



CCIE Enterprise Infrastructure v1.0 Bootcamp

LAN Switching



LAN Switching Core Functions

- + Core LAN Switching Goals
 - + Establish layer 2 intra-VLAN IPv4 & IPv6 connectivity
- + Related Core Protocols & Technologies
 - + VLANs
 - + Trunking
 - + Spanning-Tree (STP)
 - + Rapid Spanning-Tree (RSTP)
 - + Multiple Spanning-Tree (MST)
 - + EtherChannels

LAN Switching Peripherals

- + Related Peripheral Protocols & Technologies
 - + VTP v1/v2/v3
 - + Optional STP Features
 - + CDP & LLDP
 - + UDLD
 - + SPAN/RSPAN/ERSPAN
 - + Layer 2 Security
 - + Private VLANs, VACLs, Port Security, Storm Control, DHCP Snooping, Dynamic ARP Inspection (DAI), IP Source Guard, IPv6 RA Guard

VLANs, Trunking, & STP Overview

- + VLANs, Trunking, & STP form the minimum requirement for connectivity
 - + I.e. without them, no layer 2 functionality
- + Ideal final verification
 - + **show spanning-tree [vlan X | mst X]**
 - + If all switches agree on root bridge, VLAN is end-to-end
 - + Minor exception is inter-region MST

VLANs, Trunking, & STP Troubleshooting

- + What if the VLAN is not end-to-end?
 - + Working backwards from here...
- + Does the VLAN exist?
 - + **show vlan brief**
 - + **show vlan id X**
- + Is the VLAN active?
 - + **show vlan brief**
 - + **show vlan id X**

VLAN Creation Errors

- + Why would a VLAN not exist?
 - + VLAN is not auto-created when Layer 3 SVI is created
 - + VTP client mode switch cannot create VLANs
 - + Parser allows you to assign it to an access port though...
 - + VTPv3 server mode switch cannot create VLANs if not the Primary Server
 - + Parser allows you to assign it to an access port though...

VLAN Trunking

- + Is the VLAN trunking between the switches?
 - + **show interface trunk**
- + Why would the VLAN not be trunking?
 - + Failure of DTP negotiation
 - + Static encapsulation mismatches
 - + VLAN not in the allowed list
 - + VLAN is suspended
 - + STP instance not in the forwarding state

Spanning-Tree Protocol Overview

- + Three operating modes
 - + Per VLAN Spanning-Tree (PVST)
 - + spanning-tree mode pvst (default)
 - + Rapid Per VLAN Spanning-Tree (Rapid PVST)
 - + spanning-tree mode rapid-pvst
 - + Multiple Spanning-Tree (MST)
 - + spanning-tree mode mst
- + Ideal final verification
 - + show spanning-tree [VLAN X | MST X]
 - + If all switches agree on the root bridge, STP is end-to-end
 - + Minor exception is inter-region MST

STP Troubleshooting

- + Why would STP not be end-to-end?
 - + VLAN does not exist
 - + VLAN is not active
 - + VLAN is not allowed on trunks
 - + STP is disabled
 - + STP is filtered (**bpdudfilter**)
 - + STP is err-disable (**bpduguard**)
 - + STP is root-inconsistent (**rootguard**)
 - + PVST Simulation inconsistency (MST root bridge election)
 - + Switches are not in the same MST region

EtherChannels Overview

- + Link Aggregation (LAG) goal is to hide physical topology details from STP
 - + Ideal final verification is STP
 - + **show spanning-tree [VLAN X | MST X]**
 - + If STP sees only logical LAG interface, LAG is functional

EtherChannel Verifications

- + Has the channel successfully formed?
 - + **show etherchannel summary**
 - + How do we interpret output flags?
 - + Independent/Individual means LACP/PAgP negotiation error
- + Does STP see the LAG as a single port?
 - + **show spanning-tree**
- + Are the switches LACP/PAgP adjacent?
 - + **show [lacp | pagp] neighbor**
- + Are LACP/PAgP frames being sent/received?
 - + **show [lacp | pagp] counters**

EtherChannel Troubleshooting

- + Why would a LAG not form?
 - + Catalyst suffers from order-of-operations problems with EtherChannels
 - + Is the channel vs. members layer 2 or layer 3?
 - + Does the channel config match the members?
 - + Does the config of the members match amongst themselves?
 - + Mismatched negotiation parameters
 - + LACP vs. PAgP vs. static LAG (on)

