



Numerics

144-bit Layer 3 TCAM [6-27, 31-65](#)

A

AAA down policy, NAC Layer 2 IP validation [1-6](#)

abbreviating commands [2-4](#)

ABRs [31-24](#)

AC (command switch) [5-10](#)

access-class command [28-21](#)

access control entries

See ACEs

access-denied response, VMPS [11-27](#)

access groups

IP [28-22](#)

Layer 3 [28-22](#)

accessing

clusters, switch [5-13](#)

command switches [5-11](#)

member switches [5-13](#)

switch clusters [5-13](#)

access lists

See ACLs

access ports

and Layer 2 protocol tunneling [14-10](#)

defined [9-3](#)

in switch clusters [5-8](#)

accounting

with IEEE 802.1x [8-8, 8-30](#)

with RADIUS [7-28](#)

with TACACS+ [7-11, 7-17](#)

ACEs

and QoS [29-7](#)

defined [28-2](#)

Ethernet [28-2](#)

IP [28-2](#)

ACLs

ACEs [28-2](#)

and logging [28-7](#)

any keyword [28-14](#)

applying

on bridged packets [28-39](#)

on multicast packets [28-40](#)

on routed packets [28-39](#)

on switched packets [28-38](#)

time ranges to [28-18](#)

to Layer 2 and Layer 3 interfaces [28-21](#)

to QoS [29-7](#)

classifying traffic for QoS [29-37](#)

comments in [28-19](#)

compatibility on the same switch [28-3](#)

compiling [28-22](#)

configuration conflict examples [28-44](#)

configuring with VLAN maps [28-37](#)

defined [28-2](#)

examples, not fitting in hardware [28-45](#)

examples of [28-22, 29-37](#)

extended IP

configuring for QoS classification [29-38](#)

creating [28-11](#)

matching criteria [28-9](#)

feature manager [28-43](#)

hardware and software handling [28-7](#)

hardware support for [28-7](#)

ACLs (continued)

- host keyword [28-14](#)
- input router ACL configuration guidelines [28-8](#)
- IP
 - applying to interface [28-20](#)
 - creating [28-8](#)
 - defined [28-8](#)
 - fragments and QoS guidelines [29-28](#)
 - implicit deny [28-11, 28-15, 28-17](#)
 - implicit masks [28-11](#)
 - matching criteria [28-9](#)
 - matching criteria for port ACLs [28-4](#)
 - matching criteria for router ACLs [28-3](#)
 - named [28-16](#)
 - options and QoS guidelines [29-28](#)
 - undefined [28-22](#)
 - violations, logging [28-17](#)
 - virtual terminal lines, setting on [28-20](#)
- limiting actions [28-38](#)
- logging messages [28-11](#)
- log keyword [28-17](#)
- MAC extended [28-27, 29-39](#)
- matching [28-8, 28-22, 28-29](#)
- merge failure examples [28-46](#)
- monitoring [28-41](#)
- named [28-16](#)
- not fitting in hardware [28-45](#)
- number per QoS class map [29-28](#)
- numbers [28-9](#)
- policy maps and QoS classification [29-28](#)
- port
 - and voice VLAN [28-4](#)
 - defined [28-2](#)
 - limitations [28-4](#)
- preventing excessive TCAM usage [28-8](#)
- QoS [29-7, 29-37](#)
- resequencing entries [28-16](#)
- router [28-2](#)

ACLs (continued)

- standard IP
 - configuring for QoS classification [29-37](#)
 - creating [28-10](#)
 - matching criteria [28-9](#)
- support for [1-5](#)
- time ranges [28-18](#)
- undefined [28-29](#)
- unsupported features [28-8](#)
- using router ACLs with VLAN maps [28-37](#)
- VLAN maps
 - configuration guidelines [28-31](#)
 - configuring [28-30](#)
 - defined [28-5](#)
- active links [18-2](#)
- active router [32-1](#)
- addresses
 - displaying the MAC address table [6-26](#)
- dynamic
 - accelerated aging [15-8](#)
 - changing the aging time [6-21](#)
 - default aging [15-8](#)
 - defined [6-19](#)
 - learning [6-20](#)
 - preventing frame forwarding [36-5](#)
 - removing [6-21](#)
- filtering frames by MAC address [36-6](#)
- MAC, discovering [6-29](#)
- multicast
 - group address range [34-1, 34-3](#)
 - STP address management [15-8](#)
- static
 - adding and removing [6-24](#)
 - defined [6-19](#)
- address resolution [6-29, 31-8](#)
- Address Resolution Protocol
 - See ARP
 - See ARP table
- adjacency tables, with CEF [31-73](#)

- administrative distances
 - defined [31-83](#)
 - OSPF [31-30](#)
 - routing protocol defaults [31-75](#)
- advertisements
 - CDP [22-1](#)
 - RIP [31-19](#)
 - VTP [11-19, 12-3](#)
- aggregate addresses, BGP [31-57](#)
- aggregated ports
 - See EtherChannel
- aggregate policers [29-50](#)
- aggregate policing [1-7](#)
- aging, accelerating [15-8](#)
- aging time
 - accelerated
 - for MSTP [16-23](#)
 - for STP [15-8, 15-22](#)
 - bridge table for fallback bridging [36-6](#)
 - MAC address table [6-21](#)
 - maximum
 - for MSTP [16-24](#)
 - for STP [15-22, 15-23](#)
- alarms, RMON [25-3](#)
- allowed-VLAN list [11-21](#)
- area border routers
 - See ABRs
- ARP
 - configuring [31-9](#)
 - defined [31-8](#)
 - encapsulation [31-10](#)
 - static cache configuration [31-9](#)
 - support for [1-3](#)
- ARP table
 - address resolution [6-29](#)
 - managing [6-29](#)
- ASBRs [31-24](#)
- AS-path filters, BGP [31-52](#)
- asymmetrical links, and IEEE 802.1Q tunneling [14-4](#)
- attributes, RADIUS
 - vendor-proprietary [7-31](#)
 - vendor-specific [7-29](#)
- audience [iii](#)
- authentication
 - EIGRP [31-39](#)
 - HSRP [32-8](#)
 - local mode with AAA [7-36](#)
 - NTP associations [6-4](#)
 - RADIUS
 - defined [7-18](#)
 - key [7-21](#)
 - login [7-23](#)
 - TACACS+
 - defined [7-11](#)
 - key [7-13](#)
 - login [7-14](#)
 - See also port-based authentication
- authentication failed VLAN
 - See restricted VLAN
- authentication keys, and routing protocols [31-84](#)
- authoritative time source, described [6-2](#)
- authorization
 - with RADIUS [7-27](#)
 - with TACACS+ [7-11, 7-16](#)
- authorized ports with IEEE 802.1x [8-7](#)
- autoconfiguration [3-3](#)
- automatic discovery
 - considerations
 - beyond a noncandidate device [5-7](#)
 - brand new switches [5-8](#)
 - connectivity [5-4](#)
 - different VLANs [5-6](#)
 - management VLANs [5-7](#)
 - non-CDP-capable devices [5-5](#)
 - noncluster-capable devices [5-5](#)
 - routed ports [5-7](#)
 - in switch clusters [5-4](#)
 - See also CDP

automatic QoS

See QoS

automatic recovery, clusters [5-10](#)

See also HSRP

autonegotiation

duplex mode [1-2](#)

interface configuration guidelines [9-15](#)

mismatches [37-10](#)

autonomous system boundary routers

See ASBRs

autonomous systems, in BGP [31-45](#)

Auto-RP, described [34-5](#)

autosensing, port speed [1-2](#)

auxiliary VLAN

See voice VLAN

B

BackboneFast

described [17-9](#)

enabling [17-19](#)

support for [1-4](#)

backup interfaces

See Flex Links

backup links [18-2](#)

bandwidth for QoS

allocating [29-65](#)

described [29-13](#)

banners

configuring

login [6-19](#)

message-of-the-day login [6-17](#)

default configuration [6-17](#)

when displayed [6-17](#)

BGP

aggregate addresses [31-57](#)

aggregate routes, configuring [31-57](#)

CIDR [31-57](#)

clear commands [31-61](#)

BGP (continued)

community filtering [31-54](#)

configuring neighbors [31-55](#)

default configuration [31-43](#)

described [31-42](#)

enabling [31-45](#)

monitoring [31-61](#)

multipath support [31-49](#)

neighbors, types of [31-45](#)

path selection [31-49](#)

peers, configuring [31-55](#)

prefix filtering [31-53](#)

resetting sessions [31-48](#)

route dampening [31-60](#)

route maps [31-51](#)

route reflectors [31-59](#)

routing domain confederation [31-58](#)

routing session with multi-VRF CE [31-67](#)

show commands [31-61](#)

supernets [31-57](#)

support for [1-7](#)

Version 4 [31-42](#)

binding cluster group and HSRP group [32-10](#)

binding database

address, DHCP server

See DHCP, Cisco IOS server database

DHCP snooping

See DHCP snooping binding database

binding database, DHCP snooping

See DHCP snooping binding database

bindings

address, Cisco IOS DHCP server [18-7](#)

DHCP snooping database [18-7](#)

IP source guard [18-19](#)

binding table, DHCP snooping

See DHCP snooping binding database

blocking packets [21-6](#)

- booting
 - boot loader, function of [3-2](#)
 - boot process [3-1](#)
 - manually [3-12](#)
 - specific image [3-13](#)
- boot loader
 - accessing [3-14](#)
 - described [3-2](#)
 - environment variables [3-14](#)
 - prompt [3-14](#)
 - trap-door mechanism [3-2](#)
- bootstrap router (BSR), described [34-5](#)
- Border Gateway Protocol
 - See BGP
- BPDU
 - error-disabled state [17-2](#)
 - filtering [17-3](#)
 - RSTP format [16-12](#)
- BPDU filtering
 - described [17-3](#)
 - enabling [17-16](#)
 - support for [1-4](#)
- BPDU guard
 - described [17-2](#)
 - enabling [17-15](#)
 - support for [1-4](#)
- bridged packets, ACLs on [28-39](#)
- bridge groups
 - See fallback bridging
- bridge protocol data unit
 - See BPDU
- broadcast flooding [31-16](#)
- broadcast packets
 - directed [31-13](#)
 - flooded [31-13](#)
- broadcast storm control
 - See storm control
- broadcast storm-control command [21-4](#)
- broadcast storms [31-13](#)

C

- cables, monitoring for unidirectional links [23-1](#)
- cache engines, redirecting traffic to [33-1](#)
- CAMs, ACLs not loading in [28-45](#)
- candidate switch
 - automatic discovery [5-4](#)
 - defined [5-3](#)
 - requirements [5-3](#)
 - See also command switch, cluster standby group, and member switch
- CA trustpoint
 - configuring [7-45](#)
 - defined [7-42](#)
- caution, described [iv](#)
- CDP
 - and trusted boundary [29-33](#)
 - automatic discovery in switch clusters [5-4](#)
 - configuring [22-2](#)
 - default configuration [22-2](#)
 - described [22-1](#)
 - disabling for routing device [22-3, 22-4](#)
 - enabling and disabling
 - on an interface [22-4](#)
 - on a switch [22-3](#)
 - Layer 2 protocol tunneling [14-7](#)
 - monitoring [22-4](#)
 - overview [22-1](#)
 - power negotiation extensions [9-6](#)
 - support for [1-3](#)
 - transmission timer and holdtime, setting [22-2](#)
 - updates [22-2](#)
- CEF [31-72](#)
- CGMP
 - as IGMP snooping learning method [20-8](#)
 - clearing cached group entries [34-52](#)
 - enabling server support [34-32](#)
 - joining multicast group [20-3](#)
 - overview [34-8](#)

CGMP (continued)

server support only [34-8](#)switch support of [1-2](#)CIDR [31-57](#)CipherSuites [7-43](#)

Cisco Discovery Protocol

See CDP

Cisco Express Forwarding

See CEF

Cisco Group Management Protocol

See CGMP

Cisco Intelligence Engine 2100 Series Configuration Registrar

See IE2100

Cisco intelligent power management [9-6](#)

Cisco IOS DHCP server

See DHCP, Cisco IOS DHCP server

Cisco IOS File System

See IFS

Cisco Network Assistant

See Network Assistant

CiscoWorks 2000 [1-9, 27-4](#)

classless interdomain routing

See CIDR

classless routing [31-7](#)

class maps for QoS

configuring per physical port [29-40](#)configuring per-port per-VLAN [29-42](#)described [29-7](#)displaying [29-71](#)

class of service

See CoS

clearing interfaces [9-21](#)

CLI

abbreviating commands [2-4](#)command modes [2-1](#)configuration logging [2-5](#)described [1-9](#)

editing features

CLI (continued)

enabling and disabling [2-7](#)keystroke editing [2-7](#)wrapped lines [2-8](#)error messages [2-5](#)filtering command output [2-9](#)getting help [2-3](#)

history

changing the buffer size [2-6](#)described [2-5](#)disabling [2-6](#)recalling commands [2-6](#)no and default forms of commands [2-4](#)client mode, VTP [12-3](#)

clock

See system clock

clusters, switch

accessing [5-13](#)automatic discovery [5-4](#)automatic recovery [5-10](#)benefits [1-10](#)compatibility [5-4](#)described [5-1](#)

managing

through SNMP [5-15](#)planning [5-4](#)

planning considerations

automatic discovery [5-4](#)automatic recovery [5-10](#)host names [5-13](#)IP addresses [5-13](#)passwords [5-13](#)RADIUS [5-14](#)SNMP [5-14, 5-15](#)TACACS+ [5-14](#)

See also candidate switch, command switch, cluster standby group, member switch, and standby command switch

- cluster standby group
 - and HSRP group [32-10](#)
 - automatic recovery [5-12](#)
 - considerations [5-11](#)
 - defined [5-2](#)
 - requirements [5-3](#)
 - virtual IP address [5-11](#)
 - See also HSRP
- CNS
 - Configuration Engine
 - configID, deviceID, hostname [4-3](#)
 - configuration service [4-2](#)
 - described [4-1](#)
 - event service [4-3](#)
 - embedded agents
 - described [4-5](#)
 - enabling automated configuration [4-6](#)
 - enabling configuration agent [4-9](#)
 - enabling event agent [4-8](#)
 - for upgrading [4-12](#)
- Coarse Wave Division Multiplexer GBIC modules
 - See CWDM GBIC modules
- command-line interface
 - See CLI
- command modes [2-1](#)
- commands
 - abbreviating [2-4](#)
 - no and default [2-4](#)
 - setting privilege levels [7-8](#)
- command switch
 - accessing [5-11](#)
 - active (AC) [5-10](#)
 - configuration conflicts [37-10](#)
 - defined [5-2](#)
 - passive (PC) [5-10](#)
 - password privilege levels [5-14](#)
 - priority [5-10](#)
 - recovery
 - from command-switch failure [5-10](#)
 - command switch (continued)
 - from failure [37-6](#)
 - from lost member connectivity [37-10](#)
 - redundant [5-10](#)
 - replacing
 - with another switch [37-8](#)
 - with cluster member [37-7](#)
 - requirements [5-2](#)
 - standby (SC) [5-10](#)
 - See also candidate switch, cluster standby group, member switch, and standby command switch
- community list, BGP [31-54](#)
- community strings
 - configuring [5-14, 27-8](#)
 - for cluster switches [27-4](#)
 - in clusters [5-14](#)
 - overview [27-4](#)
 - SNMP [5-14](#)
- config.text [3-11](#)
- configurable leave timer, IGMP [20-5](#)
- configuration conflicts
 - ACL, displaying [28-44](#)
 - recovering from lost member connectivity [37-10](#)
- configuration examples, network [1-10](#)
- configuration files
 - clearing the startup configuration [B-18](#)
 - creating using a text editor [B-9](#)
 - default name [3-11](#)
 - deleting a stored configuration [B-18](#)
 - described [B-7](#)
 - downloading
 - automatically [3-11](#)
 - preparing [B-10, B-12, B-15](#)
 - reasons for [B-8](#)
 - using FTP [B-13](#)
 - using RCP [B-16](#)
 - using TFTP [B-10](#)
 - guidelines for creating and using [B-8](#)
 - invalid combinations when copying [B-5](#)

- configuration files (continued)
 - limiting TFTP server access [27-15](#)
 - obtaining with DHCP [3-7](#)
 - password recovery disable considerations [7-5](#)
 - specifying the filename [3-12](#)
 - system contact and location information [27-15](#)
 - types and location [B-9](#)
 - uploading
 - preparing [B-10](#), [B-12](#), [B-15](#)
 - reasons for [B-8](#)
 - using FTP [B-14](#)
 - using RCP [B-17](#)
 - using TFTP [B-11](#)
 - VMPS database [11-28](#)
 - configuration guidelines, multi-VRF CE [31-65](#)
 - configuration logging [2-5](#)
 - configuration settings, saving [3-10](#)
 - configure terminal command [9-9](#)
 - Configuring a Restricted VLAN [8-32](#)
 - configuring PoE [9-16](#)
 - config-vlan mode [2-2](#), [11-6](#)
 - conflicts, configuration [37-10](#)
 - congestion-avoidance techniques [29-12](#)
 - congestion-management techniques [29-12](#), [29-15](#)
 - connections, secure remote [7-38](#)
 - connectivity problems [37-11](#)
 - consistency checks in VTP version 2 [12-4](#)
 - console port, connecting to [2-10](#)
 - content-routing technology
 - See WCCP
 - conventions
 - command [iv](#)
 - for examples [iv](#)
 - publication [iv](#)
 - text [iv](#)
 - CoS
 - in Layer 2 frames [29-2](#)
 - override priority [13-5](#)
 - trust priority [13-6](#)
 - CoS-to-DSCP map for QoS [29-54](#)
 - CoS-to-egress-queue map [29-60](#)
 - counters, clearing interface [9-21](#)
 - CPU q, in show forward command output [37-20](#)
 - crashinfo file [37-21](#)
 - critical authentication, IEEE 802.1x [8-33](#)
 - cross-stack UplinkFast, STP
 - connecting stack ports [17-8](#)
 - described [17-5](#)
 - enabling [17-18](#)
 - fast-convergence events [17-7](#)
 - Fast Uplink Transition Protocol [17-6](#)
 - limitations [17-8](#)
 - normal-convergence events [17-7](#)
 - Stack Membership Discovery Protocol [17-6](#)
 - support for [1-4](#)
 - cryptographic software image
 - Kerberos [7-32](#)
 - SSL [7-41](#)
 - customer edge devices [31-62](#)
 - CWDM GBIC modules, network example [1-19](#)
 - CWDM OADM modules [1-19](#)
-
- ## D
- daylight saving time [6-13](#)
 - debugging
 - enabling all system diagnostics [37-18](#)
 - enabling for a specific feature [37-17](#)
 - redirecting error message output [37-18](#)
 - using commands [37-17](#)
 - default commands [2-4](#)
 - default configuration
 - auto-QoS [29-18](#)
 - banners [6-17](#)
 - BGP [31-43](#)
 - booting [3-11](#)
 - CDP [22-2](#)
 - DHCP [18-9](#)

default configuration (continued)

- DHCP option 82 [18-9](#)
- DHCP snooping [18-9](#)
- DHCP snooping binding database [18-9](#)
- DNS [6-16](#)
- dynamic ARP inspection [19-5](#)
- EIGRP [31-35](#)
- EtherChannel [30-8](#)
- fallback bridging [36-3](#)
- Flex Links [18-4](#)
- HSRP [32-4](#)
- IEEE 802.1Q tunneling [14-4](#)
- IEEE 802.1x [8-19](#)
- IGMP [34-27](#)
- IGMP filtering [20-22](#)
- IGMP snooping [20-7](#)
- IGMP throttling [20-23](#)
- initial switch information [3-3](#)
- IP addressing, IP routing [31-4](#)
- IP multicast routing [34-9](#)
- IP source guard [18-20](#)
- Layer 2 interfaces [9-14](#)
- Layer 2 protocol tunneling [14-10](#)
- MAC address table [6-21](#)
- MAC address-table move update [18-4](#)
- MSDP [35-4](#)
- MSTP [16-15](#)
- multi-VRF CE [31-64](#)
- MVR [20-18](#)
- NTP [6-4](#)
- optional spanning-tree features [17-14](#)
- OSPF [31-25](#)
- password and privilege level [7-2](#)
- port security [21-9](#)
- RADIUS [7-20](#)
- RIP [31-19](#)
- RMON [25-3](#)
- RSPAN [24-8](#)
- SNMP [27-6](#)

default configuration (continued)

- SPAN [24-8](#)
- SSL [7-44](#)
- standard QoS [29-26](#)
- storm control [21-3](#)
- STP [15-11](#)
- system message logging [26-3](#)
- system name and prompt [6-15](#)
- TACACS+ [7-13](#)
- UDLD [23-4](#)
- VLAN, Layer 2 Ethernet interfaces [11-19](#)
- VLANs [11-7](#)
- VMPS [11-29](#)
- voice VLAN [13-2](#)
- VTP [12-6](#)
- WCCP [33-4](#)
- default gateway [3-10, 31-11](#)
- default networks [31-75](#)
- default routes [31-75](#)
- default routing [31-2](#)
- deleting VLANs [11-10](#)
- denial-of-service attack [21-1](#)
- description command [9-18](#)
- designing your network, examples [1-10](#)
- destination addresses, in ACLs [28-13](#)
- detecting indirect link failures, STP [17-10](#)
- device [B-18](#)
- device discovery protocol [22-1](#)
- device manager
 - described [1-2, 1-9](#)
 - upgrading a switch [B-18](#)
- DHCP
 - Cisco IOS server database
 - configuring [18-17](#)
 - default configuration [18-9](#)
 - described [18-7](#)
 - DHCP-based autoconfiguration
 - client request message exchange [3-4](#)
 - configuring

DHCP-based autoconfiguration (continued)

- client side [3-3](#)
- DNS [3-6](#)
- relay device [3-6](#)
- server-side [3-5, 18-11](#)
- TFTP server [3-6](#)

example [3-8](#)

lease options

- for IP address information [3-5](#)
- for receiving the configuration file [3-5](#)

overview [3-3](#)

relationship to BOOTP [3-4](#)

relay support [1-8](#)

support for [1-3](#)

DHCP binding database

See DHCP snooping binding database

DHCP binding table

See DHCP snooping binding database

DHCP option 82

- circuit ID suboption [18-5](#)
- configuration guidelines [18-9](#)
- default configuration [18-9](#)
- displaying [18-18](#)
- enabling
 - relay agent [18-11](#)
 - relay agent information option [18-11](#)
- forwarding address, specifying [18-13](#)
- helper address [18-13](#)
- overview [18-3](#)
- packet format
 - circuit ID suboption [18-5](#)
 - remote ID suboption [18-5](#)
- policy for reforwarding [18-12](#)
- reforwarding policy [18-12](#)
- remote ID suboption [18-5](#)
- support for [1-3](#)
- validating [18-12](#)

DHCP relay agent [18-11](#)

DHCP server [18-11](#)

DHCP snooping

- accepting untrusted packets from edge switch [18-3, 18-15](#)
- and private VLANs [18-16](#)
- binding database
 - See DHCP snooping binding database
- configuration guidelines [18-9](#)
- default configuration [18-9](#)
- displaying binding tables [18-18](#)
- displaying configuration [18-18](#)
- message exchange process [18-4](#)
- option 82 data insertion [18-3](#)
- trusted interface [18-2](#)
- untrusted interface [18-2](#)
- untrusted messages [18-2](#)

DHCP snooping binding database

- adding bindings [18-17](#)
- binding file
 - format [18-7](#)
- bindings [18-7](#)
- clearing agent statistics [18-18](#)
- configuring [18-17](#)
- default configuration [18-9](#)
- deleting
 - binding file [18-18](#)
 - bindings [18-18](#)
 - database agent [18-18](#)
- described [18-2, 18-7](#)
- displaying [18-18](#)
 - status and statistics [18-18](#)
- enabling [18-17](#)
- entries [18-2](#)
- entry [18-7](#)
- renewing database [18-18](#)
- resetting
 - delay value [18-18](#)
 - timeout value [18-18](#)

DHCP snooping binding table

See DHCP snooping binding database

- Differentiated Services architecture, QoS [29-2](#)
- Differentiated Services Code Point [29-2](#)
- Diffusing Update Algorithm (DUAL) [31-34](#)
- directed unicast requests [1-3](#)
- directories
 - changing [B-3](#)
 - creating and removing [B-4](#)
 - displaying the working [B-3](#)
- discovery, clusters
 - See automatic discovery
- Distance Vector Multicast Routing Protocol
 - See DVMRP
- distance-vector protocols [31-2](#)
- distribute-list command [31-83](#)
- DNS
 - and DHCP-based autoconfiguration [3-6](#)
 - default configuration [6-16](#)
 - displaying the configuration [6-17](#)
 - overview [6-15](#)
 - setting up [6-16](#)
 - support for [1-3](#)
- documentation, related [v](#)
- document conventions [iv](#)
- domain names
 - DNS [6-15](#)
 - VTP [12-8](#)
- Domain Name System
 - See DNS
- dot1q-tunnel switchport mode [11-17](#)
- double-tagged packets
 - IEEE 802.1Q tunneling [14-2](#)
 - Layer 2 protocol tunneling [14-10](#)
- downloading
 - configuration files
 - preparing [B-10, B-12, B-15](#)
 - reasons for [B-8](#)
 - using FTP [B-13](#)
 - using RCP [B-16](#)
 - using TFTP [B-10](#)
 - downloading (continued)
 - image files
 - deleting old image [B-22](#)
 - preparing [B-21, B-24, B-28](#)
 - reasons for [B-18](#)
 - using CMS [1-2](#)
 - using FTP [B-25](#)
 - using HTTP [1-2, B-18](#)
 - using Network Assistant [1-2](#)
 - using RCP [B-29](#)
 - using TFTP [B-21](#)
 - using the device manager or Network Assistant [B-18](#)
- drop threshold for Layer 2 protocol packets [14-10](#)
- DSCP [1-6, 1-7, 29-2](#)
- DSCP-to-CoS map for QoS [29-56](#)
- DSCP-to-DSCP-mutation map for QoS [29-58](#)
- DSCP-to-threshold map for QoS [29-62](#)
- DTP [1-4, 11-16](#)
- DUAL finite state machine, EIGRP [31-35](#)
- duplex mode, configuring [9-15](#)
- DVMRP
 - autosummarization
 - configuring a summary address [34-48](#)
 - disabling [34-50](#)
 - connecting PIM domain to DVMRP router [34-40](#)
 - enabling unicast routing [34-44](#)
 - interoperability
 - with Cisco devices [34-38](#)
 - with IOS software [34-7](#)
 - mrinfo requests, responding to [34-43](#)
 - neighbors
 - advertising the default route to [34-42](#)
 - discovery with Probe messages [34-38](#)
 - displaying information [34-43](#)
 - prevent peering with nonpruning [34-46](#)
 - rejecting nonpruning [34-45](#)
 - overview [34-7](#)

DVMRP (continued)

routes

- adding a metric offset [34-50](#)
- advertising all [34-50](#)
- advertising the default route to neighbors [34-42](#)
- caching DVMRP routes learned in report messages [34-44](#)
- changing the threshold for syslog messages [34-47](#)
- deleting [34-52](#)
- displaying [34-52](#)
- favoring one over another [34-50](#)
- limiting the number injected into MBONE [34-47](#)
- limiting unicast route advertisements [34-38](#)

routing table [34-8](#)source distribution tree, building [34-8](#)support for [1-8](#)

tunnels

- configuring [34-40](#)
- displaying neighbor information [34-43](#)

dynamic access ports

- characteristics [11-3](#)
- configuring [11-30](#)
- defined [9-3](#)

dynamic addresses

See addresses

dynamic ARP inspection

- ARP cache poisoning [19-1](#)
- ARP requests, described [19-1](#)
- ARP spoofing attack [19-1](#)

clearing

- log buffer [19-15](#)
- statistics [19-15](#)

configuration guidelines [19-6](#)

configuring

- ACLs for non-DHCP environments [19-8](#)
- in DHCP environments [19-7](#)
- log buffer [19-12](#)
- rate limit for incoming ARP packets [19-4, 19-10](#)

default configuration [19-5](#)

dynamic ARP inspection (continued)

- denial-of-service attacks, preventing [19-10](#)
- described [19-1](#)

DHCP snooping binding database [19-2](#)

displaying

- ARP ACLs [19-14](#)
- configuration and operating state [19-14](#)
- log buffer [19-15](#)
- statistics [19-15](#)
- trust state and rate limit [19-14](#)

error-disabled state for exceeding rate limit [19-4](#)function of [19-2](#)interface trust states [19-3](#)

log buffer

- clearing [19-15](#)
- configuring [19-12](#)
- displaying [19-15](#)

logging of dropped packets, described [19-4](#)man-in-the middle attack, described [19-2](#)network security issues and interface trust states [19-3](#)priority of ARP ACLs and DHCP snooping entries [19-4](#)

rate limiting of ARP packets

- configuring [19-10](#)
- described [19-4](#)
- error-disabled state [19-4](#)

statistics

- clearing [19-15](#)
- displaying [19-15](#)

validation checks, performing [19-11](#)dynamic desirable trunking mode [11-17](#)

Dynamic Host Configuration Protocol

See DHCP-based autoconfiguration

dynamic port VLAN membership

- described [11-28](#)
- reconfirming [11-31](#)
- troubleshooting [11-33](#)
- types of connections [11-30](#)

VMPS database configuration file [11-28](#)dynamic routing [31-2](#)

Dynamic Trunking Protocol

See DTP

E

EBGP 31-41

editing features

enabling and disabling 2-7

keystrokes used 2-7

wrapped lines 2-8

egress q, in show forward command output 37-20

EIGRP

authentication 31-39

components 31-34

configuring 31-37

default configuration 31-35

definition 31-34

interface parameters, configuring 31-38

monitoring 31-40

stub routing 31-39

support for 1-7

enable password 7-4

enable secret password 7-4

encryption, CipherSuite 7-43

encryption for passwords 7-4

Enhanced IGRP

See EIGRP

environment variables

function of 3-15

location in Flash 3-14

equal-cost routing 1-8, 31-74

error messages

during command entry 2-5

setting the display destination device 26-4

severity levels 26-8

system message format 26-2

EtherChannel

automatic creation of 30-3

channel groups

binding physical and logical interfaces 30-3

numbering of 30-3

configuration guidelines 30-8

configuring

Layer 2 interfaces 30-9

Layer 3 physical interfaces 30-13

Layer 3 port-channel logical interfaces 30-12

default configuration 30-8

destination MAC address forwarding 30-6

displaying status 30-19

forwarding methods 30-15

interaction

with STP 30-8

with VLANs 30-9

LACP, support for 1-2

Layer 3 interface 31-3

load balancing 30-6, 30-15

logical interfaces, described 30-3

number of interfaces per 30-2

overview 30-1

PAgP

aggregate-port learners 30-5

compatibility with Catalyst 1900 30-15

displaying status 30-19

interaction with other features 30-6

learn method and priority configuration 30-15

modes 30-4

overview 30-3

silent mode 30-5

support for 1-2

port-channel interfaces

described 30-3

numbering of 30-3

port groups 9-5

source MAC address forwarding 30-6

support for 1-2

EtherChannel guard

described [17-12](#)enabling [17-20](#)

Ethernet VLANs

adding [11-8](#)defaults and ranges [11-8](#)modifying [11-8](#)events, RMON [25-3](#)

examples

conventions for [iv](#)network configuration [1-10](#)

expedite queue for QoS

10/100 Ethernet ports

allocating bandwidth [29-69](#)configuring [29-69](#)described [29-15](#)

Gigabit-capable Ethernet ports

allocating bandwidth [29-65](#)configuring [29-65](#)described [29-12](#)

Express Setup

overview [1-1](#)

See also getting started guide

extended-range VLANs

configuration guidelines [11-12](#)configuring [11-11](#)creating [11-12, 11-13](#)defined [11-1](#)

extended system ID

MSTP [16-17](#)STP [15-3, 15-15](#)Extensible Authentication Protocol over LAN [8-1](#)

external BGP

See EBGp

external neighbors, BGP [31-45](#)**F**

fallback bridging

and protected ports [36-4](#)

bridge groups

creating [36-4](#)described [36-2](#)displaying [36-12](#)function of [36-2](#)number supported [36-4](#)removing [36-4](#)

bridge table

changing the aging time [36-6](#)clearing [36-12](#)displaying [36-12](#)configuration guidelines [36-3](#)connecting interfaces with [9-9](#)default configuration [36-3](#)described [36-1](#)

frame forwarding

filtering by MAC address [36-6](#)flooding packets [36-2](#)for static addresses [36-5](#)forwarding packets [36-2](#)preventing for dynamically learned stations [36-5](#)to static addresses [36-5](#)overview [36-1](#)protocol, unsupported [36-3](#)

STP

disabling on an interface [36-12](#)forward-delay interval [36-10](#)hello BPDU interval [36-10](#)interface priority [36-8](#)maximum-idle interval [36-11](#)path cost [36-9](#)switch priority [36-8](#)VLAN-bridge STP [36-1, 36-2](#)support for [1-8](#)SVIs and routed ports [36-1](#)

- fallback bridging (continued)
 - unsupported protocols [36-3](#)
 - VLAN-bridge STP [15-11](#)
- fallback VLAN name [11-28](#)
- Fast Uplink Transition Protocol [17-6](#)
- feature manager, ACL [28-43](#)
- FIB [31-73](#)
- fiber-optic, detecting unidirectional links [23-1](#)
- files
 - copying [B-4](#)
 - crashinfo
 - description [37-21](#)
 - displaying the contents of [37-21](#)
 - location [37-21](#)
 - deleting [B-5](#)
 - displaying the contents of [B-7](#)
 - tar
 - creating [B-5](#)
 - displaying the contents of [B-6](#)
 - extracting [B-7](#)
 - image file format [B-19](#)
- file system
 - displaying available file systems [B-2](#)
 - displaying file information [B-3](#)
 - local file system names [B-1](#)
 - network file system names [B-4](#)
 - setting the default [B-3](#)
- filtering
 - in a VLAN [28-30](#)
 - non-IP traffic [28-27](#)
 - show and more command output [2-9](#)
 - with fallback bridging [36-6](#)
- filters, IP
 - See ACLs, IP
- flash device, number of [B-1](#)
- Flex Links
 - configuration guidelines [18-4](#)
 - configuring [18-5](#)
 - default configuration [18-4](#)
- Flex Links (continued)
 - description [18-1](#)
 - monitoring [18-8](#)
- flooded traffic, blocking [21-6](#)
- flow-based packet classification [1-7](#)
- flowcharts
 - QoS classification [29-6](#)
 - QoS policing and marking [29-10](#)
 - QoS queueing and scheduling
 - 10/100 ports [29-15](#)
 - Gigabit-capable ports [29-12](#)
- flow control [1-2, 9-17](#)
- forward-delay time
 - MSTP [16-23](#)
 - STP [15-5, 15-22](#)
- Forwarding Information Base
 - See FIB
- forwarding non-routable protocols [36-1](#)
- FTP
 - accessing MIB files [A-3](#)
 - configuration files
 - downloading [B-13](#)
 - overview [B-11](#)
 - preparing the server [B-12](#)
 - uploading [B-14](#)
 - image files
 - deleting old image [B-26](#)
 - downloading [B-25](#)
 - preparing the server [B-24](#)
 - uploading [B-26](#)

G

- GBIC modules
 - See GBICs
- GBICs
 - 1000BASE-LX/LH module [1-14](#)
 - 1000BASE-SX module [1-14](#)
 - 1000BASE-T module [1-14](#)

GBICs (continued)

1000BASE-ZX module [1-14](#)CWDM module [1-19](#)GigaStack module [1-12](#)security and identification [37-10](#)get-bulk-request operation [27-3](#)get-next-request operation [27-3, 27-4](#)get-request operation [27-3, 27-4](#)get-response operation [27-3](#)

Gigabit Interface Converters

See GBICs

GigaStack GBIC

fast transition of redundant link [17-5](#)

See also GBICs

global configuration mode [2-2](#)global leave, IGMP [20-12](#)

guide

audience [iii](#)purpose of [iii](#)guide mode [1-10](#)

GUIs

See device manager and Network Assistant [1-9](#)

Hhardware, determining ACL configuration fit [28-45](#)

hello time

MSTP [16-22](#)STP [15-21](#)help, for the command line [2-3](#)

history

changing the buffer size [2-6](#)described [2-5](#)disabling [2-6](#)recalling commands [2-6](#)history table, level and number of syslog messages [26-10](#)

host names

in clusters [5-13](#)hosts, limit on dynamic ports [11-33](#)

Hot Standby Router Protocol

See HSRP

HP OpenView [1-9](#)

HSRP

authentication string [32-8](#)automatic cluster recovery [5-12](#)binding to cluster group [32-10](#)cluster standby group considerations [5-11](#)command-switch redundancy [1-3](#)default configuration [32-4](#)definition [32-1](#)monitoring [32-10](#)overview [32-1](#)priority [32-6](#)routing redundancy [1-7](#)timers [32-8](#)tracking [32-7](#)

See also clusters, cluster standby group, and standby command switch

HTTP over SSL

see HTTPS

HTTPS [7-42](#)configuring [7-46](#)self-signed certificate [7-42](#)HTTP secure server [7-42](#)

IIBPG [31-41](#)

ICMP

redirect messages [31-11](#)support for [1-8](#)time exceeded messages [37-13](#)traceroute and [37-13](#)unreachable messages [28-6](#)unreachables and ACLs [28-7](#)

ICMP ping

executing [37-11](#)overview [37-11](#)

ICMP Router Discovery Protocol

See IRDP

IDS, using with SPAN and RSPAN [24-2](#)

IE2100

described [1-9](#)

support for [1-3](#)

IEEE 802.1D

See STP

IEEE 802.1p [13-1](#)

IEEE 802.1Q

and trunk ports [9-3](#)

configuration limitations [11-18](#)

encapsulation [11-16](#)

native VLAN for untagged traffic [11-23](#)

tunneling

compatibility with other features [14-5](#)

defaults [14-4](#)

described [14-1](#)

tunnel ports and ACLs [28-3](#)

tunnel ports with other features [14-6](#)

IEEE 802.1s

See MSTP

IEEE 802.1w

See RSTP

IEEE 802.1x

See port-based authentication

IEEE 802.3af

See PoE

IEEE 802.3x flow control [9-17](#)

ifIndex values, SNMP [27-5](#)

IFS [1-3](#)

IGMP

configurable leave timer, procedures [20-11](#)

configuring the switch

as a member of a group [34-27](#)

statically connected member [34-31](#)

controlling access to groups [34-28](#)

default configuration [34-27](#)

deleting cache entries [34-52](#)

IGMP (continued)

displaying groups [34-52](#)

fast switching [34-31](#)

flooded multicast traffic

controlling the length of time [20-12](#)

disabling on an interface [20-13](#)

global leave [20-12](#)

query solicitation [20-12](#)

recovering from flood mode [20-12](#)

host-query interval, modifying [34-29](#)

joining multicast group [20-3](#)

join messages [20-3](#)

leave processing, enabling [20-10](#)

leaving multicast group [20-5](#)

multicast reachability [34-27](#)

overview [34-3](#)

queries [20-3](#)

report suppression

described [20-6](#)

disabling [20-14](#)

support for [1-2](#)

throttling action [20-22](#)

Version 1

changing to Version 2 [34-29](#)

described [34-3](#)

Version 2

changing to Version 1 [34-29](#)

described [34-3](#)

maximum query response time value [34-31](#)

pruning groups [34-31](#)

query timeout value [34-30](#)

IGMP configurable leave timer, described [20-5](#)

IGMP filtering

configuring [20-23](#)

default configuration [20-22](#)

described [20-22](#)

monitoring [20-28](#)

- IGMP groups
 - configuring the throttling action [20-26](#)
 - setting the maximum number [20-26](#)
- IGMP profile
 - applying [20-24](#)
 - configuration mode [20-23](#)
 - configuring [20-23](#)
- IGMP snooping
 - configuring [20-6](#)
 - default configuration [20-7](#)
 - definition [20-2](#)
 - enabling and disabling [20-7](#)
 - global configuration [20-7](#)
 - Immediate Leave [20-5](#)
 - method [20-8](#)
 - monitoring [20-14](#)
 - support for [1-2](#)
 - VLAN configuration [20-8](#)
- IGMP throttling
 - configuring [20-26](#)
 - default configuration [20-23](#)
 - described [20-22](#)
 - displaying action [20-28](#)
- IGP [31-24](#)
- Immediate-Leave, IGMP [20-5](#)
- inaccessible authentication bypass [8-13](#)
- interface
 - number [9-9](#)
 - range macros [9-12](#)
- interface command [9-9, 9-10](#)
- interface configuration mode [2-3](#)
- interfaces
 - configuration guidelines [9-15](#)
 - configuring [9-9](#)
 - configuring duplex mode [9-15](#)
 - configuring speed [9-15](#)
 - counters, clearing [9-21](#)
 - described [9-18](#)
 - descriptive name, adding [9-18](#)
- interfaces (continued)
 - displaying information about [9-21](#)
 - flow control [9-17](#)
 - management [1-9](#)
 - monitoring [9-20](#)
 - naming [9-18](#)
 - physical, identifying [9-9](#)
 - range of [9-10](#)
 - restarting [9-22](#)
 - shutting down [9-22](#)
 - supported [9-9](#)
 - types of [9-1](#)
- interfaces range macro command [9-12](#)
- Interior Gateway Protocol
 - See IGP
- internal BGP
 - See IBGP
- internal neighbors, BGP [31-45](#)
- Internet Control Message Protocol
 - See ICMP
- Internet Group Management Protocol
 - See IGMP
- Inter-Switch Link
 - See ISL
- inter-VLAN routing [1-7, 31-2](#)
- Intrusion Detection System
 - See IDS
- IOS File System
 - See IFS
- ip access-group command [28-22](#)
- IP ACLs
 - applying to an interface [28-20](#)
 - extended, creating [28-11](#)
 - for QoS classification [29-7](#)
 - implicit deny [28-11, 28-15, 28-17](#)
 - implicit masks [28-11](#)
 - logging [28-17](#)
 - named [28-16](#)
 - standard, creating [28-10](#)

IP ACLs (continued)

- undefined [28-22](#)
- virtual terminal lines, setting on [28-20](#)

IP addresses

- candidate or member [5-3, 5-13](#)
- classes of [31-5](#)
- cluster access [5-2](#)
- command switch [5-3, 5-11, 5-13](#)
- default configuration [31-4](#)
- discovering [6-29](#)
- for IP routing [31-4](#)
- MAC address association [31-8](#)
- monitoring [31-17](#)
- redundant clusters [5-11](#)
- standby command switch [5-11, 5-13](#)
- See also IP information

IP broadcast address [31-15](#)ip cef command [31-73](#)IP directed broadcasts [31-13](#)ip igmp profile command [20-23](#)

IP information

- assigned
 - manually [3-10](#)
 - through DHCP-based autoconfiguration [3-3](#)
- default configuration [3-3](#)

IP multicast routing

addresses

- all-hosts [34-1, 34-3](#)
- all-multicast-routers [34-1, 34-3](#)
- host group address range [34-1, 34-3](#)

administratively-scoped boundaries, described [34-36](#)and IGMP snooping [20-2, 20-6](#)

Auto-RP

- adding to an existing sparse-mode cloud [34-14](#)
- benefits of [34-14](#)
- clearing the cache [34-52](#)
- configuration guidelines [34-10](#)
- filtering incoming RP announcement messages [34-16](#)
- overview [34-5](#)

IP multicast routing (continued)

- preventing candidate RP spoofing [34-16](#)
- preventing join messages to false RPs [34-16](#)
- setting up in a new internetwork [34-14](#)
- using with BSR [34-22](#)

bootstrap router

- configuration guidelines [34-10](#)
- configuring candidate BSRs [34-20](#)
- configuring candidate RPs [34-21](#)
- defining the IP multicast boundary [34-19](#)
- defining the PIM domain border [34-18](#)
- overview [34-5](#)
- using with Auto-RP [34-22](#)

Cisco implementation [34-2](#)

configuring

- basic multicast routing [34-10](#)
- IP multicast boundary [34-36](#)
- TTL threshold [34-34](#)

default configuration [34-9](#)

enabling

- multicast forwarding [34-11](#)
- PIM mode [34-11](#)

group-to-RP mappings

- Auto-RP [34-5](#)
- BSR [34-5](#)

MBONE

- deleting sdr cache entries [34-52](#)
- described [34-33](#)
- displaying sdr cache [34-53](#)
- enabling sdr listener support [34-34](#)
- limiting DVMRP routes advertised [34-47](#)
- limiting sdr cache entry lifetime [34-34](#)
- SAP packets for conference session announcement [34-33](#)
- Session Directory (sdr) tool, described [34-33](#)

IP multicast routing (continued)

monitoring

packet rate loss [34-53](#)peering devices [34-53](#)tracing a path [34-53](#)multicast forwarding, described [34-6](#)PIMv1 and PIMv2 interoperability [34-9](#)protocol interaction [34-2](#)reverse path check (RPF) [34-6](#)

routing table

deleting [34-52](#)displaying [34-52](#)

RP

assigning manually [34-12](#)configuring Auto-RP [34-14](#)configuring PIMv2 BSR [34-18](#)monitoring mapping information [34-23](#)using Auto-RP and BSR [34-22](#)statistics, displaying system and network [34-52](#)TTL thresholds, described [34-34](#)

See also CGMP

See also DVMRP

See also IGMP

See also PIM

IP phones

and IEEE 802.1x authentication [8-15](#)and QoS [13-1](#)automatic classification and queueing [29-17](#)configuring [13-3](#)trusted boundary for QoS [29-33](#)IP precedence [29-2](#)IP-precedence-to-DSCP map for QoS [29-55](#)

IP protocols

in ACLs [28-13](#)routing [1-7](#)IP routes, monitoring [31-85](#)

IP routing

connecting interfaces with [9-9](#)enabling [31-18](#)

IP source guard

and 802.1x [18-20](#)and DHCP snooping [18-19](#)and EtherChannels [18-20](#)and port security [18-20](#)and private VLANs [18-20](#)and routed ports [18-20](#)and TCAM entries [18-20](#)and trunk interfaces [18-20](#)and VRF [18-20](#)

binding configuration

automatic [18-19](#)manual [18-19](#)binding table [18-19](#)configuration guidelines [18-20](#)default configuration [18-20](#)described [18-19](#)disabling [18-21](#)

displaying

bindings [18-22](#)configuration [18-22](#)enabling [18-21](#)

filtering

source IP address [18-19](#)source IP and MAC address [18-19](#)source IP address filtering [18-19](#)source IP and MAC address filtering [18-19](#)

static bindings

adding [18-21](#)deleting [18-21](#)

IP traceroute

executing [37-13](#)overview [37-13](#)

IP unicast routing

address resolution [31-8](#)administrative distances [31-75, 31-83](#)ARP [31-8](#)assigning IP addresses to Layer 3 interfaces [31-6](#)authentication keys [31-84](#)

IP unicast routing (continued)

broadcast

address [31-15](#)flooding [31-16](#)packets [31-13](#)storms [31-13](#)classless routing [31-7](#)configuring static routes [31-74](#)

default

addressing configuration [31-4](#)gateways [31-11](#)networks [31-75](#)routes [31-75](#)routing [31-2](#)directed broadcasts [31-13](#)dynamic routing [31-2](#)enabling [31-18](#)EtherChannel Layer 3 interface [31-3](#)IGP [31-24](#)inter-VLAN [31-2](#)

IP addressing

classes [31-5](#)configuring [31-4](#)IRDP [31-12](#)Layer 3 interfaces [31-3](#)MAC address and IP address [31-8](#)passive interfaces [31-82](#)

protocols

distance-vector [31-2](#)dynamic [31-2](#)link-state [31-2](#)proxy ARP [31-8](#)redistribution [31-76](#)reverse address resolution [31-8](#)routed ports [31-3](#)static routing [31-2](#)steps to configure [31-3](#)subnet mask [31-5](#)subnet zero [31-6](#)

IP unicast routing (continued)

supernet [31-7](#)UDP [31-15](#)with SVIs [31-3](#)

See also BGP

See also EIGRP

See also OSPF

See also RIP

ip unreachable command [28-6](#)

IRDP

configuring [31-12](#)definition [31-12](#)support for [1-8](#)

ISL

and trunk ports [9-3](#)encapsulation [1-4, 11-16](#)trunking with IEEE 802.1 tunneling [14-4](#)

Jjoin messages, IGMP [20-3](#)

K

KDC

described [7-32](#)

See also Kerberos

Kerberos

authenticating to

boundary switch [7-34](#)KDC [7-34](#)network services [7-35](#)configuration examples [7-32](#)configuring [7-35](#)credentials [7-32](#)cryptographic software image [7-32](#)described [7-32](#)KDC [7-32](#)

Kerberos (continued)

- operation [7-34](#)
- realm [7-33](#)
- server [7-33](#)
- switch as trusted third party [7-32](#)
- terms [7-33](#)
- TGT [7-34](#)
- tickets [7-32](#)

key distribution center

- See KDC

Ll2protocol-tunnel command [14-12](#)

LACP

- Layer 2 protocol tunneling [14-9](#)
- See EtherChannel

Layer 2 frames, classification with CoS [29-2](#)Layer 2 interfaces, default configuration [9-14](#)

Layer 2 protocol tunneling

- configuring [14-9](#)
- configuring for EtherChannels [14-13](#)
- default configuration [14-10](#)
- defined [14-8](#)
- guidelines [14-11](#)

Layer 2 traceroute

- and ARP [37-15](#)
- and CDP [37-15](#)
- described [37-14](#)
- IP addresses and subnets [37-15](#)
- MAC addresses and VLANs [37-15](#)
- multicast traffic [37-15](#)
- multiple devices on a port [37-15](#)
- unicast traffic [37-14](#)
- usage guidelines [37-15](#)

Layer 3 features [1-7](#)

Layer 3 interfaces

- assigning IP addresses to [31-6](#)
- changing from Layer 2 mode [31-6](#)
- types of [31-3](#)

Layer 3 packets, classification methods [29-2](#)LDAP [4-2](#)leave processing, IGMP [20-10](#)

lightweight directory access protocol

- See LDAP

line configuration mode [2-3](#)

Link Aggregation Control Protocol

- See EtherChannel

Link Failure

- detecting unidirectional [16-8](#)

link redundancy

- See Flex Links

links, unidirectional [23-1](#)link state advertisements (LSAs) [31-28](#)link-state protocols [31-2](#)logging messages, ACL [28-11](#)

login authentication

- with RADIUS [7-23](#)
- with TACACS+ [7-14](#)

login banners [6-17](#)

log messages

- See system message logging

long-distance, high-bandwidth transport configuration
example [1-19](#)Long-Reach Ethernet (LRE) technology [1-12](#)

loop guard

- described [17-13](#)
- enabling [17-21](#)
- support for [1-4](#)

Mmac access-group command [28-29](#)MAC ACLs and Layer 2 interfaces [28-29](#)

MAC addresses

- aging time [6-21](#)
 - and VLAN association [6-20](#)
 - building the address table [6-20](#)
 - default configuration [6-21](#)
 - discovering [6-29](#)
 - displaying [6-26](#)
 - displaying in DHCP snooping binding table [18-18](#)
 - displaying in the IP source binding table [18-22](#)
 - dynamic
 - learning [6-20](#)
 - removing [6-21](#)
 - in ACLs [28-27](#)
 - IP address association [31-8](#)
 - static
 - adding [6-24](#)
 - allowing [6-26](#)
 - characteristics of [6-24](#)
 - dropping [6-25](#)
 - removing [6-24](#)
 - sticky secure, adding [21-8](#)
- ## MAC address multicast entries, monitoring [20-15](#)
- ## MAC address-table move update
- configuration guidelines [18-4](#)
 - configuring [18-6](#)
 - default configuration [18-4](#)
 - description [18-3](#)
 - monitoring [18-8](#)
- ## MAC address-to-VLAN mapping [11-27](#)
- ## MAC extended access lists [28-27, 29-5, 29-39](#)
- ## macros
- See Smartports macros
- ## magic packet [8-16](#)
- ## manageability features [1-3](#)
- ## management options
- benefits
 - clustering [1-10](#)
 - Network Assistant [1-10](#)
 - CLI [2-1](#)

management options (continued)

- CNS [4-1](#)
 - overview [1-9](#)
- ## management VLAN
- considerations in switch clusters [5-7](#)
 - discovery through different management VLANs [5-7](#)
- ## MANs
- CWDM configuration example [1-19](#)
 - long-distance, high-bandwidth transport configuration example [1-19](#)
- ## mapping tables for QoS
- configuring
 - CoS-to-DSCP [29-54](#)
 - CoS-to-egress-queue [29-60](#)
 - DSCP [29-53](#)
 - DSCP-to-CoS [29-56](#)
 - DSCP-to-DSCP-mutation [29-58](#)
 - DSCP-to-threshold [29-62](#)
 - IP-precedence-to-DSCP [29-55](#)
 - policed-DSCP [29-56](#)
 - described [29-10](#)
- ## marking
- action in policy map [29-44](#)
 - action with aggregate policers [29-50](#)
 - described [29-4, 29-8](#)
- ## matching, ACLs [28-8](#)
- ## maximum aging time
- MSTP [16-24](#)
 - STP [15-22, 15-23](#)
- ## maximum hop count, MSTP [16-24](#)
- ## maximum-paths command [31-49, 31-74](#)
- ## membership mode, VLAN port [11-3](#)
- ## member switch
- automatic discovery [5-4](#)
 - defined [5-2](#)
 - passwords [5-13](#)
 - recovering from lost connectivity [37-10](#)

- member switch (continued)
 - requirements [5-3](#)
 - See also candidate switch, cluster standby group, and standby command switch
- memory, optimizing [6-26](#)
- messages
 - logging ACL violations [28-17](#)
 - to users through banners [6-17](#)
- metrics, in BGP [31-49](#)
- metric translations, between routing protocols [31-79](#)
- metropolitan-area networks
 - See MANs
- metro tags [14-2](#)
- MIBs
 - accessing files with FTP [A-3](#)
 - location of files [A-3](#)
 - overview [27-1](#)
 - SNMP interaction with [27-4](#)
 - supported [A-1](#)
- minimum-reserve levels
 - assigning to a queue [29-15, 29-68](#)
 - configuring the buffer size [29-16, 29-68](#)
 - default size [29-15](#)
- mini-point-of-presence
 - See POP
- mirroring traffic for analysis [24-1](#)
- mismatches, autonegotiation [37-10](#)
- modules, GBIC
 - 1000BASE-LX/LH [1-14](#)
 - 1000BASE-SX [1-14](#)
 - 1000BASE-T [1-14](#)
 - 1000BASE-ZX [1-14](#)
 - CWDM [1-19](#)
 - GigaStack [1-12](#)
- monitoring
 - access groups [28-41](#)
 - ACL
 - configuration [28-41](#)
 - configuration conflicts [28-44](#)
 - fit in hardware [28-45](#)
 - information [28-41](#)
 - BGP [31-61](#)
 - cables for unidirectional links [23-1](#)
 - CDP [22-4](#)
 - CEF [31-73](#)
 - EIGRP [31-40](#)
 - fallback bridging [36-12](#)
 - features [1-8](#)
 - Flex Links [18-8](#)
 - HSRP [32-10](#)
 - IEEE 802.1Q tunneling [14-17](#)
 - IGMP
 - filters [20-28](#)
 - snooping [20-14](#)
 - interfaces [9-20](#)
 - IP
 - address tables [31-17](#)
 - multicast routing [34-51](#)
 - routes [31-85](#)
 - Layer 2 protocol tunneling [14-17](#)
 - MAC address-table move update [18-8](#)
 - MSDP peers [35-19](#)
 - multicast router ports [20-15](#)
 - multi-VRF CE [31-72](#)
 - MVR [20-21](#)
 - network traffic for analysis with probe [24-1](#)
 - OSPF [31-33](#)
 - port blocking [21-17](#)
 - port protection [21-17](#)
 - RP mapping information [34-23](#)
 - source-active messages [35-19](#)
 - speed and duplex mode [9-16](#)
 - traffic flowing among switches [25-1](#)

monitoring (continued)

traffic suppression [21-17](#)tunneling [14-17](#)

VLAN

filters [28-42](#)maps [28-42](#)VLANs [11-15](#)VMPS [11-32](#)VTP [12-15](#)

MSDP

and dense-mode regions

sending SA messages to [35-17](#)specifying the originating address [35-18](#)benefits of [35-3](#)clearing MSDP connections and statistics [35-19](#)

controlling source information

forwarded by switch [35-12](#)originated by switch [35-8](#)received by switch [35-14](#)default configuration [35-4](#)

filtering

incoming SA messages [35-14](#)SA messages to a peer [35-12](#)SA requests from a peer [35-11](#)join latency, defined [35-6](#)

meshed groups

configuring [35-16](#)defined [35-16](#)originating address, changing [35-18](#)overview [35-1](#)peer-RPF flooding [35-2](#)

peers

configuring a default [35-4](#)monitoring [35-19](#)peering relationship, overview [35-1](#)requesting source information from [35-8](#)shutting down [35-16](#)

MSDP (continued)

source-active messages

caching [35-6](#)clearing cache entries [35-19](#)defined [35-2](#)filtering from a peer [35-11](#)filtering incoming [35-14](#)filtering to a peer [35-12](#)limiting data with TTL [35-14](#)monitoring [35-19](#)restricting advertised sources [35-9](#)

MSTP

boundary ports

configuration guidelines [16-16](#)

BPDU filtering

described [17-3](#)enabling [17-16](#)

BPDU guard

described [17-2](#)enabling [17-15](#)CIST, described [16-3](#)configuration guidelines [16-15, 17-14](#)

configuring

forward-delay time [16-23](#)hello time [16-22](#)link type for rapid convergence [16-25](#)maximum aging time [16-24](#)maximum hop count [16-24](#)MST region [16-16](#)neighbor type [16-25](#)path cost [16-21](#)port priority [16-20](#)root switch [16-17](#)secondary root switch [16-19](#)switch priority [16-22](#)

CST

defined [16-3](#)operations between regions [16-4](#)default configuration [16-15](#)

MSTP (continued)

- default optional feature configuration [17-14](#)
- described [16-2](#)
- displaying status [16-26](#)
- enabling the mode [16-16](#)
- EtherChannel guard
 - described [17-12](#)
 - enabling [17-20](#)
- extended system ID
 - effects on root switch [16-17](#)
 - effects on secondary root switch [16-19](#)
 - unexpected behavior [16-18](#)
- IEEE 802.1s
 - implementation [16-6](#)
- instances supported [15-9](#)
- interface state, blocking to forwarding [17-2](#)
- interoperability and compatibility among modes [15-10](#)
- interoperability with IEEE 802.1D
 - described [16-8](#)
 - restarting migration process [16-26](#)
- IST
 - defined [16-3](#)
 - master [16-3](#)
 - operations within a region [16-3](#)
- loop guard
 - described [17-13](#)
 - enabling [17-21](#)
- mapping VLANs to MST instance [16-16](#)
- MST region
 - described [16-2](#)
 - hop-count mechanism [16-5](#)
 - supported spanning-tree instances [16-2](#)
- optional features supported [1-4](#)
- Port Fast
 - described [17-2](#)
 - enabling [17-14](#)
- preventing root switch selection [17-12](#)

MSTP (continued)

- root guard
 - described [17-12](#)
 - enabling [17-20](#)
- root switch
 - configuring [16-18](#)
 - effects of extended system ID [16-17](#)
 - unexpected behavior [16-18](#)
 - shutdown Port Fast-enabled port [17-2](#)
- multicast groups
 - and IGMP snooping [20-6](#)
 - Immediate Leave [20-5](#)
 - joining [20-3](#)
 - leaving [20-5](#)
 - static joins [20-10](#)
- multicast packets
 - ACLs on [28-40](#)
- multicast packets, blocking [21-6](#)
- multicast router ports
 - adding [20-9](#)
 - monitoring [20-15](#)
- Multicast Source Discovery Protocol
 - See MSDP
- multicast storm control
 - See storm control
- multicast storm-control command [21-4](#)
- Multicast VLAN Registration
 - See MVR
- Multiple Spanning Tree Protocol
 - See MSTP
- multiple VPN routing/forwarding in customer edge devices
 - See multi-VRF CE
- multi-VRF CE
 - configuration example [31-68](#)
 - configuration guidelines [31-65](#)
 - configuring [31-64](#)
 - default configuration [31-64](#)
 - defined [31-62](#)

multi-VRF CE (continued)

- displaying [31-72](#)
- monitoring [31-72](#)
- network components [31-64](#)
- packet-forwarding process [31-64](#)
- support for [1-7](#)

MVR

- configuring interfaces [20-20](#)
- default configuration [20-18](#)
- described [20-15](#)
- modes [20-19](#)
- monitoring [20-21](#)
- setting global parameters [20-19](#)
- support for [1-2](#)

N

NAC

- AAA down policy [1-6](#)
- critical authentication [8-13, 8-33](#)
- IEEE 802.1x authentication using a RADIUS server [8-37](#)
- IEEE 802.1x validation using RADIUS server [8-37](#)
- inaccessible authentication bypass [1-6, 8-33](#)
- Layer 2 IEEE 802.1x validation [1-6, 8-37](#)
- Layer 2 IP validation [1-6](#)

named IP ACLs [28-16](#)

NameSpace Mapper

See NSM

native VLAN

- and IEEE 802.1Q tunneling [14-4](#)
- configuring [11-23](#)
- default [11-23](#)

neighbor discovery/recovery, EIGRP [31-34](#)neighbors, BGP [31-55](#)

Network Admission Control

See NAC

Network Assistant

- described [1-2, 1-9](#)
- downloading image files [1-2](#)
- upgrading a switch [B-18](#)

network configuration examples

- increasing network performance [1-11](#)
- large network [1-16](#)
- long-distance, high-bandwidth transport [1-19](#)
- providing network services [1-11](#)
- small to medium-sized network [1-14](#)

network design

- performance [1-11](#)
- services [1-11](#)

network management

- CDP [22-1](#)
- RMON [25-1](#)
- SNMP [27-1](#)

Network Time Protocol

See NTP

no commands [2-4](#)non-IP traffic filtering [28-27](#)nontrunking mode [11-17](#)

normal-range VLANs

- configuration modes [11-6](#)
- defined [11-1](#)

no switchport command [9-5](#)note, described [iv](#)

not-so-stubby areas

See NSSA

NSM [4-3](#)NSSA, OSPF [31-28](#)

NTP

associations

- authenticating [6-4](#)
- defined [6-2](#)
- enabling broadcast messages [6-6](#)
- peer [6-5](#)
- server [6-5](#)
- default configuration [6-4](#)

NTP (continued)

- displaying the configuration [6-11](#)
- overview [6-2](#)
- restricting access
 - creating an access group [6-8](#)
 - disabling NTP services per interface [6-10](#)
- source IP address, configuring [6-10](#)
- stratum [6-2](#)
- support for [1-3](#)
- synchronizing devices [6-5](#)
- time
 - services [6-2](#)
 - synchronizing [6-2](#)

O

OADM modules

- See CWDM OADM modules

Open Shortest Path First

- See OSPF

optical add/drop multiplexer modules

- See CWDM OADM modules

optimizing system resources [6-26](#)options, management [1-9](#)

OSPF

- area parameters, configuring [31-28](#)
- configuring [31-26](#)
- default configuration
 - metrics [31-30](#)
 - route [31-30](#)
 - settings [31-25](#)
- described [31-24](#)
- interface parameters, configuring [31-27](#)
- LSA group pacing [31-32](#)
- monitoring [31-33](#)
- router IDs [31-32](#)
- route summarization [31-30](#)
- support for [1-7](#)
- virtual links [31-30](#)

out-of-profile markdown [1-7](#)output interface, getting information about [37-20](#)**P**packet modification, with QoS [29-17](#)

PAGP

- Layer 2 protocol tunneling [14-9](#)

See EtherChannel

parallel paths, in routing tables [31-74](#)

passive interfaces

- configuring [31-82](#)
- OSPF [31-30](#)

pass-through mode [29-34](#)

passwords

- default configuration [7-2](#)
- disabling recovery of [7-5](#)
- encrypting [7-4](#)
- for security [1-5](#)
- in clusters [5-13](#)
- overview [7-1](#)
- setting
 - enable [7-3](#)
 - enable secret [7-4](#)
 - Telnet [7-6](#)
 - with usernames [7-7](#)
- VTP domain [12-8](#)

path cost

- MSTP [16-21](#)
- STP [15-18](#)

PBR

- defined [31-79](#)
- enabling [31-81](#)
- fast-switched policy-based routing [31-81](#)
- local policy-based routing [31-81](#)
- support for [1-8](#)

PC (passive command switch) [5-10](#)peers, BGP [31-55](#)performance, network design [1-11](#)

- performance features [1-2](#)
- persistent self-signed certificate [7-42](#)
- per-VLAN spanning-tree plus
 - See PVST+
- PE to CE routing, configuring [31-67](#)
- physical ports [9-2](#)
- PIM
 - default configuration [34-9](#)
 - dense mode
 - overview [34-4](#)
 - rendezvous point (RP), described [34-5](#)
 - RPF lookups [34-7](#)
 - displaying neighbors [34-53](#)
 - enabling a mode [34-11](#)
 - overview [34-4](#)
 - router-query message interval, modifying [34-26](#)
 - shared tree and source tree, overview [34-23](#)
 - shortest path tree, delaying the use of [34-25](#)
 - sparse mode
 - join messages and shared tree [34-5](#)
 - overview [34-5](#)
 - prune messages [34-5](#)
 - RPF lookups [34-7](#)
 - support for [1-8](#)
 - versions
 - interoperability [34-9](#)
 - troubleshooting interoperability problems [34-23](#)
 - v2 improvements [34-4](#)
- PIM-DVMRP, as snooping method [20-8](#)
- ping
 - character output description [37-12](#)
 - executing [37-11](#)
 - overview [37-11](#)
- PoE
 - auto mode [9-7](#)
 - CDP with power consumption, described [9-6](#)
 - CDP with power negotiation, described [9-6](#)
 - Cisco intelligent power management [9-6](#)
 - configuring [9-16](#)
- PoE (continued)
 - devices supported [9-5](#)
 - high-power devices operating in low-power mode [9-6](#)
 - powered-device detection and initial power allocation [9-6](#)
 - power management modes [9-7](#)
 - power negotiation extensions to CDP [9-6](#)
 - standards supported [9-6](#)
 - troubleshooting [37-16](#)
- policed-DSCP map for QoS [29-56](#)
- policers
 - configuring
 - for each matched traffic class [29-44](#)
 - for more than one traffic class [29-50](#)
 - described [29-4](#)
 - displaying [29-71](#)
 - number of [1-7, 29-9](#)
 - types of [29-8](#)
- policing
 - described [29-4](#)
 - token bucket algorithm [29-8](#)
- policy-based routing
 - See PBR
- policy maps for QoS
 - characteristics of [29-44](#)
 - configuring [29-44](#)
 - described [29-7](#)
 - displaying [29-71](#)
- POP [1-17](#)
- port ACLs
 - and voice VLAN [28-4](#)
 - defined [28-2](#)
 - limitations [28-4](#)
- Port Aggregation Protocol
 - See EtherChannel
- port-based authentication
 - accounting [8-8](#)
 - accounting services [1-5](#)
 - authentication server

port-based authentication (continued)

defined 8-2

RADIUS server 8-2

client, defined 8-2

configuration guidelines 8-20

configuring

guest VLAN 8-31

host mode 8-26

IEEE 802.1x accounting 8-30

IEEE 802.1x authentication 8-22

inaccessible authentication bypass 8-33

manual re-authentication of a client 8-27

periodic re-authentication 8-26

quiet period 8-27

RADIUS server 8-25

RADIUS server parameters on the switch 8-24

restricted VLAN 8-32

switch-to-client frame-retransmission number 8-29

switch-to-client retransmission time 8-28

default configuration 8-19

described 8-1

device roles 8-2

displaying statistics 8-38

EAPOL-start frame 8-5

EAP-request/identity frame 8-5

EAP-response/identity frame 8-5

enabling

IEEE 802.1x with guest VLAN 8-11

IEEE 802.1x with per-user ACLs 8-10

IEEE 802.1x with port security 8-15

IEEE 802.1x with restricted VLAN 8-12

IEEE 802.1x with VLAN assignment 8-9

IEEE 802.1x with voice VLAN 8-14

encapsulation 8-3

guest VLAN

configuration guidelines 8-12, 8-13

host mode 8-7

port-based authentication (continued)

inaccessible authentication bypass

configuring 8-33

described 8-13

guidelines 8-21

initiation and message exchange 8-5

magic packet 8-16

method lists 8-22

multiple-hosts mode, described 8-8

per-user ACLs, AAA authorization 8-22

ports

authorization state and dot1x port-control command 8-7

authorized and unauthorized 8-7

critical 8-13

port security, multiple-hosts mode 8-8

resetting to default values 8-38

software upgrade changes 8-22

support for 1-5

switch

as proxy 8-3

RADIUS client 8-3

upgrading from a previous release 29-22

VLAN assignment, AAA authorization 8-22

wake-on-LAN, described 8-16

port blocking 1-2, 21-6

port-channel

See EtherChannel

Port Fast

described 17-2

enabling 17-14

mode, spanning tree 11-29

support for 1-4

port membership modes, VLAN 11-3

port priority

MSTP 16-20

STP 15-17

- ports
 - access [9-3](#)
 - blocking [21-6](#)
 - dynamic access [11-3](#)
 - forwarding, resuming [21-7](#)
 - IEEE 802.1Q tunnel [11-3](#)
 - protected [21-5](#)
 - routed [9-4](#)
 - secure [21-7](#)
 - static-access [11-3, 11-10](#)
 - switch [9-2](#)
 - trunks [11-3, 11-16](#)
 - VLAN assignments [11-10](#)
- port security
 - aging [21-15](#)
 - and QoS trusted boundary [29-33](#)
 - configuration guidelines [21-10](#)
 - configuring [21-11](#)
 - default configuration [21-9](#)
 - described [21-7](#)
 - displaying [21-17](#)
 - on trunk ports [21-12](#)
 - sticky learning [21-8](#)
 - violations [21-8](#)
 - with other features [21-10](#)
- port-shutdown response, VMPS [11-27](#)
- Power over Ethernet
 - See PoE
- preemption
 - default configuration [18-4](#)
- preemption delay
 - default configuration [18-4](#)
- preferential treatment of traffic
 - See QoS
- prefix lists, BGP [31-53](#)
- preventing unauthorized access [7-1](#)
- primary links [18-2](#)
- priority
 - HSRP [32-6](#)
 - overriding CoS [13-5](#)
 - trusting CoS [13-6](#)
- private VLAN edge ports
 - See protected ports
- privileged EXEC mode [2-2](#)
- privilege levels
 - changing the default for lines [7-9](#)
 - command switch [5-14](#)
 - exiting [7-10](#)
 - logging into [7-10](#)
 - mapping on member switches [5-14](#)
 - overview [7-2, 7-8](#)
 - setting a command with [7-8](#)
- protected ports [1-5, 21-5](#)
- protocol-dependent modules, EIGRP [31-35](#)
- Protocol-Independent Multicast Protocol
 - See PIM
- provider edge devices [31-62](#)
- proxy ARP
 - configuring [31-10](#)
 - definition [31-8](#)
 - with IP routing disabled [31-11](#)
- pruning, VTP
 - enabling [12-13](#)
 - enabling on a port [11-22](#)
 - examples [12-5](#)
 - overview [12-4](#)
- pruning-eligible list
 - changing [11-22](#)
 - for VTP pruning [12-5](#)
 - VLANs [12-14](#)
- publications, related [v](#)
- PVST+
 - described [15-9](#)
 - IEEE 802.1Q trunking interoperability [15-10](#)
 - instances supported [15-9](#)

Q

QoS

and MQC commands [29-1](#)

auto-QoS

categorizing traffic [29-18](#)

configuration and defaults display [29-23](#)

configuration guidelines [29-21](#)

described [29-17](#)

displaying [29-23](#)

effects on NVRAM configuration [29-21](#)

egress queue defaults [29-18](#)

enabling for VoIP [29-22](#)

generated commands [29-19](#)

basic model [29-4](#)

classification

class maps, described [29-7](#)

defined [29-4](#)

flowchart [29-6](#)

forwarding treatment [29-3](#)

in frames and packets [29-3](#)

IP ACLs, described [29-5, 29-7](#)

MAC ACLs, described [29-5, 29-7](#)

pass-through mode, described [29-34](#)

per physical port [29-40](#)

per-port per-VLAN [29-42](#)

policy maps, described [29-7](#)

port default, described [29-5](#)

trust DSCP, described [29-5](#)

trusted CoS, described [29-5](#)

trust IP precedence, described [29-5](#)

types for IP traffic [29-5](#)

types for non-IP traffic [29-5](#)

class maps

configuring per physical port [29-40](#)

configuring per-port per-VLAN [29-42](#)

displaying [29-71](#)

QoS (continued)

configuration examples

distribution layer [29-74](#)

existing wiring closet [29-72](#)

intelligent wiring closet [29-73](#)

configuration guidelines

auto-QoS [29-21](#)

standard QoS [29-27](#)

configuring

aggregate policers [29-50](#)

auto-QoS [29-17](#)

default port CoS value [29-32](#)

DSCP maps [29-53](#)

DSCP trust states bordering another domain [29-35](#)

egress queues on 10/100 Ethernet ports [29-66](#)

egress queues on Gigabit-capable Ethernet ports [29-59](#)

IP extended ACLs [29-38](#)

IP standard ACLs [29-37](#)

MAC ACLs [29-39](#)

pass-through mode [29-34](#)

policy maps [29-44](#)

port trust states within the domain [29-30](#)

trusted boundary [29-33](#)

default auto configuration [29-18](#)

default standard configuration [29-26](#)

displaying statistics [29-71](#)

enabling globally [29-29](#)

flowcharts

classification [29-6](#)

policing and marking [29-10](#)

queueing and scheduling [29-12, 29-15](#)

implicit deny [29-7](#)

IP phones

automatic classification and queueing [29-17](#)

detection and trusted settings [29-17, 29-33](#)

QoS (continued)

mapping tables

CoS-to-DSCP [29-54](#)CoS-to-egress-queue [29-60](#)displaying [29-71](#)DSCP-to-CoS [29-56](#)DSCP-to-DSCP-mutation [29-58](#)DSCP-to-threshold [29-62](#)IP-precedence-to-DSCP [29-55](#)policed-DSCP [29-56](#)types of [29-10](#)marked-down actions [29-47](#)marking, described [29-4, 29-8](#)overview [29-2](#)packet modification [29-17](#)pass-through mode [29-34](#)

policers

configuring [29-47, 29-50](#)described [29-8](#)displaying [29-71](#)number of [29-9](#)types of [29-8](#)policies, attaching to an interface [29-9](#)

policing

described [29-4, 29-8](#)token bucket algorithm [29-8](#)

policy maps

characteristics of [29-44](#)configuring [29-44](#)displaying [29-71](#)queueing, defined [29-4](#)

queues

CoS-to-egress-queue map [29-60](#)for 10/100 Ethernet ports [29-15](#)high priority (expedite) [29-13, 29-65](#)minimum-reserve levels [29-68](#)serviced by WRR [29-13, 29-16](#)size of [29-12, 29-15](#)size ratios [29-61](#)

QoS (continued)

queues (continued)

tail-drop threshold percentages [29-13, 29-61](#)WRED drop-percentage thresholds [29-13, 29-63](#)WRR scheduling [29-65](#)

scheduling

allocating bandwidth on 10/100 Ethernet ports [29-69](#)allocating bandwidth on Gigabit-capable ports [29-65](#)defined [29-4](#)support for [1-6](#)

tail drop

configuring drop threshold percentages [29-61](#)described [29-13](#)

trust states

bordering another domain [29-35](#)described [29-5](#)trusted device [29-33](#)within the domain [29-30](#)

WRED

configuring drop-percentage thresholds [29-63](#)described [29-14](#)WRR scheduling [29-65](#)

quality of service

See QoS

queries, IGMP [20-3](#)query solicitation, IGMP [20-12](#)

R

RADIUS

attributes

vendor-proprietary [7-31](#)vendor-specific [7-29](#)

RADIUS (continued)

- configuring
 - accounting [7-28](#)
 - authentication [7-23](#)
 - authorization [7-27](#)
 - communication, global [7-21, 7-29](#)
 - communication, per-server [7-20, 7-21](#)
 - multiple UDP ports [7-21](#)
- default configuration [7-20](#)
- defining AAA server groups [7-25](#)
- described [7-18](#)
- displaying the configuration [7-31](#)
- identifying the server [7-20](#)
- in clusters [5-14](#)
- limiting the services to the user [7-27](#)
- method list, defined [7-20](#)
- operation of [7-19](#)
- suggested network environments [7-18](#)
- tracking services accessed by user [7-28](#)
- Random Early Detection, described [29-14](#)
- range
 - macro [9-12](#)
 - of interfaces [9-10](#)
- rapid convergence [16-10](#)
- rapid per-VLAN spanning-tree plus
 - See rapid PVST+
- rapid PVST+
 - described [15-9](#)
 - IEEE 802.1Q trunking interoperability [15-10](#)
 - instances supported [15-9](#)
- rapid-PVST+ [11-2](#)
- Rapid Spanning Tree Protocol
 - See RSTP
- RARP [31-8](#)

RCP

- configuration files
 - downloading [B-16](#)
 - overview [B-14](#)
 - preparing the server [B-15](#)
 - uploading [B-17](#)
- image files
 - deleting old image [B-31](#)
 - downloading [B-29](#)
 - preparing the server [B-28](#)
 - uploading [B-31](#)
- reconfirmation interval, VMPS, changing [11-31](#)
- recovery procedures [37-1](#)
- redundancy
 - EtherChannel [30-2](#)
 - features [1-3](#)
 - HSRP [32-1](#)
 - STP
 - backbone [15-7](#)
 - multidrop backbone [17-5](#)
 - path cost [11-25](#)
 - port priority [11-24](#)
- redundant links and UplinkFast [17-17](#)
- reliable transport protocol, EIGRP [31-34](#)
- reloading software [3-16](#)
- Remote Authentication Dial-In User Service
 - See RADIUS
- Remote Copy Protocol
 - See RCP
- Remote Network Monitoring
 - See RMON
- report suppression, IGMP
 - described [20-6](#)
 - disabling [20-14](#)
- resequencing ACL entries [28-16](#)
- resets, in BGP [31-48](#)
- resetting a UDLD-shutdown interface [23-6](#)

- restricted VLAN
 - configuring [8-32](#)
 - using with port-based authentication [8-12](#)
- restricting access
 - NTP services [6-8](#)
 - overview [7-1](#)
 - passwords and privilege levels [7-2](#)
 - RADIUS [7-17](#)
 - TACACS+ [7-10](#)
- retry count, VMPS, changing [11-32](#)
- reverse address resolution [31-8](#)
- Reverse Address Resolution Protocol
 - See RARP
- RFC
 - 1058, RIP [31-19](#)
 - 1112, IP multicast and IGMP [20-2](#)
 - 1157, SNMPv1 [27-2](#)
 - 1163, BGP [31-41](#)
 - 1166, IP addresses [31-5](#)
 - 1253, OSPF [31-24](#)
 - 1267, BGP [31-41](#)
 - 1305, NTP [6-2](#)
 - 1587, NSSAs [31-24](#)
 - 1757, RMON [25-2](#)
 - 1771, BGP [31-41](#)
 - 1901, SNMPv2C [27-2](#)
 - 1902 to 1907, SNMPv2 [27-2](#)
 - 2236, IP multicast and IGMP [20-2](#)
 - 2273-2275, SNMPv3 [27-2](#)
- RIP
 - advertisements [31-19](#)
 - authentication [31-22](#)
 - configuring [31-20](#)
 - default configuration [31-19](#)
 - described [31-19](#)
 - hop counts [31-19](#)
 - split horizon [31-22](#)
 - summary addresses [31-22](#)
 - support for [1-7](#)
- RMON
 - default configuration [25-3](#)
 - displaying status [25-6](#)
 - enabling alarms and events [25-3](#)
 - groups supported [25-2](#)
 - overview [25-1](#)
 - statistics
 - collecting group Ethernet [25-5](#)
 - collecting group history [25-5](#)
 - support for [1-8](#)
- root guard
 - described [17-12](#)
 - enabling [17-20](#)
 - support for [1-4](#)
- root switch
 - MSTP [16-17](#)
 - STP [15-14](#)
- route calculation timers, OSPF [31-30](#)
- route dampening, BGP [31-60](#)
- routed packets, ACLs on [28-39](#)
- routed ports
 - configuring [31-3](#)
 - defined [9-4](#)
 - in switch clusters [5-7](#)
 - IP addresses on [9-20, 31-3](#)
- route-map command for policy-based routing [31-81](#)
- route maps
 - BGP [31-51](#)
 - policy-based routing, defined [31-79](#)
- router ACLs [28-2](#)
- route reflectors, BGP [31-59](#)
- router ID, OSPF [31-32](#)
- route selection, BGP [31-49](#)
- route summarization, OSPF [31-30](#)
- route targets, VPN [31-64](#)

routing

- default [31-2](#)
- dynamic [31-2](#)
- redistribution of information [31-76](#)
- static [31-2](#)

routing domain confederation, BGP [31-58](#)

Routing Information Protocol

See RIP

routing protocol administrative distances [31-75](#)

RSPAN

- configuration guidelines [24-16](#)
- default configuration [24-8](#)
- destination ports [24-5](#)
- displaying status [24-24](#)
- IDS [24-2](#)
- interaction with other features [24-7](#)
- monitored ports [24-4](#)
- monitoring ports [24-5](#)
- overview [1-8, 24-1](#)
- received traffic [24-3](#)
- reflector port [24-5](#)
- session limits [24-8](#)
- sessions
 - creating [24-17](#)
 - defined [24-3](#)
 - limiting source traffic to specific VLANs [24-23](#)
 - monitoring VLANs [24-22](#)
 - removing source (monitored) ports [24-21](#)
 - specifying monitored ports [24-17](#)
- source ports [24-4](#)
- transmitted traffic [24-4](#)
- VLAN-based [24-6](#)

RSTP

active topology, determining [16-9](#)

BPDU

- format [16-12](#)
- processing [16-13](#)

designated port, defined [16-9](#)

designated switch, defined [16-9](#)

RSTP (continued)

- interoperability with IEEE 802.1D
 - described [16-8](#)
 - restarting migration process [16-26](#)
 - topology changes [16-13](#)
- overview [16-8](#)
- port roles
 - described [16-9](#)
 - synchronized [16-11](#)
- proposal-agreement handshake process [16-10](#)
- rapid convergence
 - described [16-10](#)
 - edge ports and Port Fast [16-10](#)
 - point-to-point links [16-10, 16-25](#)
 - root ports [16-10](#)
- root port, defined [16-9](#)
- See also MSTP

running configuration, saving [3-10](#)

S

SC (standby command switch) [5-10](#)

scheduled reloads [3-16](#)

SDM

- configuring [6-29](#)
- described [6-26](#)
- templates
 - number of [6-26](#)
 - resources used for Fast Ethernet switches [6-28](#)
 - resources used for Gigabit Ethernet switches [6-27](#)

sdm prefer extended-match command [31-65](#)

secure HTTP client

- configuring [7-47](#)
- displaying [7-48](#)

secure HTTP server

- configuring [7-46](#)
- displaying [7-48](#)

secure ports, configuring [21-7](#)

secure remote connections [7-38](#)

- Secure Shell
 - See SSH
- Secure Socket Layer
 - See SSL
- security, port [21-7](#)
- security features [1-5](#)
- sequence numbers in log messages [26-8](#)
- server mode, VTP [12-3](#)
- service-provider networks
 - and customer VLANs [14-2](#)
 - and IEEE 802.1Q tunneling [14-1](#)
 - Layer 2 protocols across [14-8](#)
 - Layer 2 protocol tunneling for EtherChannels [14-9](#)
 - MSTP and RSTP [16-1](#)
- set-request operation [27-4](#)
- setup program, failed command switch replacement [37-7](#), [37-8](#)
- severity levels, defining in system messages [26-8](#)
- show access-lists hw-summary command [28-7](#)
- show cdp traffic command [22-5](#)
- show configuration command [9-18](#)
- show fm command [28-43](#)
- show forward command [37-19](#)
- show interfaces command [9-16](#), [9-18](#)
- show l2protocol command [14-12](#), [14-14](#), [14-15](#)
- show mac access-group command [28-29](#)
- show running-config command
 - displaying ACLs [28-21](#), [28-32](#), [28-34](#)
 - interface description in [9-18](#)
- show tcam command [28-43](#)
- shutdown command on interfaces [9-22](#)
- shutdown threshold for Layer 2 protocol packets [14-10](#)
- Simple Network Management Protocol
 - See SNMP
- Smartports macros
 - applying Cisco-default macros [10-6](#)
 - applying global parameter values [10-5](#), [10-6](#)
 - applying macros [10-5](#)
 - applying parameter values [10-5](#), [10-7](#)
- Smartports macros (continued)
 - configuration guidelines [10-3](#)
 - creating [10-4](#)
 - default configuration [10-2](#)
 - defined [10-1](#)
 - displaying [10-8](#)
 - tracing [10-3](#)
 - website [10-2](#)
- SNAP [22-1](#)
- SNMP
 - accessing MIB variables with [27-4](#)
 - agent
 - described [27-4](#)
 - disabling [27-7](#)
 - community strings
 - configuring [27-8](#)
 - for cluster switches [27-4](#)
 - overview [27-4](#)
 - configuration examples [27-16](#)
 - default configuration [27-6](#)
 - groups [27-9](#)
 - ifIndex values [27-5](#)
 - in-band management [1-3](#)
 - in clusters [5-14](#)
 - informs
 - and trap keyword [27-11](#)
 - described [27-5](#)
 - differences from traps [27-5](#)
 - enabling [27-14](#)
 - limiting access by TFTP servers [27-15](#)
 - limiting system log messages to NMS [26-10](#)
 - manager functions [1-9](#), [27-3](#)
 - managing clusters with [5-15](#)
 - MIBs
 - location of [A-3](#)
 - supported [A-1](#)
 - notifications [27-5](#)
 - overview [27-1](#), [27-4](#)
 - status, displaying [27-17](#)

SNMP (continued)

- system contact and location [27-15](#)
- trap manager, configuring [27-13, 27-14](#)
- traps
 - described [27-3, 27-5](#)
 - differences from informs [27-5](#)
 - enabling [27-11, 27-14](#)
 - enabling MAC address notification [6-22](#)
 - overview [27-1, 27-4](#)
 - types of [27-11](#)
- users [27-9](#)
- versions supported [27-2](#)

snooping, IGMP [20-2](#)

software images

- location in flash [B-19](#)
- recovery procedures [37-2](#)
- scheduling reloads [3-16](#)
- tar file format, described [B-19](#)
- See also downloading and uploading

source addresses, in ACLs [28-13](#)

SPAN

- configuration guidelines [24-9](#)
- default configuration [24-8](#)
- destination ports [24-5](#)
- displaying status [24-24](#)
- IDS [24-2](#)
- interaction with other features [24-7](#)
- monitored ports [24-4](#)
- monitoring ports [24-5](#)
- overview [1-8, 24-1](#)
- ports, restrictions [21-11](#)
- received traffic [24-3](#)
- session limits [24-8](#)
- sessions
 - creating [24-9](#)
 - defined [24-3](#)
 - limiting source traffic to specific VLANs [24-15](#)
 - monitoring VLANs [24-14](#)
 - removing destination (monitoring) ports [24-13](#)

SPAN (continued)

- sessions (continued)
 - removing source (monitored) ports [24-13](#)
 - specifying monitored ports [24-9](#)
- source ports [24-4](#)
- transmitted traffic [24-4](#)
- VLAN-based [24-6](#)

spanning tree and native VLANs [11-18](#)

Spanning Tree Protocol

See STP

speed, configuring on interfaces [9-15](#)split horizon, RIP [31-22](#)

SSH

- configuring [7-38](#)
- cryptographic software image [7-37](#)
- described [7-38](#)
- encryption methods [7-38](#)
- user authentication methods, supported [7-38](#)

SSL

- configuration guidelines [7-44](#)
- configuring a secure HTTP client [7-47](#)
- configuring a secure HTTP server [7-46](#)
- cryptographic software image [7-41](#)
- described [7-41](#)
- monitoring [7-48](#)

Stack Membership Discovery Protocol [17-6](#)

standby command switch

- configuring
- considerations [5-11](#)
- defined [5-2](#)
- priority [5-10](#)
- requirements [5-3](#)
- virtual IP address [5-11](#)
- See also cluster standby group and HSRP

standby group, cluster

See cluster standby group and HSRP

standby ip command [32-5](#)standby links [18-2](#)standby router [32-1](#)

- standby timers, HSRP [32-8](#)
- startup configuration
 - booting
 - manually [3-12](#)
 - specific image [3-13](#)
 - clearing [B-18](#)
 - configuration file
 - automatically downloading [3-11](#)
 - specifying the filename [3-12](#)
 - default boot configuration [3-11](#)
- static access ports
 - assigning to VLAN [11-10](#)
 - defined [9-3, 11-3](#)
- static addresses
 - See addresses
- static IP routing [1-8](#)
- static MAC addressing [1-5](#)
- static routes, configuring [31-74](#)
- static routing [31-2](#)
- static VLAN membership [11-2](#)
- statistics
 - CDP [22-4](#)
 - IEEE 802.1x [8-38](#)
 - interface [9-21](#)
 - IP multicast routing [34-52](#)
 - OSPF [31-33](#)
 - QoS ingress and egress [29-71](#)
 - RMON group Ethernet [25-5](#)
 - RMON group history [25-5](#)
 - SNMP input and output [27-17](#)
 - VTP [12-15](#)
- sticky learning
 - configuration file [21-8](#)
 - defined [21-8](#)
 - disabling [21-8](#)
 - enabling [21-8](#)
 - saving addresses [21-8](#)
- storm control
 - configuring [21-3](#)
 - default configuration [21-3](#)
 - described [21-1](#)
 - disabling [21-4](#)
 - displaying [21-17](#)
 - thresholds [21-1](#)
- STP
 - accelerating root port selection [17-4](#)
 - BackboneFast
 - described [17-9](#)
 - enabling [17-19](#)
 - BPDU filtering
 - described [17-3](#)
 - enabling [17-16](#)
 - BPDU guard
 - described [17-2](#)
 - enabling [17-15](#)
 - BPDU message exchange [15-2](#)
 - configuration guidelines [15-12, 17-14](#)
 - configuring
 - forward-delay time [15-22](#)
 - hello time [15-21](#)
 - in cascaded stack [15-23](#)
 - maximum aging time [15-22, 15-23](#)
 - path cost [15-18](#)
 - port priority [15-17](#)
 - root switch [15-14](#)
 - secondary root switch [15-16](#)
 - spanning-tree mode [15-13](#)
 - switch priority [15-20](#)
 - counters, clearing [15-24](#)
 - cross-stack UplinkFast
 - described [17-5](#)
 - enabling [17-18](#)
 - default configuration [15-11](#)
 - default optional feature configuration [17-14](#)
 - designated port, defined [15-3](#)
 - designated switch, defined [15-3](#)

STP (continued)

- detecting indirect link failures [17-10](#)
- disabling [15-14](#)
- displaying status [15-24](#)
- EtherChannel guard
 - described [17-12](#)
 - enabling [17-20](#)
- extended system ID
 - affects on root switch [15-15](#)
 - affects on the secondary root switch [15-16](#)
 - overview [15-3](#)
 - unexpected behavior [15-15](#)
- features supported [1-4](#)
- inferior BPDU [15-3](#)
- instances supported [15-9](#)
- interface state, blocking to forwarding [17-2](#)
- interface states
 - blocking [15-5](#)
 - disabled [15-6](#)
 - forwarding [15-5, 15-6](#)
 - learning [15-6](#)
 - listening [15-6](#)
 - overview [15-4](#)
- interoperability and compatibility among modes [15-10](#)
- Layer 2 protocol tunneling [14-7](#)
- limitations with IEEE 802.1Q trunks [15-10](#)
- load sharing
 - overview [11-23](#)
 - using path costs [11-25](#)
 - using port priorities [11-24](#)
- loop guard
 - described [17-13](#)
 - enabling [17-21](#)
- modes supported [15-9](#)
- multicast addresses, affect of [15-8](#)
- optional features supported [1-4](#)
- overview [15-2](#)
- path costs [11-25, 11-26](#)

STP (continued)

- Port Fast
 - described [17-2](#)
 - enabling [17-14](#)
- port priorities [11-24](#)
- preventing root switch selection [17-12](#)
- protocols supported [15-9](#)
- redundant connectivity [15-7](#)
- root guard
 - described [17-12](#)
 - enabling [17-20](#)
- root port, defined [15-3](#)
- root switch
 - affects of extended system ID [15-3, 15-15](#)
 - configuring [15-15](#)
 - election [15-3](#)
 - unexpected behavior [15-15](#)
- settings in a cascaded stack [15-23](#)
- shutdown Port Fast-enabled port [17-2](#)
- superior BPDU [15-3](#)
- timers, described [15-20](#)
- UplinkFast
 - described [17-3](#)
 - enabling [17-17](#)
- VLAN-bridge [15-11](#)
- stratum, NTP [6-2](#)
- stub areas, OSPF [31-28](#)
- stub routing, EIGRP [31-39](#)
- subnet mask [31-5](#)
- subnet zero [31-6](#)
- summer time [6-13](#)
- SunNet Manager [1-9](#)
- supernet [31-7](#)
- SVIs
 - and IP unicast routing [31-3](#)
 - and router ACLs [28-3](#)
 - connecting VLANs [9-8](#)
 - defined [9-4](#)
 - routing between VLANs [11-2](#)

- switch clustering technology [5-1](#)
 - switch console port [1-3](#)
 - switched packets, ACLs on [28-38](#)
 - switched ports [9-2](#)
 - switchport block multicast command [21-6](#)
 - switchport block unicast command [21-7](#)
 - switchport command [9-14](#)
 - switchport mode dot1q-tunnel command [14-6](#)
 - switchport protected command [21-6](#)
 - switch priority
 - MSTP [16-22](#)
 - STP [15-20](#)
 - switch software features [1-1](#)
 - switch virtual interfaces
 - See SVIs
 - synchronization, BGP [31-45](#)
 - syslog
 - See system message logging
 - system clock
 - configuring
 - daylight saving time [6-13](#)
 - manually [6-11](#)
 - summer time [6-13](#)
 - time zones [6-12](#)
 - displaying the time and date [6-12](#)
 - overview [6-1](#)
 - See also NTP
 - System Database Management
 - See SDM
 - system message logging
 - default configuration [26-3](#)
 - defining error message severity levels [26-8](#)
 - disabling [26-4](#)
 - displaying the configuration [26-12](#)
 - enabling [26-4](#)
 - facility keywords, described [26-12](#)
 - level keywords, described [26-9](#)
 - limiting messages [26-10](#)
 - message format [26-2](#)
 - system message logging (continued)
 - overview [26-1](#)
 - sequence numbers, enabling and disabling [26-8](#)
 - setting the display destination device [26-4](#)
 - synchronizing log messages [26-6](#)
 - syslog facility [1-8](#)
 - timestamps, enabling and disabling [26-7](#)
 - UNIX syslog servers
 - configuring the daemon [26-11](#)
 - configuring the logging facility [26-11](#)
 - facilities supported [26-12](#)
 - system MTU
 - IEEE 802.1Q tunneling [14-5](#)
 - maximums [14-5](#)
 - system name
 - default configuration [6-15](#)
 - default setting [6-15](#)
 - manual configuration [6-15](#)
 - See also DNS
 - system prompt
 - default setting [6-14, 6-15](#)
 - system resource templates [6-26](#)
-
- ## T
- TACACS+
 - accounting, defined [7-11](#)
 - authentication, defined [7-11](#)
 - authorization, defined [7-11](#)
 - configuring
 - accounting [7-17](#)
 - authentication key [7-13](#)
 - authorization [7-16](#)
 - login authentication [7-14](#)
 - default configuration [7-13](#)
 - displaying the configuration [7-17](#)
 - identifying the server [7-13](#)
 - in clusters [5-14](#)
 - limiting the services to the user [7-16](#)

TACACS+ (continued)

- operation of [7-12](#)
- overview [7-10](#)
- tracking services accessed by user [7-17](#)

tagged packets

- IEEE 802.1Q [14-3](#)
- Layer 2 protocol [14-7](#)

tail drop

- described [29-13](#)
- support for [1-7](#)

tar files

- creating [B-5](#)
- displaying the contents of [B-6](#)
- extracting [B-7](#)
- image file format [B-19](#)

TCAMs

- ACL regions [28-47](#)
- ACLs not loading in [28-45](#)
- allocations, monitoring [28-48](#)
- monitoring usage [28-47](#)

Telnet

- accessing management interfaces [2-10](#)
- number of connections [1-3](#)
- setting a password [7-6](#)

templates, system resources [6-26](#)temporary self-signed certificate [7-42](#)

Terminal Access Controller Access Control System Plus

See TACACS+

terminal lines, setting a password [7-6](#)

ternary content addressable memory

See TCAM

TFTP

- configuration files
 - downloading [B-10](#)
 - preparing the server [B-10](#)
 - uploading [B-11](#)
- configuration files in base directory [3-6](#)
- configuring for autoconfiguration [3-6](#)

TFTP (continued)

- image files
 - deleting [B-22](#)
 - downloading [B-21](#)
 - preparing the server [B-21](#)
 - uploading [B-23](#)
- limiting access by servers [27-15](#)

TFTP server [1-3](#)threshold, traffic level [21-2](#)

time

See NTP and system clock

time-range command [28-18](#)time ranges in ACLs [28-18](#)timestamps in log messages [26-7](#)time zones [6-12](#)

Token Ring VLANs

- support for [11-5](#)
- VTP support [12-4](#)

TOS [1-6](#)

traceroute, Layer 2

- and ARP [37-15](#)
- and CDP [37-15](#)
- described [37-14](#)
- IP addresses and subnets [37-15](#)
- MAC addresses and VLANs [37-15](#)
- multicast traffic [37-15](#)
- multiple devices on a port [37-15](#)
- unicast traffic [37-14](#)
- usage guidelines [37-15](#)

traceroute command [37-13](#)

See also IP traceroute

traffic

- blocking flooded [21-6](#)
- fragmented [28-5](#)
- unfragmented [28-5](#)

traffic policing [1-7](#)traffic suppression [21-1](#)transparent mode, VTP [12-3, 12-11](#)trap-door mechanism [3-2](#)

- traps
 - configuring MAC address notification [6-22](#)
 - configuring managers [27-11, 27-14](#)
 - defined [27-3](#)
 - enabling [6-22, 27-11, 27-14](#)
 - notification types [27-11](#)
 - overview [27-1, 27-4](#)
 - troubleshooting
 - connectivity problems [37-11](#)
 - detecting unidirectional links [23-1](#)
 - determining packet disposition [37-19](#)
 - displaying crash information [37-21](#)
 - GBIC security and identification [37-10](#)
 - PIMv1 and PIMv2 interoperability problems [34-23](#)
 - PoE ports [37-16](#)
 - show forward command [37-19](#)
 - with CiscoWorks [27-4](#)
 - with debug commands [37-17](#)
 - with ping [37-11](#)
 - with system message logging [26-1](#)
 - with traceroute [37-13](#)
 - trunking encapsulation [1-4](#)
 - trunk ports
 - configuring [11-20](#)
 - defined [9-3, 11-3](#)
 - encapsulation [11-20, 11-25, 11-26](#)
 - trunks
 - allowed-VLAN list [11-21](#)
 - configuring [11-20, 11-25, 11-26](#)
 - ISL [11-16](#)
 - load sharing
 - setting STP path costs [11-25](#)
 - using STP port priorities [11-24](#)
 - native VLAN for untagged traffic [11-23](#)
 - parallel [11-25](#)
 - pruning-eligible list [11-22](#)
 - to non-DTP device [11-16](#)
 - VLAN 1 minimization [11-21](#)
 - trusted boundary for QoS [29-33](#)
 - trustpoints, CA [7-42](#)
 - tunneling
 - defined [14-1](#)
 - IEEE 802.1Q [14-1](#)
 - Layer 2 protocol [14-8](#)
 - tunnel ports
 - defined [11-3](#)
 - described [9-4, 14-1](#)
 - IEEE 802.1Q, configuring [14-6](#)
 - IEEE 802.1Q and ACLs [28-3](#)
 - incompatibilities with other features [14-5](#)
 - twisted-pair Ethernet, detecting unidirectional links [23-1](#)
 - type of service
 - See TOS
-
- ## U
- UDLD
 - default configuration [23-4](#)
 - echoing detection mechanism [23-3](#)
 - enabling
 - globally [23-5](#)
 - per interface [23-5](#)
 - Layer 2 protocol tunneling [14-10](#)
 - link-detection mechanism [23-1](#)
 - neighbor database [23-2](#)
 - overview [23-1](#)
 - resetting an interface [23-6](#)
 - status, displaying [23-7](#)
 - support for [1-3](#)
 - UDP, configuring [31-15](#)
 - unauthorized ports with IEEE 802.1x [8-7](#)
 - unicast MAC address filtering
 - and adding static addresses [6-25](#)
 - and broadcast MAC addresses [6-25](#)
 - and CPU packets [6-25](#)
 - and multicast addresses [6-25](#)
 - and router MAC addresses [6-25](#)

unicast MAC address filtering (continued)

configuration guidelines [6-25](#)

described [6-25](#)

unicast storm control

See storm control

unicast storm control command [21-4](#)

unicast traffic, blocking [21-6](#)

UniDirectional Link Detection protocol

See UDLD

UNIX syslog servers

daemon configuration [26-11](#)

facilities supported [26-12](#)

message logging configuration [26-11](#)

unrecognized Type-Length-Value (TLV) support [12-4](#)

upgrading software images

See downloading

upgrading with CNS [4-12](#)

UplinkFast

described [17-3](#)

enabling [17-17](#)

support for [1-4](#)

uploading

configuration files

preparing [B-10, B-12, B-15](#)

reasons for [B-8](#)

using FTP [B-14](#)

using RCP [B-17](#)

using TFTP [B-11](#)

image files

preparing [B-21, B-24, B-28](#)

reasons for [B-18](#)

using FTP [B-26](#)

using RCP [B-31](#)

using TFTP [B-23](#)

User Datagram Protocol

See UDP

user EXEC mode [2-2](#)

username-based authentication [7-7](#)

V

version-dependent transparent mode [12-4](#)

virtual IP address

cluster standby group [5-11](#)

command switch [5-11](#)

Virtual Private Network

See VPN

virtual router [32-1, 32-3](#)

vlan.dat file [11-4](#)

VLAN 1 minimization, support for [1-4](#)

VLAN ACLs

See VLAN maps

VLAN configuration

at bootup [11-7](#)

saving [11-7](#)

VLAN configuration mode [2-2, 11-6](#)

VLAN database

and startup configuration file [11-7](#)

and VTP [12-1](#)

VLAN configuration saved in [11-7](#)

VLANs saved in [11-4](#)

vlan database command [11-6](#)

vlan dot1q tag native command [14-4](#)

vlan global configuration command [11-6](#)

VLAN ID, discovering [6-29](#)

VLAN management domain [12-2](#)

VLAN Management Policy Server

See VMPS

VLAN map entries, order of [28-31](#)

VLAN maps

applying [28-34](#)

common uses for [28-34](#)

configuration example [28-35](#)

configuration guidelines [28-31](#)

configuring [28-30](#)

creating [28-31](#)

defined [28-2](#)

denying access example [28-36](#)

VLAN maps (continued)

- denying and permitting packets [28-32](#)
- displaying [28-42](#)
- examples [28-36](#)
- support for [1-5](#)
- usage [28-5](#)

VLAN membership

- confirming [11-31](#)
- modes [11-3](#)

VLAN Query Protocol

- See VQP

VLANs

- adding [11-8](#)
- adding to VLAN database [11-8](#)
- aging dynamic addresses [15-8](#)
- allowed on trunk [11-21](#)
- and spanning-tree instances [11-2, 11-6, 11-12](#)
- configuration guidelines, normal-range VLANs [11-5](#)
- configuration options [11-6](#)
- configuring [11-1](#)
- configuring IDs 1006 to 4094 [11-12](#)
- connecting through SVIs [9-8](#)
- creating in config-vlan mode [11-8](#)
- creating in VLAN configuration mode [11-9](#)
- customer numbering in service-provider networks [14-3](#)
- default configuration [11-7](#)
- deleting [11-10](#)
- described [9-2, 11-1](#)
- displaying [11-15](#)
- extended-range [11-1, 11-11](#)
- features [1-4](#)
- illustrated [11-2](#)
- internal [11-13](#)
- limiting source traffic with RSPAN [24-23](#)
- limiting source traffic with SPAN [24-15](#)
- modifying [11-8](#)
- monitoring with RSPAN [24-22](#)
- monitoring with SPAN [24-14](#)
- native, configuring [11-23](#)

VLANs (continued)

- normal-range [11-1, 11-4](#)
- number supported [1-4](#)
- parameters [11-4](#)
- port membership modes [11-3](#)
- static-access ports [11-10](#)
- STP and IEEE 802.1Q trunks [15-10](#)
- supported [11-2](#)
- Token Ring [11-5](#)
- traffic between [11-2](#)
- trunks, VLAN 1 minimization [11-21](#)
- VLAN-bridge STP [15-11, 36-1](#)
- VTP modes [12-3](#)

VLAN Trunking Protocol

- See VTP

VLAN trunks [11-16](#)

VMPS

- administering [11-32](#)
- configuration example [11-33](#)
- configuration guidelines [11-29](#)
- default configuration [11-29](#)
- description [11-27](#)
- dynamic port membership
 - described [11-28](#)
 - reconfirming [11-31](#)
 - troubleshooting [11-33](#)
- entering server address [11-30](#)
- mapping MAC addresses to VLANs [11-27](#)
- monitoring [11-32](#)
- reconfirmation interval, changing [11-31](#)
- reconfirming membership [11-31](#)
- retry count, changing [11-32](#)

voice VLAN

- Cisco 7960 phone, port connections [13-1](#)
- configuration guidelines [13-3](#)
- configuring IP phones for data traffic
 - override CoS of incoming frame [13-5](#)
 - trust CoS priority of incoming frame [13-6](#)

voice VLAN (continued)

- configuring ports for voice traffic in
 - 802.1p priority tagged frames [13-4](#)
 - 802.1Q frames [13-4](#)
- connecting to an IP phone [13-3](#)
- default configuration [13-2](#)
- described [13-1](#)
- displaying [13-6](#)

VPN

- configuring routing in [31-67](#)
- forwarding [31-64](#)
- in service provider networks [31-62](#)
- routes [31-62](#)

VPN routing and forwarding table

See VRF

VQP [1-4, 11-27](#)

VRF

- defining [31-64](#)
- tables [31-62](#)

VTP

- adding a client to a domain [12-14](#)
- advertisements [11-19, 12-3](#)
- and extended-range VLANs [12-1](#)
- and normal-range VLANs [12-1](#)
- client mode, configuring [12-10](#)
- configuration
 - global configuration mode [12-7](#)
 - guidelines [12-8](#)
 - privileged EXEC mode [12-7](#)
 - requirements [12-9](#)
 - saving [12-7](#)
 - VLAN configuration mode [12-7](#)
- configuration mode options [12-7](#)
- configuration requirements [12-9](#)
- configuration revision number
 - guideline [12-14](#)
 - resetting [12-14](#)

VTP (continued)

- configuring
 - client mode [12-10](#)
 - server mode [12-9](#)
 - transparent mode [12-11](#)
- consistency checks [12-4](#)
- default configuration [12-6](#)
- described [12-1](#)
- disabling [12-11](#)
- domain names [12-8](#)
- domains [12-2](#)
- Layer 2 protocol tunneling [14-7](#)
- modes
 - client [12-3, 12-10](#)
 - server [12-3, 12-9](#)
 - transitions [12-3](#)
 - transparent [12-3, 12-11](#)
- monitoring [12-15](#)
- passwords [12-8](#)
- pruning
 - disabling [12-13](#)
 - enabling [12-13](#)
 - examples [12-5](#)
 - overview [12-4](#)
 - support for [1-4](#)
- pruning-eligible list, changing [11-22](#)
- server mode, configuring [12-9](#)
- statistics [12-15](#)
- support for [1-4](#)
- Token Ring support [12-4](#)
- transparent mode, configuring [12-11](#)
- using [12-1](#)
- version, guidelines [12-8](#)
- version 1 [12-4](#)
- version 2
 - configuration guidelines [12-8](#)
 - disabling [12-13](#)
 - enabling [12-12](#)
 - overview [12-4](#)

W

WCCP

- authentication [33-3](#)
- configuration guidelines [33-5](#)
- default configuration [33-4](#)
- described [33-1](#)
- displaying [33-8](#)
- enabling [33-5](#)
- features unsupported [33-4](#)
- forwarding method [33-3](#)
- Layer-2 header rewrite [33-3](#)
- MD5 security [33-3](#)
- message exchange [33-2](#)
- monitoring and maintaining [33-8](#)
- negotiation [33-3](#)
- packet redirection [33-3](#)
- packet-return method [33-3](#)
- redirecting traffic received from a client [33-5](#)
- setting the password [33-5](#)
- unsupported WCCPv2 features [33-4](#)

Web Cache Communication Protocol

See WCCP

Weighted Random Early Detection

See WRED

Weighted Round Robin

See WRR

weighted round robin, described [29-4](#)

wizards [1-10](#)

WRED [1-7, 29-14](#)

WRR [1-7, 29-4](#)

X

Xmodem protocol [37-2](#)

