2^0 = 1
2^1 = 2
2^2 = 4
2^3 = 8
2^4 = 16
2^5 = 32
2^6= 64
2^7 = 128
2^8 = 256
2^9 = 512
2^10 = 1024
2^11 = 2048
2^12 = 4096

Ports
20-21: FTP
22: SSH
23: Telnet
25: SMTP
53: dns
69: tftp
80: http
110: POP3
143: imap
161: snmp
194: irc
443: https
546: dhcp

Ports
Well Known
0 - 1023

Registered
1024 - 49151

Private/dyn.
49152-
65533

UDP
dns
snmp
dhcp
rip
tftp
VoIP
Games

DHCP
DHCPDISCOVER ->
DHCPOFFER <-
DHCPREQUEST ->
DHCPACK <-

HTTP
Get
Post (submit)
Put (upload)

FTP
2 connections:
1 - Control traffic
2 - Data exchange

DNS record types
A: End device
NS: Authoritative nameserver
cname: Canonical name *(when multiple services have the same address)*
MX: mail exchange records

IPv4

IP Class
A: 1.0.0.0 - 127.255.255.255
B: 128.0.0.0 - 191.255.255.255
C: 224.0.0.0 - 239.255.255.255

Subnet Class
A: 255.0.0.0 - 255.128.0.0
B: 255.0.0.0 - 255.255.240.0
C: 255.255.255.0 - 255.255.255.192

Local
10.0.0.0/8
172.16.0.0 - 172.31.0.0/16
192.168.0.0/16

Reserved
Loopback: 127.0.0.1
Link-Local: 169.254.0.0/16
TestNet: 192.0.2.0/24
ISP: 100.64.0.0/10
Experimental:
240.0.0.0 - 255.255.255.254

Valid Subnets
255, 254, 252,
248, 240, 224,
192, 128, 0

IPv4 Packet header

Version	Internet Header Length	Diff. Services	Total Length
Identification		Flag	Fragment Offset
TTL	Protocol	Header Checksum	
Source IP			
Dest. IP			
Options (Opt.)			Padding

IPv6

Unspecified: :: /128 (all 0s)
Default route: :: /0 (Default unicast)
local: ::1 /128 (loopback)
fe80:: /10 (link-local
unique local: fc00:: /7 (not in use)
global unicast: 2001:: /3
Multicast: FF00:: /8
All-nodes multi: FF02::1
All-routers multi: FF02::2
All 0s host address: router anycast (reserved for routers)

IPv6 Packet header

Version	Traffic Class	Flow Label
Payload length	Next header	Hop limit
Source IP		
Dest IP		

Nibble aligned
/64, /60, /56,
/52, /48, etc.

OSI	TCP/IP	Protocols
7. App.	App.	http, dns,
6. Pres.		dhcp, ftp,
5. Sess.		imap, pop
4. Transp.	Transp.	tcp, udp
3. Netwrk	Internet	IP, ICMP, EIGRP
2. Data-lk	Ntwrk Accss	Ethernet, WLAN
1. Physical		

Configuration register
0x2102 : default, loads IOS from flash
0x2142: ignores NVRAM
0x2120: ROMon mode

Boot Process
1- POST and bootstrap
2- Locate and load IOS
3- Locate and load startup-config
or
3a- Enter setup mode

Access Bootloader CLI (emergency)
1- Connect PC to console port
2- Unplug power cord
3- Reconnect, within 15 sec. hold down mode button
4- Continue holding until system led is red..green. Release.
5- Switch prompt appears.

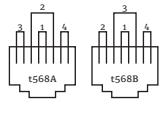
IOS

show ip arp

Windows

arp -a
arp -d <-- deletes arp table
netstat <-- shows ports
netstat -r <-- host routing table
nslookup
ipconfig /displaydns
ipconfig /all <-- shows NIC MAC

Twisted Pairs



Pair 1: blue
Pair 2: orange
Pair 3: green
Pair 4: brown

Straight-throught: A-A or B-B
Crossover: A-B

Data-Link *(Ethernet Frame)*

Frame Start	Addressing	Type	Control	Data	Error Detection (FCS)	Frame Stop

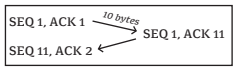
Minimum frame size is 64 bytes. Maximum is 1518 bytes.
Frames smaller than 64 bytes are considered "Runt".

Multicast MAC starts with 01-00-5E
Broadcast MAC is all Fs

TCP Segment header

Source Port	Destination Port
Sequence Number	
Acknowledgement Number	
Header length / Reserved (future) / Control Bits	Window
Checksum	Urgent
Options	
Application layer Data	

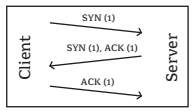
TCP sequence numbers



UDP Segment header

Source Port	Destination Port
Length	Checksum
Application Data	

TCP 3-Way handshake



802.3	Ethernet
802.11	wifi
802.15	Bluetooth *(Also WPLAN)*
802.16	WiMAX

IoT: Internet of things
IoC: Internet over copper
byod: Bring your own device
pdu: protocol data unit
NIC: Network interface card
arp: Address resolution protocol
nfc: near field communication
nrz: non-return to zero (encoding technique)
isr: integrated service router
wap: wireless access point
fttp: fiber to the home
ppp: point-to-point protocol
rfc: request for comment
PoE: power over Ethernet (voip)
mac: media access control
llc: logical link control
cam: content addressable memory (table of mac addresses)
cef: cisco express forwarding (layer 3 switch)
fib: forwarding information base (routing table)
csma: carrier sense multiple access
mtu: maximum transmission unit (max size of pdu)
eigrp: enhanced interior gateway routing protocol
ospf: open shortest path first
ehwic: enhanced WAN interface card
tftp: trivial file transfer protocol
snmp: simple network management protocol
udp: user datagram protocol
tcp: transmission control protocol
isn: initial sequance number (tcp handshake)
SLAAC: stateless address autoconfiguration (ipv6)
RA: router advertisement
RS: router solicitation
NP/NDP: neighbor discovery protocol
DAD: duplicate address detection
NA: Neighbor advertisement
NS: Neighbor solicitation
CIDR: classless inter-domain routing
rir: regional internet registry
vlsm: variable length subnet mask
utp: Unshielded twisted pairs
rtp: real-time transport protocol
rtcp: real-time transport control protocol
ifs: IOS file system
PSTN: Public swiched telephone network
ASIC: Application-specific integrated circuit
HPC: High performance computing
RPS: Redundent power system
MDIX: medium dependant interface crossover
Wins: Windows internet naming system
ACL: Access Control list
ACE: Access Control Entries
NTP: Network time protocol
DTP: Dynamic Trunk Protocol
MTBF: Mean time between failures (reliability)
EIGRP: Enhanced Interior Gateway Routing protocol
OSFP: Open shortest path first
IS-IS: Intermediate system to intermediate system
RIP: Routing Information Protocol
RIPng: next generation
MP-BGP4: Multicast protocol-Border gateway protocol
SDM: Switch database manager
AS: Autonomous systemp (routing domain)
LSP: Link-state packet
LSBS: Link-state database
ABR: Area Border Routers (OSPF)
MD5: Message digest 5 (auth)
SOHO: Small/home office
STP: Spanning tree protocol
RSTP: Rapid spanning tree protocol
DBR: Designated backup router
BR: Backup router
CDP: Cisco Discovery Protocol
STP: Spanning-tree protocol
STA: Spanning-tree algorythm
BPDU Bridge protocol data unit
BID Bridge ID
RSTP Rapid STP
MST Multiple Spanning-tree protocol (Cisco) up to 16 RSTP
PVST Per-Vlan Spanning-Tree
TC Topology Change
TCA: Topology change acknowledgement
FHRP: First Hop Redundancy Protocol
HSRP Hot Stanby Router Protocol <- Cisco
VRRP Virtual Router Redundancy Protocol
GLBP: Gateway Load Balancing Protocol
IRDP ICMP router discovery protocol
WDS Wireless domain services
WLSE Ciscoworks wireless LAN Solution Engine
SPS Single-Point-Setup (wlan)
WLC Wlan controller
WCS Cisco Wireless Control Systems
LWAPP Lightweight Access Control Protocol
BSA Basic Service Area
IBSS Independant Basic Service Set
BSS: Basic Service Set
ESS Extended Service Set
DS Distribution System
ESA Extended Service Area
IBSS Wifi ad-hoc (indpdt basic service set) 802.11
DCF Distributed coordination function (CDMA/CD)
NBMA Non broadcast multiaccess (ospf)
ASBR Autonomous system boundary router (ospf)
ABR Area border router
FSM Finite State Machine (DUAL - EIGRP)
FD Feasible Distance
FS Feasible Successor (backup router EIGRP)
FC Feasible conditions

c1900-universalk9-mz.SPA.152-4.M3.bin

Hardware
Image designation
Memory Location
Compression format
Digital Signature Indicator
Major Release
Minor Release
New Feature Release
Extended Maintenance Release
Maintenance Rebuild
Extension

OSPF Multiarea LSAs
type4 = ASBR advertisement coming from ABR
type5= ASBR advertisement

OSPF adjacency
Down State: No Hello are received (contain router-id)
Init State: Hello are received
Two-Way: DR and BDR election
ExStart: Negotiate master/slave and DVD packet seq. numbers
Exchange: Exchange of DBD
Loading: Additional info is sent
Full: routers converged

IPv4 number of hosts/subnets

	Addresses	Hosts	Netmask	Amount of a Class C
/30	4	2	255.255.255.252	1/64
/29	8	6	255.255.255.248	1/32
/28	16	14	255.255.255.240	1/16
/27	32	30	255.255.255.224	1/8
/26	64	62	255.255.255.192	1/4
/25	128	126	255.255.255.128	1/2
/24	256	254	255.255.255.0	1
/23	512	510	255.255.254.0	2
/22	1024	1022	255.255.252.0	4
/21	2048	2046	255.255.248.0	8
/20	4096	4094	255.255.240.0	16
/19	8192	8190	255.255.224.0	32
/18	16384	16382	255.255.192.0	64
/17	32768	32766	255.255.128.0	128
/16	65536	65534	255.255.0.0	256

IPv4 subnet ranges

/25 -- 2 Subnets -- 126 Hosts/Subnet

Network #	IP Range	Broadcast
.0	.1-.126	.127
.128	.129-.254	.255

/26 -- 4 Subnets -- 62 Hosts/Subnet

Network #	IP Range	Broadcast
.0	.1-.62	.63
.64	.65-.126	.127
.128	.129-.190	.191
.192	.193-.254	.255

/27 -- 8 Subnets -- 30 Hosts/Subnet

Network #	IP Range	Broadcast
.0	.1-.30	.31
.32	.33-.62	.63
.64	.65-.94	.95
.96	.97-.126	.127
.128	.129-.158	.159
.160	.161-.190	.191
.192	.193-.222	.223
.224	.225-.254	.255

/28 -- 16 Subnets -- 14 Hosts/Subnet

Network #	IP Range	Broadcast
.0	.1-.14	.15
.16	.17-.30	.31
.32	.33-.46	.47
.48	.49-.62	.63
.64	.65-.78	.79
.80	.81-.94	.95
.96	.97-.110	.111
.112	.113-.126	.127
.128	.129-.142	.143
.144	.145-.158	.159
.160	.161-.174	.175
.176	.177-.190	.191
.192	.193-.206	.207
.208	.209-.222	.223
.224	.225-.238	.239
.240	.241-.254	.255

/29 -- 32 Subnets -- 6 Hosts/Subnet

Network #	IP Range	Broadcast
.0	.1-.6	.7
.8	.9-.14	.15
.16	.17-.22	.23
.24	.25-.30	.31
.32	.33-.38	.39
.40	.41-.46	.47
.48	.49-.54	.55
.56	.57-.62	.63
.64	.65-.70	.71
.72	.73-.78	.79
.80	.81-.86	.87
.88	.89-.94	.95
.96	.97-.102	.103
.104	.105-.110	.111
.112	.113-.118	.119
.120	.121-.126	.127
.128	.129-.134	.135
.136	.137-.142	.143
.144	.145-.150	.151
.152	.153-.158	.159
.160	.161-.166	.167
.168	.169-.174	.175
.176	.177-.182	.183
.184	.185-.190	.191
.192	.193-.198	.199
.200	.201-.206	.207
.208	.209-.214	.215
.216	.217-.222	.223
.224	.225-.230	.231
.232	.233-.238	.239
.240	.241-.246	.247
.248	.249-.254	.255

/30 -- 64 Subnets -- 2 Hosts/Subnet

Network #	IP Range	Broadcast
.0	.1-.2	.3
.4	.5-.6	.7
.8	.9-.10	.11
.12	.13-.14	.15
.16	.17-.18	.19
.20	.21-.22	.23
.24	.25-.26	.27
.28	.29-.30	.31
.32	.33-.34	.35
.36	.37-.38	.39
.40	.41-.42	.43
.44	.45-.46	.47
.48	.49-.50	.51
.52	.53-.54	.55
.56	.57-.58	.59
.60	.61-.62	.63
.64	.65-.66	.67
.68	.69-.70	.71
.72	.73-.74	.75
.76	.77-.78	.79
.80	.81-.82	.83
.84	.85-.86	.87
.88	.89-.90	.91
.92	.93-.94	.95
.96	.97-.98	.99
.100	.101-.102	.103
.104	.105-.106	.107
.108	.109-.110	.111
.112	.113-.114	.115
.116	.117-.118	.119
.120	.121-.122	.123
.124	.125-.126	.127
.128	.129-.130	.131
.132	.133-.134	.135
.136	.137-.138	.139
.140	.141-.142	.143
.144	.145-.146	.147
.148	.149-.150	.151
.152	.153-.154	.155
.156	.157-.158	.159
.160	.161-.162	.163
.164	.165-.166	.167
.168	.169-.170	.171
.172	.173-.174	.175
.176	.177-.178	.179
.180	.181-.182	.183
.184	.185-.186	.187
.188	.189-.190	.191
.192	.193-.194	.195
.196	.197-.198	.199
.200	.201-.202	.203
.204	.205-.206	.207
.208	.209-.210	.211
.212	.213-.214	.215
.216	.217-.218	.219
.220	.221-.222	.223
.224	.225-.226	.227
.228	.229-.230	.231
.232	.233-.234	.235
.236	.237-.238	.239
.240	.241-.242	.243
.244	.245-.246	.247
.248	.249-.250	.251
.252	.253-.254	.255

Generic

show history	Shows last 10 commands
terminal history size	change history size
terminal length 0-x	max lines output, 0=inf.
show int | {include | exclude | begin | section}	
boot system	sets boot env. variable
show bootvar	show env. variable
no password	remove password on line
delete flash: vlan.dat	
erase startup-config	

License

show license {feature|udi}	
license install {stored-location-url}	install licese.xml, needs #reload

config)# license accept end user agreement
config)# license boot module {module} technology-package {ipbasek9|securityk9|datak9|uck9}
append disable, then reload to cancel
Activate evaluation RTU license {module}=device model (eg:1900)
must #license accept end user agreement fefore activating evaluation

license clear {seck9}	
license save {fileSys://location}	backup license
license install {fileSys://location}	install license

TFTP

copy {source-url} {destination-url}	copy IOS to TFTP server
copy flash0: tftp:	example of IOS backup
copy tftp: flash0:	install IOS on Flash
show flash0:	shows free space on flash0:

Boot System

config)# boot system flash0://c1900-universalk9-mz.SPA.152-4.M3.bin
exit
copy runing-config startup-config
reload
Can boot from TFTP server: boot system tftp://
if no boot system, router loads first valid image

show version	verify IOS version in use

Show Command / Shows

show int g0/0 switchport	access/trunk, encapsulation, autonego dynamic, connected to vlan#, trunking
show int g0/0	(runts, giants)
show mac-address-table	MAC-IP associations

show controllers ethernet-controller g0/0 phy | include auto-mdix
shows auto-mdix status on g0/0

show ssh	check ongoing ssh connections
show ip ssh	show ssh version/info
show ip protocols	show current routing protocol
show ip ospf neighbor	Adjacency database/nighbor table
show ip ospf database	Link-State database/topology table
show ip ospf interface brief	Associated masks/costs
show ip ospf interface g0/0	Link metric
show vlan summary	
show int vlan 20	
show vlan brief	
show vlan name {name}	
show spanning-tree <= shows cost, priority, root id	
show spanning-tree summary <= port states	
debug spanning-tree events	
show spanning-tree active	show active interfaces
show spanning-tree vlan {vlan-id}	

Switchports

if)# switchport port-security violation {protect | restrict | shutdown}
-- to bring up a securily down port: if)#shut --> if)# no shut
if)# switchport port-security mac-address {mac-address}
if)# switchport port-security mac-address sticky
if)# switchport mode {access | trunk}
if)# switchport port-security maximum 2

if)# switchport port-security	ENABLES SECURITY
if)# switchport nonegotiate	Force trunk, doesn't generate VLAN tag
if)# switchport mode dynamic auto	Auto trunk or access (not good practice)
if)# switchport mode desirable	Tries to be trunk (not good practice)

show port-security g0/0
show port-security address (shows registered MAC)

if)# switchport protected	Can only communicate with unprotected port

show interfaces g0/0 switchport

NTP Server

ntp server {ip address} <- syncs with server
ntp master {stratum} (0-15, 8 is default) <- sets as server
show ntp status lower stratum = more priority
show ntp associations

Security

no cdp run	globally disable cdp

VLANs

vlan {vlan-id}	creates vlan and enter basic config
name {name}	while in basic config
if)# switchport access vlan {vlan-id}	assigns vlan to interface in int. config
if)# switchport trunk native vlan {vlan-id}	sets native vlan on trunk

if)# switchport trunk allowed vlan {vlan-list}
List VLANs like so: 10,20,30 (no spaces)

show int g0/0 switchport	shows switchp. config including trunk info

Layer 3 switches

ip routing	routing must be enabled globally
if)# no switchport	enable a routed port
show sdm prefer	switch database manager
sdm prefer ?	

Routing

best route = longest match

interface loopback 0	creates loopback interface
no shut	brings loopback up
clock rate	Only on serial DTE interface
show ip route {connected | rip | ospf}	specify show ip route type

Static Route

ip route {destination-network} {submask} {next-hop | exit interface}
ip route 0.0.0.0 0.0.0.0 {next-hop | exit-interface} creates default static route
ip route 0.0.0.0 0.0.0.0 {next-hop | exit-interface} 5 admin distance = 5
used as floating/backup route
ipv6 route ::/0 {next-hop | exit-interface}

Routing Protocols

router ?	shows supported protocols
ipv6 unicast-routing	enables ipv6
router rip	enters rip config
router)# version 2	enables RIPv2
router)# no version	broadcast v1, accepts v1 & v2

router)# network {network to advertise}

router)# passive-interface g0/0	disable router advertising
router)# passive-interface default	globally disables RA
router)# no router rip	disables RIP and erase RIP routes

RIPng

if)# ipv6 rip {domain-name} enable
if)# ipv6 rip {domain-name} default-information originates

OSPF

clear ip ospf process	forces ospf restart to change router ID

router)# auto-cost reference-bandwidth {mb/s}
gigabit = 1000 10gigabit = 10000 default = 100

if)# bandwidth {kb/s}	only affects metric calculation
if)# ip ospf cost {metric}	manual metric input (not calculated)
if)# ip ospf priority {0-255}	DR/BDR election (moreso than router-id)

debug ip ospf adj <= debug election process
router)# default-information originates <= propagates default static route via RA
if)# ip ospf {hello | dead}-interval {seconds} <= dead is 4x hello
if)# ipv6 ospf authentification ipsec spi <= OSPFv3 ipsec authentification

Globally enable OSPFv2 Authentication

router)# area {area-id} authentication message-digest
ip ospf message-digest-key {key(1)} md5 {password}

Per-interface OSPFv2 Authentication

if)#ip ospf message-digest-key {key(1)} md5 {password}
if)#ip ospf authentication message-digest
* interface config bypass global router config

Multiarea OSPF

router)# summary-address {address}{mask} <= summary route on ASBR
router)# area {area-id} range {address}{mask} <= summary route on ABR

show ip ospf database
show ip ospf interface | include message <= message-digest state

DHCP Functions

if)# ip dhcp excluded-address {address}	reserved static addresses
if)# ip dhcp {poolname}	creates pool & enter pool config
dhcp-config)# network {address} {mask}	define network range
dhcp-config)# default-router {gateway-ip}	
dhcp-config)# dns-server {dns-address}	
dhcp-config)# domain-name {domain.com}	
dhcp-config)# lease {time}	
dhcp-config)# netbios-name-server {WINS}	

DHCP security (snooping)

ip dhcp snooping

ip dhcp snooping vlan 1	enables dhcp snooping on vlan 1
if)# ip dhcp snooping trust	allow a port to issue DHCPOFFER (server)
if)# ip dhcp snooping limit rate	optional
no service dhcp	disables dhcp
show ip dhcp binding	list clients with associated addresses
show ip dhcp server statistics	messages sent/received

show run | section dhcp
show ip dhcp conflict

debug ip dhcp server events	outputs dhcp debug info

Distant DHCP / DHCP relay

# int g0/0	router int. where clients are connected
if)# ip helper-address {distant-dhcp-ip}	
if)# ip address dhcp	"dhcp" instead of static address

Windows

>ipconfig /all	show dhcp info
>ipconfig /release	sets ip to 0.0.0.0
>ipconfig /renew	sends DHCPDISCOVER

SLAAC

if)# no ipv6 nd managed-config-flag	sets M flag to 0 (default)
if)# no ipv6 nd other-config-flag	sets O flag to 0 (default)
if)# ipv6 enable	enables link-local
if)# ipv6 address autoconfig	enables SLAAC

Stateless DHCPv6

if)# ipv6 nd other-config-flag	sets O flag to 1

Stateful DHCPv6

if)# ipv6 nd managed-config-flag	sets M flag to 1, O flag not involved

DHCPv6 Server setup

ipv6 dhcp {pool-name}
dhcp)# address prefix {address/prefix} lifetime {time} sets address range
dhcp)# dns-server {dns-ip}
dhcp)# domain-name {domain.com}

Applying DHCPv6 to an interface

if)# ipv6 address {desired dhcp-server-ip}
if)# ipv6 dhcp server {pool-name}

if)# ipv6 nd manage-config-flag	stateful (method)
if)# ipv6 nd other-config-flag	stateless (method)

DHCPv6 relay

if)# ipv6 dhcp relay des

show ipv6 dhcp pool	shows pool config
debug ipv6 dhcp detail	shows client/server message exchanged
show ipv6 dhcp binding	shows link-local & dhcp-issued association (stateful)
debug ipv6 dhcp details	

Access Lists

access-list {acl-number} {deny | permit} {opt-remark} {source} {source-wildcard} {log}
ip access-list {standard | extended}{acl-name}

std-nacl)# no 15	erase line 15
std-nacl)# 15 deny [...]	add line 15

statements (lines) cannot be overwritten

if)# ip access-group {acl-number | acl-name} {in | out}
clear access-list counter {access-list-number or name}

line)# access-class {name | number} {in | out} acl on vty, only numbered acls, supports ip/ipv6

show run | include access-list 1

show access-lists	show access-list 1

IPv6 Access Lists

access-list {acl-name}
ipv6-acl)# {deny | permit} {protocol} {source w/ prefix | any | host} {destination} {operator} {port}
if)# ipv6 traffic-filter {acl-name} {in | out}

Static NAT

ip nat inside source static {local-ip} {global-ip}

no ip nat inside source static	removes NAT
if)# ip nat inside	sets inside interface } config each subif
if)# ip nat outside	sets outside interface } config each subif

Dynamic NAT

ip nat pool {pool-name} {start-ip} {end-ip} netmask {mask} <-- Pool of outside addresses
access-list list {acl-number} permit {ip} {wildcard} <-- Inside addresses to translate
ip nat inside source list {acl-number} pool {pool-name} <-- Binds ACL to pool

if)# ip nat inside
if)# ip nat outside

ip nat translation timeout {timeout-seconds}
-- Dynamic NAT default timeout is 24 hours --

PAT with single public address

ip nat inside source list {acl-number} interface {g0/0} overload
-- no nat pool {address of outside interface} --

PAT with pool of public addresses

ip nat pool {pool-name} {start-ip} {end-ip} netmask {netmask}
access-list {acl-number} permit {source} {source-wildcard}
ip nat inside source list {acl-number} pool {pool-name} overload

if)# ip nat inside
if)# ip nat outside

Port Forwarding

ip nat inside source static {tcp | udp} {local-ip} {local-port} {global-ip} {global-port} {ext.*}
-- extendable is applied automatically --

if)# ip nat inside
if)# ip nat outside

Show / Troubleshoot NAT

debug ip nat {detailed}
show access-lists

show ip NAT statistics	shows active translations
clear ip nat statistics	reset translations counter
show ip NAT translations	shows NAT table

-- Shows all static translations. Dynamic translations are created by traffic --

clear ip nat translations ?

clear ip nat translations *	clear all

clear ip nat translations {inside | outside}

show ip nat translations verbose	timeout info and more

EtherChannel

config)# interface range f0/1 - 2
range)# channel-group 1 mode {active | passive(lacp) | on | auto | desirable(pagp)}

config)# interface port-channel 1 <= enter etherchannel config

show interface port-channel <= General status, can add channel number
show etherchannel summary <= ports per channel, protocols, layer 2,3
show etherchannel port-channel <= more detailed per-channel info
show interfaces f0/1 etherchannel <= int. role in etherchannel

*If misconfigured, suppress port-channel & recreate to prevent STP
from blocking ports: #no interface port-channel 1

STP

spanning-tree cost {1 - 200,000,000} <= manually set port cost
no spanning-tree vlan 1 <= disable STP
spanning-tree portfast <= access port, doesnt foward BPDUs
spanning-tree link-type {point-to-point | shared}

Forcing root bridge

spanning-tree vlan {vlan-id} root primary <= sets to 4096 lower than lowest
spanning-tree vlan {vlan-id} root secondary <= blindly sets to 28672
spanning-tree vlan {vlan-id} priority {value} <= alternate, manual method

PortFast

spanning-tree portfast <= automatic fowarding regardless of convergence
spanning-tree portfast default <= all non-trunking ports in portfast
if)# spanning-tree bpduguard enable <= disable portfast port on BPDU reception
spanning-tree bpduguard default <= disable all portfast ports on BPDU reception
show run <= see per-port configs
BPDU frames are sent every 2 seconds

Duplex settings

if)# duplex {half | full}
if)# speed {auto | 10 | 100 | 1000}
if)# mdix auto

SSH

line)# transport input ssh } login local
line)# login local }
ip ssh version 2 (sets SSH v2)
ip domain-name test.com
crypto key generate rsa (modulus 1024)
crypto key zeroize rsa
user {username} password {password}

Subinterfaces

interface g0/0.10
subif)# encapsulation dot1q 10 {native}
subif)# ip address {ip} {mask}
exit
if)# no shut

EIGRP

router eigrp {autonomous-sytem 1 - 65535}
router)# eigrp router-id 0.0.0.0
router)# network 192.168.0.0 <= w/ classful, wildcard not needed
router)# network 192.168.0.0 0.0.0.3
wildcard prevent other subnets from being advertised
router)# eigrp log-neighbor-changes <= enabled by default
router)# passive-interface g0/0
router)# auto-summary
router)# metric weights {tos} {k1}{k2}{k3}{k4}{k5}
router)# auto-summary
if)# ip summary-address eigrp {as}{network}{mask}
when routes are summarized, individual subnets stop appearing
ip route 0.0.0.0 0.0.0.0 {interface | next-hop}
router)# redistribute static <= network edge router
if)# bandwidth {kilobit/sec}
if)# ip bandwidth-percent eigrp {as}{percent} <= default is 50%
if)# ip hello-interval eigrp {as}{seconds 1-65,535}
if)# ip hold-time eigrp {as}{seconds 1-65,535} <= default is 15
hold/hello don't need to match between routers
router)# maximum-paths {1-32} <= equal-cost load-balancing
router)# variance {value} <= unequal load-balancing
router)# traffic-share balanced <= unequal load-balancing
if variance =2, only routes w/ less
than 2 times successor can be used

debug eigrp fsm
show eigrp topology all-links

EIGRP for IPv6

config)# ipv6 router eigrp {autonomous-sytem}
eigrp for ipv6 is in down state by default
rtr)# no shut
rtr)# passive-interface g0/0
activating interface is done in interface config
if)# ipv6 eigrp {autonomous-system}
if)# ipv6 summary-address eigrp {as}{network}{prefix}
there is no auto-summary for ipv6
ipv6 router ::/0 {interface | next-hop}
rtr)# redistribute static

EIGRP authentication

config)# key chain {name}
keychain)# key {key-id}
chain-key)# key-string {password}
if)# ip authentication mode eigrp {as} md5
if)# ip authentication key-chain eigrp {as} {keychain name}

EIGRP precision

passive route: viable, can forward traffic
active: DUAL sends queries for a path, labelled A in topo table
sum. route = 5, int. route = 90, ext. route = 170
EIGRP multicast address: 224.0.0.9
Delay metric: ethernet=1000, fa=100, g=10, t1(serial)=20000
1024kbps=20000, 56kbps=20000
NSF aware: is neighbor is down, retains route and wait to up
NULL int. = bit bucket
k1 & k3 are delay and metric (set to 1). others are set to 0
EIGRP is protocol 88

HSRP

if)# standby 1 ip 192.168.1.1 <= on access port (not serial)
if)# standby 1 priority 150
if)# standby 1 preempt
show standby <= state of virtual router
on the other router: if)# standby 1 ip 192.168.1.1 <= same ip

GLBP

if)# glbp 1 ip 192.168.1.1 <= on access port (not serial)
if)# glbp 1 priority 150
if)# glbp 1 preempt
if)# glbp load-blancing round-robin
show glbp brief <= state of virtual router
on the other router:
if)# glbp 1 ip 192.168.1.1 <= same ip
if)# glbp 1 load-balancing round-robin

Rapid PVST+

supports UplinkFast and BackBoneFast
spanning-tree mode rapid-pvst
clear spanning-tree detected-protocols

First-Hop Redundancy

show standby <= show hsrp status
show glbp
show run int g0/0 <= shows HSRP/GLBP setup