
 - network infrastructure trends, 152–157
 - services, 146–150
- redundant links, 815–817
- Referer field (HTTP request header), 355
- referrals (DNS), resolution process, 414–417
- reflexive ACLs, 172–173
- registered informal namespaces, 321
- registries, 94
- relative URIs, 311
 - naming, 314–315
- relative URLs, 316
- reliability, 257
- Remote Network Monitoring, 699
- removing, temporal redundancy, 987, 989
- request header, 347
 - fields, 352
 - Accept field, 353
 - Accept-Charset field, 353
 - Accept-Encoding field, 354
 - Authorization field, 354
 - Host field, 354
 - If-Modified-Since field, 355
 - Max-Forwardst field, 355
 - Range field, 355
 - Referer field, 355
 - User-Agent field, 356
 - methods, 348
 - CONNECT, 351
 - DELETE, 351
 - GET, 349
 - HEAD, 349
 - OPTION, 348
 - POST, 349
 - PUT, 350
 - TRACE, 351
 - request URI, 351
- request URI, 351
- Rescorla, Eric, 379
- reserved characters, 318
- residual macroblock, 989
- resolving DNS names, 404–406, 411
 - caching, 420
 - client applications, 422–423
 - TTL values, 421
 - DNS proxy, 409
 - caching-only servers, 411
 - forwarders, 410
 - DNS servers, 407
 - iterative queries, 417
 - queries, 412
 - recursive queries, 417
 - referrals, 414–417
 - root hints, 413–414
- resources (HTTP), 309
 - URNs, 320
- response header
 - fields, 362–363
 - Status-Codes, 356
 - client error status codes, 360
 - informational status codes, 357
 - redirection status codes, 359
 - server error status codes, 362
 - success status codes, 358

response time

- load balancers, 945
- SSL offloaders, 949

 retransmission, 276

reverse proxy caching. *See* RPC

reverse zones, 402

RFC 1738, 315

RFC 1918 filtering, 870

RFC 2827 filtering, 870

RFCs (requests for comments), 310

RHI (Route Health Injection), 846

RMI, passing through firewalls, 106

RMON (Remote Network Monitoring), 699

root DNS servers, 407

root hints (DNS), resolution process, 413–414

root port (RP), 512

root ports (RPs), 829

root switches, setting priority, 511

round-robin predictors, 676

route filters, 876

Route Health Injection (RHI), 846

router ACLs (RACLs), 170

routing, 655

- between core and aggregation routers, 846, 849
- NAT, 557, 561–562
- neighbor router authentication, 876
- OSPF, 853
- passive states, 552
- process overview, 655

 routing protocol security, 875–876

RP (root port), 512

RPC (reverse proxy caching), 683

- optimizing server performance, 63

 RPR+, 835

RRs (resource records), 402–403

- TTL values, 421

 RSA (Rivest, Shamir, and Adelman), ephemeral

RSA, 631

RTP (Real-time Transport Protocol), 454

- load balancing, 472
- payload types, 455
- QuickTime, 460

 RTSP (Real-Time Streaming Protocol), 467–470

S

SACK, 292–293

SANs (storage-area networks), connecting storage

- devices to servers, 19

 scalability

- in Data Center design, 117
- EtherChannels, 815
- spanning-tree algorithm, 824

 scanning, 162

scripting, 88

- ASP, 1022
- CGI, 1019

 secondary root switches, 511

secret-key algorithms, 190

- SSL, 378

 security

- AAA, 197
- attacks
 - buffer overflow, 167
 - DDoS, 164
 - DoS, 163
 - eavesdropping, 165
 - Internet infrastructure attacks, 166
 - Layer 2, 167–168
 - scanning/probing, 162
 - session hijacking, 167
 - trust exploitation, 166
 - unauthorized access, 165
 - viruses and worms, 165

- authentication, 640
 - AAA protocols, 645–646
 - challenge/response schemes, 642
 - digital certificates, 642
 - HTTP, 364
 - Kerberos, 644
 - OTPs, 641
- campus core, 884
- cryptography, 188–189
 - asymmetric, 602–606
 - asymmetric encryption, 191
 - CAs, 619–625
 - ciphers, 608
 - cryptographic hashing algorithms, 193–194
 - digital signatures, 195
 - export-grade ciphers, 611
 - FIPS, 609
 - hashing algorithms, 607–608
 - NIST, 609
 - PKI, 612–619
 - symmetric, 190, 597–602
- Data Center framework
 - incident response and attack mitigation, 202
 - secure management framework, 200–201
 - security life cycle, 198
 - security policies, 198
- defining security zones, 865–868
- implications for application integration, 104–107
- Internet edge, 869
 - ACLs, 873
 - antispoofing filtering, 870
 - auRPF, 872
 - IDSs, 880–882
 - Internet edge design, 882
 - securing routing protocols, 875–876
 - stateful firewalls, 878–879
 - traffic rate limiting, 874
 - uRPF, 873
- intranet server farms, 885–886
 - ARP inspection, 895
 - design alternatives, 896–906
 - IDSs, 891–893
 - packet filters, 890
 - port security, 894
 - stateful firewalls, 887–888
 - VLAN features, 895
- isolation of management infrastructure, 200
- management network, 908
 - authentication, 911–913
 - encryption, 910
 - isolation, 908–910
 - secure design, 914
- need overview, 159
- network management
 - SNMPv3, 649
 - SSH, 647
- network security infrastructure, 169
 - ACLs, 169–171
 - firewalls, 173–178
 - IDSs, 178–182
 - Layer 2, 183–187
- services, 25
- terminology, 160
- threats, 160
- transport security, 626
 - IPSec, 633–634, 637–639
 - SGC, 631
 - SSL, 626–629
 - SSL cipher suites, 632–633
- VLANs, 506
- VPNs, 196
- vulnerability, 161
 - out-of-date software, 161
 - software default settings, 162

- segments, 41, 245
 - MSS, 44
 - small segments, 46
- SEQ numbers, 666
- sequence number field (TCP), 262
- sequence numbers, 257
- sequence states (TCP), 38
- server adapters, 33
- server applications, processes, 51–53
- server error status codes (HTTP response header), 362
- server failures, 54–55
- server farms
 - aggregation layer, 15
 - alternate Layer 2/Layer 3 designs, 133
 - ARP inspection, 895
 - creating, 749
 - design alternatives, 896–906
 - extranet server farms, 124
 - generic Layer 2/Layer 3 designs, 126–130
 - Layer 2 access switches, 130–131
 - Internet server farms, 120
 - dedicated, 120
 - DMZ server farms, 120
 - Intranet server farms, 122–124
 - load-balancing algorithms, 673–675
 - multiple-tier designs, 133–135
 - collapsed multitier design, 137–138
 - expanded multitier design, 135–136
 - port security, 894
 - security, 885–886
 - IDSs, 891–893
 - packet filters, 890
 - stateful firewalls, 887–888
 - VLAN features, 895
 - signatures, 892
- server markdowns, 704
- server recovery, 706
- servers, 73, 690
 - clustering
 - geographical, 101
 - implications for application integration, 99–104
 - session persistence, 749
 - cookies, 728, 732
 - database, 96
 - DNS
 - forwarders, placement of, 427–428
 - site selectors, 431
 - split namespace, 428–430
 - dual-attached, 821
 - failure detection, 700
 - probes, 701
 - SNMP, 701
 - health management, 224, 689
 - CISCO-SLB-MIB, 698–699
 - DFP, 708
 - graceful shutdown feature, 691
 - in-band server health, 224, 703–706
 - load balancing overview, 690
 - HTTP and HTTPS (case study), 722–723
 - Max/Min Connections, 694–695
 - out-of-band server health, 225, 707–718
 - probe comparison, 709
 - slowstart feature, 693
 - SNMP, 697–698
 - virtual hosting environment (case study), 718–720
 - XML, 696–697
 - HTTP, 442
 - load balancing, 205, 209–210
 - application integration implications, 98
 - maximum connections, 682
 - multihoming, 33

- sessions, 727
 - persistence, 761
 - session tracking, 728
 - tracking, 736–740
- streaming, 442
- URL cookies, 776, 778
- vservers, 690
- web, 86
- server-selection mechanism (load balancers), 653–654
- server-side ActiveX, 89
- server-side JavaScript, 88
- server-side programming, 87–89
 - ASP, 1022
 - case study, 90–91
 - CGI, 1018–1019
 - servlets and JSP, 1021
- server-specific APIs, 88
- services
 - Data Centers, 22
 - application, 24
 - business continuance, 27
 - business continuance infrastructure, 26
 - IP infrastructure, 23
 - security, 25
 - storage, 26
 - web services, 151
- servlet APIs, session-tracking case study, 743–748
- servlets, 88, 1021
- session affinity, 53
- session keys, 616
- session negotiation phases (SSL), 376–378
- session sharing servers, 761
- sessions, 727
 - APPN service, 579
 - hijacking, 167
 - persistence, 219, 673–674, 749
 - cookies, 222–223, 769
 - e-commerce applications, 790
 - HTTP, 754, 757
 - multi-port protocols, 755–756
 - predictors, 761
 - proxy servers, 758–759
 - SSL, 755
 - sticky groups, 764
 - sticky methods, 762
 - resuming, 380, 382, 785
 - session cookies, 728–729, 769
 - matching predictable strings, 773
 - session tracking, 728
 - SSL, persistence challenges, 787
 - tracking, 736
 - Apache mod_session (case study), 740–741
 - combining methods, 740
 - cookies, 731, 739
 - form hidden fields, 737
 - HTTP sessions with servlets (case study), 743–748
 - URL rewriting, 738
- SGC, 631
- SHA (Secure Hash Algorithm), 608
- shared links, 829
- short-lived traffic, 925–927
 - performance metrics, 933
 - SSL connections, 947
- show cdp command, output, 501
- show spanning-tree vlan 10 command, 516
- show spanning-tree vlan command, 514
- signature-based IDSs, 181
- signatures, 105, 181
 - digital, 195
 - IDSs, 107, 891
 - Internet edge IDSs, 881
 - Solaris, 894
 - Windows, 893

- site selection architecture, 430–433
 - caching, 436–437
 - proximity, 435
 - referrals to site selectors, 433–435
 - stickiness, 437–438
- size (Ethernet), 487–488
- slave name servers, 418
- slices, 991
- sliding windows, 277
- slow paths, 933
- slow start, 279
- slowstart feature, 693
- small segments, 46
- SMTP probes, 718
- smurf attacks, 163
- SNA (Systems Network Architecture), 577
 - APPN, 579–580
 - over TCP/IP, 580
 - DLSw, 580–581
 - SNAsw, 581–585
 - subnetwork SNA, 577–579
 - VTAM, 571
- SNAsw (SNA switching), 581
 - BXN, 583
 - DLUR/DLUS, 583
 - EES, 582–583
 - TN3270, 584–585
- SNMP (Simple Network Management Protocol)
 - Management Stations, 697
 - OIDs, 697–698
 - server failure detection, 700–701
 - TRAPs, 700
- SNMPv3, 649
- SOA (Start of Authority) records, 403
- sockets, 39–40
- software
 - clustering, 100
 - default settings (security risk), 162
 - load balancing, 98
 - middleware, 76, 91–92
 - components, 93
 - traffic patterns, 94–95
 - out-of-date (security risk), 161
 - performance metric testing, 952
- Solaris signatures, 894
- Solaris 2, enabling PMTUD, 291
- source IP hash, 768
- source IP predictor, 681
- source IP stickiness, 221, 765–76, 792
- spanning trees, 822, 841–843
 - client-side VLANs, 826
 - selecting algorithms, 823–825
- spatial redundancy, 448
 - removing, 987–989
- specifications, MIME, 323
- speed negotiate command, 492
- split namespace, 428–430
- splitting (stream), 471
- spoofing
 - ARP, 167
 - connection spoofing, 664–667
- SQL (Structured Query Language), 96
- SQL Slammer, 165
- SSH, 647
- SSL (Secure Sockets Layer), 626
 - authentication, 385–387
 - PKI, 388–389
 - certificates, 629
 - ciphersuites, 371, 389–390, 632–633
 - client authentication, 642
 - connections, 371–372
 - connection, 371
 - data encryption, 378
 - example applications of, 370–371
 - handshakes, 374–378
 - HTTPS, 372–374
 - load balancing, 382–384

- offloading, 794–796
 - CPS metric, 948
 - latency, 949
 - performance metrics, 946
 - PPS metric, 949
- performance, 379–380
 - optimizing, 384–385
- persistence, 755, 791
- probes, 715
- secret keys, 378
- sessions, 372, 380–382
- stickiness, 785
 - challenges and concerns, 787–788
 - configuring, 786
 - TCP/IP layers, 627–628
 - traces, analyzing, 391–393
 - VPNs, 639
- SSLv2, 627
- SSLv3, TLS 1.0, 627
- SSO, 835
- standalone servers, processes, 52
- standard ACLs, 170
- standard retransmission, 446
- standards
 - cookies, 735
 - PKI, 614
- stateful devices, 803
- stateful failover, 227, 231
- stateful firewalls, 175, 878–879
 - intranet server farms, 887–888
- stateless failover, 231
- static routing, 527
- Status-Codes (HTTP response header), 56, 356, 983–985
 - client error status codes, 360
 - informational status codes, 357
 - redirection status codes, 359
 - server error status codes, 362
 - success status codes, 358
- Step-Up, 631
- stickiness, 219, 674
 - in site-selection architecture, 437–438
- sticky failover, 231
- sticky groups, 764
- sticky methods, 761–762
- sticky tables, 221
- storage layer, 19
- storage services, 26
- storing cookies, 734–735
- STP (Spanning-Tree Protocol), 508
 - 802.1s configuration, 519–520
 - bridge identifiers, 510
 - convergence, 827
 - failure detection, 513
 - logical ports, 517–518
 - loop prevention, 832–833
 - multiple VLANs, 513–517
 - port roles and states, 510–512
 - rapid PVST+ configuration, 518
 - versions, 509
- stream splitting, 471
- streaming, 441–442
 - applications, session persistence, 757
 - congestion, 463
 - download rate, 466
 - HTTP tunneling, 466
 - real-time streaming, 443
 - RTSP, 467, 469
 - selecting protocol, 445
 - servers, 74, 442
 - packetizer module, 453
 - unicast/multicast packets, 471
 - software products, 473
 - streaming rate, 466
 - TCP, 462
 - transport formats, 454
 - RTCP, 457–459
 - RTP, 454

- UDP, 464–465
 - video, 447
- stub areas, 543, 854
- stub resolver (DNS), 405
- subdomains, 398
- subnetwork SNA, 577–579
- success status codes (HTTP response header), 358
- summarization
 - EIGRP, 555, 860
 - OSPF, 550, 853
- supervisor redundancy, 834–835
- suppressing broadcasts, 487
- SVIs, VLANs, 813
- switch fabric, 233–234
- switch ports, 505
- switching
 - debounce feature, 831
 - Ethernet, 498–499
 - frame size support, 497
 - MAC address table, 500
 - failure detection, 513
 - Layer 3, 807
 - multilayer, performance metrics, 936–937
 - operation overview, 654
 - root, setting priority, 511
- switching paths, 806, 933
 - Cisco IOS, 807–808
 - MLS, 809
- switchport mode trunk command, 506, 841
- switchport trunk allowed vlan 10,20 command, 506
- switchport trunk encapsulation dot1q command, 506
- symmetric cryptography, 597
 - 3DES, 600
 - DES, 598–600
 - RCs, 602
- symmetric encryption, 190
- SYN floods, 163
- SYN retransmission mechanism, 55
- Sysplex, 585–589
- system jumbo mtu command, 497

T

- tables
 - ARP, 526
 - CAM, 526
- TACACS+, 645
- tagging traffic, 504
- TCN (Topology Change Notification) BPDUs, 527
- TCP (Transport Control Protocol), 256, 461
 - ACKs, 48
 - applications, 41
 - HTTP, 47
 - Telnet, 43–46
 - configuring on web servers, 57
 - connections, 257, 267
 - establishment, 268–270
 - termination, 272–275
 - data processing, 41
 - flow control, 257
 - congestion avoidance, 279
 - congestion control, 278
 - delayed ACKs, 280
 - fast recovery, 280
 - immediate ACKs, 280
 - Nagle algorithm, 281–282
 - retransmission, 276
 - sliding windows, 277
 - slow start, 279
 - half close, 282
 - header compression, 296–298
 - header fields, 258–259
 - acknowledgment number field, 263
 - checksum field, 266
 - control flags, 264–266
 - options field, 266–267
 - sequence number field, 262
 - TCP header length field, 264
 - urgent pointer field, 266
 - window size field, 266

- keepalives, 55
- maximum burst size on high-speed networks, 49–50
- monitoring connections, 67
- MSS, 283–284
- multiplexing, 257
- offloading, 33
- PAWS, 295
- PMTUD, 284–287
 - black-hole problem, 287–288
 - enabling on Linux, 291–292
 - enabling on Solaris 2, 291
 - enabling on Windows 2000/Windows NT, 289–290
 - enabling on Windows 95/Windows 98, 290
- probes, 711
- Real Player, 463
- reliability, 257
- retransmission, 44
- SACK, 292–293
- segments, 42
- sequence numbers, 257
- server failure handling, 54
 - SYN retransmission, 55
 - TCP timeouts, 54
- server failures, 54
- streaming, 462
- timestamps, 294
- versus UDP, 445–446
- well-known port numbers, 260–261
- window scale, 295
- windows, 47–50
- TCP/IP protocol suite, 243
 - client/server architectures, 37–39
- TE field (HTTP header), 982
- Telnet
 - connection establishment, 43
 - connection termination, 46
 - delayed ACKs, 45
 - interactive traffic, 41–43
 - MSS, 44
 - Nagle algorithm, 46
 - TCP retransmission, 44
- temporal redundancy, 448
 - removing, 987–989
- temporary cookies, 729
- terminating TCP connections, 272, 275
- testing performance metrics, 950
 - hardware, 953
 - selecting data mix, 956–957
 - software, 952
 - test environment, 954–955
 - tools, 951
- thick clients, 9, 83
- thin clients, 83
- threaded servers versus forking servers, 51, 53
- threats (security), 160
- three-way handshakes, 268
- thresholds, reassigning connections, 705
- throughput, multilayer switch metrics, 936
- timestamps, 294
- TLDs (top-level domains), 399
- TN3270 servers, 74, 584–585
- topologies
 - Data Center architecture, 13–14
 - access layer, 16–18
 - aggregation layer, 15
 - layers, 14
 - storage layer, 19
 - transport layer, 20–21
 - EIGRP, 859
 - fully switched, 804
 - Layer 2, 818
 - minimizing changes, 831
 - OSPF, 852
 - redundant Layer 2/Layer 3 designs, 139
 - access layer, 141–146
 - application architecture trends, 150–151

- network infrastructure trends, 152–157
- services, 146–150
- VLANs, 804
- TOS field, 248–250
- total length field, 250
- totally stubby area, 543
- TRACE method (request header), 351
- traceroute, 252
- tracking
 - server health, 224
 - in-band server health tracking, 224
 - out-of-band server health tracking, 225
 - user sessions, 736
 - Apache mod_session (case study), 740–741
 - combining methods, 740
 - cookies, 739
 - form hidden fields, 737
 - HTTP sessions with servlets (case study), 743–748
 - URL rewriting, 738
- traffic
 - channeling, 507
 - client NAT, 663
 - encoding formats, 450–451
 - Internet, HTTP, 328
 - load balancing
 - architecture, 232–235
 - cache load balancing, 210–211
 - connection failover, 231
 - connection persistence, 219
 - connection tracking, 219
 - firewall load balancing, 212–213
 - flexibility, 659
 - high availability, 226–230
 - implications for application integration, 97–98
 - Layer 4 load balancing, 216
 - Layer 5 load balancing, 217
 - process description, 215–216
 - server health, 224–225
 - server load balancing, 209–210
 - session persistence, 219, 222–223
 - stateful failover, 231
 - stateless failover, 231
 - sticky failover, 231
 - VPN/IPSec load balancing, 211
 - multimedia transport formats, 454
 - RTCP, 457–459
 - RTP, 454
 - packetization, 453
 - patterns, 919–920
 - Data Centers, 924–933
 - Internet, 920–921
 - intranets, 923
 - load balancers, 939
 - protocols, 922
 - rate limiting, 874
 - SSL, load balancing, 382–384
 - switching paths, 806
 - tagging, ISL, 503
 - transport rate, 448
- traffic mix, 920
- Trailer field (HTTP header), 977
- Transfer-Encoding field (HTTP general header), 347
- transactions
 - middleware, 91
 - UDP, 301–302, 305
- transceivers, 493
 - Fast Ethernet, 495
- Transfer-Encoding headers, 343
- transparent caching, 684
- transparent devices, 824–825
- transport layer (Data Centers), 20–21
- transport protocols, UDP system calls, 40
- transport rate, 448
- transport security, 626
 - IPSec, 633
 - IKE, 637
 - security parameters, 638–639
 - TCP/IP layers, 634

- SGC, 631
- SSL, 626
 - certificates, 629
 - cipher suites, 632–633
 - TCP/IP layers, 628
- TRAPs, 700
- troubleshooting
 - DoS attacks, traffic rate limiting, 874
 - Ethernet networks, frame size issues, 488
 - firewall limitations, 178
 - flooding, 831
 - loops, 832–833
 - server failure detection, 700, 704
 - probes, 701
 - SNMP, 701
 - STP, failure detection, 513
- trunks, 503
 - configuring, 840
 - creating, 505–506
- TTL field, 251–252, 421
- TTP response header, Status-Codes, 359

U

- UDLD (Unidirectional Link Detection), 501, 832–833
- UDP (User Datagram Protocol), 50–51, 299, 461.
 - See also* TCP
 - header compression, 305
 - header fields, 299–301
 - probes, 712
 - server failure handling, 54–55
 - server failures, 54
 - streaming, 464–465
 - system calls, 40
 - transactions, 301–302, 305
 - versus TCP, 445–446
- unicast, 499
- unicast flooding, 499
- unicast MAC addresses, dummy, 98
- unicast packets, 471
- Uniform Record Locators. *See* URLs
- Uniform Resource Identifiers. *See* URIs
- Universal Resource Names. *See* URNs
- UNIX, system calls, 39–40
- unsafe characters, 318
- Upgrade field (HTTP header), 978
- upgrading applications, 71
- UplinkFast, 827–828
- urgent pointer field (TCP), 266
- URIs (Uniform Resource Identifiers), 310
 - absolute/full, 312
 - naming rules, 314–315
 - relative/partial, 311
 - request URI, 351
 - URNs and URLs, 322
- URL match, 779
- URLs (Uniform Record Locators), 311, 315
 - cookies, 776–778, 794–796
 - encoding, 316
 - hashing, 780–781
 - relative and absolute, 316
 - reserved characters, 318
 - rewriting, 738, 776
 - schemes, 316, 319
 - stickiness, 776
 - unsafe characters, 318
 - URIs and URNs, 322
- URNs (Universal Resource Names), 311, 320
 - encoding, 320
 - namespace, 321
 - URIs and URLs, 322
- uRPF, 872–873
- user agents, 84
 - browsers, 84
 - client-side programming, 85
 - helpers and plug-ins, 85
- user mode, 35–36
- User-Agent field (HTTP request header), 356

V

valuation, 197

Version field, 247

vertical scaling, 206

Via field (HTTP header), 978

video encoding, 987

video on demand (VoD), 445

video streaming, 442, 447

- codecs
 - analog, 448
 - comparison of, 452
 - MPEG, 990–991
 - popular encoding formats, 450–451
 - removing spatial and temporal
 - redundancy, 987–989
 - slices, 991
- redundancy, 448
- transport rate, 452
- transport formats, 454
 - RTCP, 457–459
 - RTP, 454

VIPAs (virtual IP addresses), DVIPAs, 587–588

virtual hosting

- configuring on web servers, 58–59
 - IP-based, 59
 - name-baseds, 61
 - port-based, 60
- server health (case study), 718–720

virtual servers (virtual servers), 690

viruses, 165

VLAN ACLs (VACLs), 170

vlan dot1q tag native command, 506

VLANs, 170, 502, 802

- 4096 VLANs, 514
- 802.1s, 516
- access ports, 520
- autostate, 814
- designing, 505–506
- PVIDs, 503

- SVIs, 813
- topologies, 804
- trunks, 503
 - virtualizing Data Center infrastructures, 810
- VoD (video on demand), 445
- VPN/IPSec load balancing, 211
- VPNs (Virtual Private Networks)
 - IPSec versus SSL, 639
 - security, 196
- VRRP, 527
 - failure detection, 535
 - master/backup election, 534
- vservers (virtual servers), 690
- VTAM (virtual telecommunications access method), 571
- VTP (VLAN Trunking Protocol), 500, 504
 - domains, defining, 504
 - modes, 839

W

W3C (World Wide Web Consortium), 151

Warning field (HTTP header), 978

WCCP (Web Cache Control Protocol), 685

Web Cache Control Protocol (WCCP), 685

web servers, 57, 86

- directories, 58
- HTTP applications, 55–56
- inserting cookies, 1010
- server processes, configuring, 57
- TCP parameters, configuring, 57
- virtual hosting, configuring, 58–61

web services, 151

weighted least connections predictor, 679

weighted round-robin predictors, 677

well-known port numbers, 260–261

window scale, 295

window size field (TCP), 266

windows, BDP, 50

- windows (TCP), 47–48
- Windows 95, enabling PMTUD, 290
- Windows 98, enabling PMTUD, 290
- Windows 2000
 - configuring loopback interfaces, 996–998
 - enabling PMTUD, 289–290
- Windows Media Video, 451, 461
- Windows NT
 - configuring loopback interfaces, 1002
 - enabling PMTUD, 289–290
- wire format, 474
- WML (Wireless Markup Language), 83
- worms, 165
- WSA (Web Services Architecture), 21

X–Z

- XML (Extensible Markup Language), 79–83,
696–697

- zones (DNS), 400–402
 - name servers, 418
 - zone transfers, 418–420