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SWITCH BOOT SEQUENCE/BASIC CONFIG

Lan switches: Responsible for directing/controlling data flow at the access layer to networked resources
Cisco switches:

- Self-configuring (runs on Cisco IOS) but can be manually configured
- Needs IP address/default gateway

Example: Adjusting port speed/BW/security can be managed both locally/remotely

- They operate at the access layer, where client network devices connect directly to the network

Bootloader: Small program stored in ROM run after POST successfully completes

- Provides access to switch if OS can't be used b/c of missing/damaged sys files
- CL is stored in flash mem

Switch Boot Sequence	1. Switch loads POST (Power On Self-Test) program stored in ROM ▪ Post checks CPU subsystem 1. Tests CPU/DRAM/portion of flash device that makes up flash file system 2. Switch loads bootloader 3. Bootloader performs low-level CPU initialization/initializes CPU registers (control where physical mem is mapped/quantity of mem/speed) 1. Bootloader initializes flash file system on system board 2. Bootloader locates/loads default IOS SW image into mem/hands control of switch to IOS

Bootloader Finds Cisco IOS Image on switch:

Bootloader finds IOS	1. Switch attempts to boot using info in the BOOT environment variable If var not set: Attempts to load/execute first exe file it can by performing recursive, depth-first search through flash file system 1. In a depth-first search of a dir: Each encountered subdir is completely searched before searching original dir (Catalyst 2960: Image file is normally contained in dir that has same name as image file) 2. IOS initializes interfaces using Cisco IOS cmds found in config file; startup-config, stored in NVRAM

Commands: From global config (config t)
boot system: BOOT environment variable
show boot var (show boot older systems): See what current IOS boot file is set to
Access boot loader through console:

1. Connect PC by console cable to switch console port. Configure terminal emulation SVI
2. Reconnect power cord to switch & w/in 15secs press/hold **MODE** button while LED is flashing green
3. Continue pressing **MODE** until LED turns briefly amber; then solid green; then release **MODE**
4. Boot loader switch prompt appears in terminal emulation SVI

Bootloader: CL supports cmds to format flash file system, reinstall OS SW/recover from lost/forgotten password Example: dir command can be used to view a list of files within a specified directory
Cisco Catalyst 2960: 7 LED indicator lights

- Monitor performance/switch activity (diff models = diff LEDs/placements)
- Mode toggles through port status/duplex/speed/PoE status of port LEDs.

System LED	Shows whether system is receiving power/functioning **OFF** Not on **GREEN** Normal

	AMBER Receiving power/Not functioning properly
RPS LED	**Redundant Power System LED** **OFF** RPS is off/not properly connected **GREEN** Connected/ready to provide backup power **BLINKING GREEN** Connected/unavailable (powering another device) **AMBER** In standby mode/fault condition **BLINKING AMBER** Internal power supply in switch failed/RPS providing power
Port LED	**OFF** No link/port administratively down **GREEN** Link present **BLINKING GREEN** Activity port sending/receiving data **ALTERNATING GREEN–AMBER** Link fault **AMBER** Port blocked to ensure loop doesn't exist in fwding domain/isn't fwding data (typically ports remain in this state for first 30 secs after being activated) **BLINKING AMBER** Port blocked to prevent possible loop in fwding domain
Port Duplex	Port LED's are off in half-duplex mode **GREEN** Port is in full-duplex
Port Speed	**OFF** Port operating at 10Mb/s **GREEN** Port operating at 100Mb/s **BLINKING GREEN** Port operating at 1000Mb/s
PoE MODE LED	**OFF** Not selected/no ports have been denied power/placed in fault condition **BLINKING AMBER** Not selected/at least 1 port denied power/PoE fault **GREEN** PoE selected/port LED's will display colors w/different meanings **ALTERNATING GREEN–AMBER** PoE denied b/c power to device will exceed switch power capacity **AMBER** PoE for port disabled

Preparing for basic switch management:

- Switch must be configured with IP/subnet mask
- To manage remotely: Must be configured with default gateway

SVI: Switch Virtual Interface || concepts related to VLANs
VLAN: Numbered logical groups to which physical ports can be assigned. Configurations/settings applied to a VLAN are also applied to all ports assigned to that VLAN
By default: Switch is configured to have management of switch controlled through VLAN 1
NOTE: These IP settings are for remote management access; settings don't allow switch to route layer 3 packets

Configuring Basic Switch Management Access with IPv4:
S1# configure terminal
S1(config)# interface vlan 99 (enter int config mode)
S1(config-if)# ip address 172.17.99.11 255.255.255.0 (configure IP/subnet)
S1(config-if)# no shutdown
S1(config-if)# end
S1# copy running-config startup-config

SVI for VLAN 99 won't appear up/up until VLAN 99 created/there is device connected to switch port with VLAN 99

To create a VLAN with the vlan_id of 99 and associate it to an interface:
S1(config)# vlan vlan_id
S1(config-vlan)# name vlan name
S1(config-vlan)# exit
S1(config)# interface interface_id
S1(config-if)# switchport access vlan vlan_id

Configure default gateway:
Default gateway: Router switch connected to: Switch fwds packets w/dest IP outside local network to default gateway
S1# configure terminal (global config)
S1(config)# IP default-gateway 172.17.99.1 (configure gateway for switch)
S1(config)# end (return to PRIV EXEC)

S1# copy running-config startup-config (save running config to startup)
S1# show ip interface brief (verify config)

Duplex Communication

Full-duplex	○ Bidirectional: Allows both ends of a connection to transmit/receive data simultaneously ○ Improves performance of a switched LAN ○ Method requires micro-segmentation ○ Most Ethernet/Fast Ethernet NICs offer full-duplex ○ Gigabit Ethernet 10Gb NICs require full-duplex connectors to operate ○ Collision detection circuit on NIC is disabled ○ Frames sent by 2 connected devices can't collide b/c devices use 2 separate circuits in cable ○ 100% efficiency in both directions (200% potential stated BW)
Half-duplex:	○ Unidirectional: Sending/receiving doesn't occur simultaneously ○ Creates performance issues often resulting in collisions ○ Older hardware like hubs are half-duplex ○ Full-duplex replaced half-duplex HW in most cases ○ Hub based efficiency 50-60% of stated BW

Micro-segmentation: Created when a switch port has only 1 device connected and operates on full-duplex. Results in a micro-size collision of device. Since there's only 1 device connected though, micro-segmented LAN is collision free.

Duplex & Speed
Duplex: int config mode cmd to manually specify duplex mode for switch port
Speed: int config cmd to manually specify speed for switch port

S1# configure terminal (config t) (global config)
S1(config)# interface FastEthernet 0/1 (int config mode)
S1(config-if)# duplex full (config int duplex)
S1(config-if)# speed 100 (config int speed)
S1(config-if)# end (return to PRIV EXEC)
S1# copy running-config startup-config (save running config to startup)

Default setting for both duplex/speed switch ports on Catalyst 2960/3560 is auto
10/100/1000 ports operate in half/full-duplex when set || 1000Mb/s (1Gb/s) operates only in full-duplex
NOTE: Mismatched settings for duplex mode/speed of switch ports can cause connectivity issues
Auto-negotiation: Failure creates mismatched settings
All fiber optic ports (100BASE-FX) operate at 1 preset speed/always full-duplex

Configure Auto MDIX (Auto medium-dependent int crossover)
When enabled: int auto detects required cable connection types/configs connection

Connecting to switches w/out auto-MDIX	○ Straight-through cables must be used (servers/workstations/routers) ○ Crossover cables must be used to connect to other switches/repeaters ○ Newer Cisco routers/switches enables the mdix auto int config mode feature ○ When using auto-MDIX on an int, the int speed/duplex must be set to auto ○ Enabled by default on 2960/3560, but not on 2950/older

S1# configure terminal (config t)(global config)
S1(config)# interface FastEthernet 0/1 (int config mode)
S1(config-if)# duplex auto (config the int auto-negotiate duplex w/connected device)
S1(config-if)# speed auto (config the int auto-negotiate speed w/connected device)
S1(config-if)# mdix auto (enable auto mdix)
S1(config-if)# end (return to PRIV EXEC)
S1# copy running-config startup-config (save running config to startup)

Examine auto-MDIX: show controllers ethernet-controller with phy keyword
Limit output to lines referencing auto-MDIX use: include Auto-MDIX filter

Verification Commands

show interfaces *[int-id]*	Display int status/config
show startup-config	Display current startup configuration
show running-config	Display current operating configuration
show flash	Display info about flash file system
show version	Display system HW/SW status
show history	Display history of cmds entered
show ip *[int-id]*	Display IP info about int
show mac-address-table or **show mac address-table**	Display MAC address table

Figuring out problems via the show interfaces command:

int up/line protocol is down	○ Could be encapsulation type mismatch ○ Int on other end could be error-disabled ○ Could be a HW issue
int down/line protocol down	○ Cable isn't attached ○ Other int problem exists ○ Other end may be admin-down
int admin down	○ manually disabled: shutdown used in active config