



CCIE Routing & Switching  
Advanced Troubleshooting Bootcamp

LAN Troubleshooting

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## Ethernet Troubleshooting

- No Ethernet switching troubleshooting in Troubleshooting Section, but it can be included in the Configuration Section
- Much larger topic domain than HDLC/PPP/Frame Relay, and considered part of the “core”
  - i.e. CCIE lab assumes you are an expert in Ethernet switching

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## Ethernet Speed/Duplex Negotiation

- Rarely a problem of mis-negotiation Cisco to Cisco switches, but can be a problem of mis-configuration
- Speed mismatch causes link to be up/down
- Duplex mismatch allows link up/up but typically results in lots of packet loss
  - CDP detects and logs this by default
  - “late collisions” in `show interface` output typically means duplex mismatch

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## VTP Troubleshooting - Modes

- VLANs failing to propagate in the topology can have devastating effect on reachability
  - i.e. cascading Layers effect
- Initially check the VTP modes and the domain
  - Server – creates and forwards VLANs
  - Client – receives VLAN information from the server(s)
  - Transparent – does not sync – it will forward VTP messages in the domain

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## VTP Troubleshooting – Domain Name

- The VTP domain name is case-sensitive and must match on all switches in the domain – use `show vtp status` in order to verify mode and name



## VTP Troubleshooting – show vtp status

```
Rack26SW1#show vtp status
VTP Version                : running VTP1 (VTP2 capable)
Configuration Revision      : 16
Maximum VLANs supported locally : 1005
Number of existing VLANs    : 16
VTP Operating Mode         : Server
VTP Domain Name            : BCTS
VTP Pruning Mode           : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation       : Disabled
MD5 digest                  : 0xE7 0xF2 0xC0 0xF5 0xC3 0xC7 0xF3 0xE3
Configuration last modified by 150.26.7.7 at 10-12-09 06:55:08
Local updater ID is 150.26.7.7 on interface Lo0 (first layer3 interface found)
```



## VTP Troubleshooting – vtp password

- VTP authentication adds security but also complexity
- Occasionally password may match through `show vtp password` but MD5 digests are different in `show vtp status`



## VTP Troubleshooting – config rev

- Device with highest configuration revision number has most updated copy of the database
- When adding switches to the topology errors in config rev. number can overwrite the network
- Can be reset to 0 by...
  - Changing VTP domain
  - Changing to VTP transparent



## VTP Troubleshooting - Trunks

- VTP messages flow over trunk links
- If trunks are broken, VTP is broken
  - Cascading Layers again
- Use `show interface trunk` to confirm functional trunks in the topology



## Access VLAN Troubleshooting

- As a safeguard, use the `switchport mode access` command in conjunction with `switchport access vlan vlan_id`
  - Avoids errors in DTP
- Ensure the VLAN exists in the database with `show vlan brief`
- You may need `show cdp neighbors` to verify interfaces that must participate in the VLAN



## Access VLAN Troubleshooting – Topo.

- Logical topology diagrams provided might hide important Layer 2 aspects of the physical topology
  - `show cdp neighbor` to verify physical topology
- Misc. verification through...
  - `show run interface`
  - `show interface switchport`

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## show interface switchport

```
Rack26SW1#show interface fa0/15 switchport
Name: Fa0/15
Switchport: Enabled
Administrative Mode: dynamic auto
Operational Mode: static access
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: native
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk associations: none
Administrative private-vlan trunk mappings: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL
Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none
```

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## Trunking Troubleshooting – DTP

- Dynamic Trunk Protocol (DTP) might cause or prevent a trunk from forming
- Verification of mode is best accomplished with **show interface switchport**



## Trunking Troubleshooting – DTP Modes

- ON (switchport mode trunk)
  - forces the interface to trunk, and sends DTP frames
- OFF (switchport mode access)
  - forces the interface to access mode (non-trunk)
- DESIRABLE (switchport mode dynamic desirable)
  - willing to trunk and sends DTP frames
- AUTO (switchport mode dynamic auto)
  - willing to trunk but does not send DTP frames
- NONEGOTIATE (switchport nonegotiate)
  - used with the ON mode – stops DTP (no frames sent)



## Trunking Troubleshooting-show int sw

```
Rack26SW1#show interface fa0/15 switchport
Name: Fa0/15
Switchport: Enabled
Administrative Mode: dynamic auto
Operational Mode: static access
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: native
Negotiation of Trunking: On
```



## Trunking Troubleshooting - DTP Quiz

- In each case – trunk or no trunk?
- AUTO - - - - - AUTO
- AUTO - - - - - DESIRABLE
- ON - - - - - AUTO
- NONEGOTIATE - - - - - AUTO





## Trunking Troubleshooting – Native VLAN

- Untagged VLAN across 802.1Q trunk links
- Must match at each end of link
  - Both CDP and DTP will detect a mismatch
- Verify with **show interface switchport** or **show interface trunk**



## Trunking Trouble.–show interface trunk

```
Rack26SW2#show int trunk
```

Port	Mode	Encapsulation	Status	Native vlan
Fa0/16	auto	802.1q	trunking	1
Fa0/17	auto	802.1q	trunking	1
Fa0/18	auto	802.1q	trunking	1
Fa0/19	auto	802.1q	trunking	1
Fa0/20	auto	802.1q	trunking	1
Fa0/21	auto	802.1q	trunking	1

```
Port          Vlans allowed on trunk
```

Fa0/16	1-4094
Fa0/17	1-4094
Fa0/18	1-4094
Fa0/19	1-4094
Fa0/20	1-4094
Fa0/21	1-4094

```
Port          Vlans allowed and active in management domain
```

Fa0/16	1-9,20,30,999
Fa0/17	1-9,20,30,999
Fa0/18	1-9,20,30,999
Fa0/19	1-9,20,30,999
Fa0/20	1-9,20,30,999



## Trunking Troubleshooting – Encapsulation

- Trunking protocol must match at each end of the link
- ISL or 802.1Q can be negotiated between the devices with DTP
  - E.g. *n-isl* indicates ISL was negotiated
- **show interface trunk** for confirmation of protocol



## EtherChannel Troubleshooting

- Can be Layer 2 or Layer 3
- Used for redundancy and load balancing
- Problems with EtherChannel can appear as:
  - Loss of connectivity due to loop
  - High CPU utilization due to loop
  - Interfaces in the Error Disabled state



## EtherChannel Trouble. – Member Ports

- Member ports in the EtherChannel should be checked for identical configuration
  - Speed/Duplex
  - Native VLAN
  - Trunking State
  - Allowed VLAN List
  - etc.



## EtherChannel Trouble. – Requirements

- Other important guidelines:
  - No interfaces of the bundle can be configured for SPAN
  - In a Layer 3 EtherChannel IP address must be assigned to logical Port Channel
  - When channeling, physical interface changes effect only the physical interface, while Port Channel interface changes effect the whole EtherChannel



## EtherChannel Trouble.-LACP vs. PAgP

- Negotiation protocols for the EtherChannel formation
- LACP is open standard; PAgP is Cisco proprietary
- Keywords are
  - PAgP – *desirable, auto*
  - LACP – *active, passive*
- The keyword `on` ensures “static” configuration
- Proper configuration is critical to avoid mismatches and issues caused with order of operations issues

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## EtherChannel Trouble. – Layer 2

```
SW2:
SW2(config)#interface range fastethernet 0/19 - 21
SW2(config-if-range)#shutdown
SW2(config-if-range)#switchport trunk encapsulation dot1q
SW2(config-if-range)#switchport mode trunk
SW2(config-if-range)#channel-group 1 mode desirable
Creating a port-channel interface Port-channel 1
SW2(config-if-range)#

SW4:
SW4(config)#interface range fastethernet 0/16 - 18
SW4(config-if-range)#switchport trunk encapsulation dot1q
SW4(config-if-range)#switchport mode trunk
SW4(config-if-range)#channel-group 1 mode desirable
Creating a port-channel interface Port-channel 1

SW2:
SW2(config-if-range)#no shutdown
```

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## EtherChannel Verifications

- `show interface trunk`
- `show etherchannel summary`
- `show etherchannel port-channel`

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## STP Troubleshooting

- STP failure and subsequent loop can impact the entire network!
- Most real world problems result from failures with BPDU propagation

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## STP Trouble. – Unidirectional Links

- Common problem for STP
- Unidirectional link means
  - Both sides of link are up
  - Local device can send frames to remote
  - Remote cannot send frames to local device
- LoopGuard and Unidirectional Link Detection are both methods to prevent this problem

## STP Trouble. – The STP Topology

- A key to troubleshooting is often to diagram the STP topology
- Check placement of the Root Bridge and blocking ports in the topology
- Diagramming is done through use of the **show spanning-tree** command
- In the real world – many tools (CiscoWorks LMS) automate this diagramming

## STP Trouble. – show spanning-tree

```
Rack27SW2#show spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID    Priority    32769
Address    000f.9052.ab80
Cost       19
Port       18 (FastEthernet0/16)
Hello Time 2 sec      Max Age 20 sec Forward Delay 15 sec
Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
Address    0016.4639.d580
Hello Time 2 sec      Max Age 20 sec Forward Delay 15 sec
Aging Time 300
```

Interface	Role	Sts	Cost	Prio.Nbr	Type
Fa0/13	Desg	FWD	19	128.15	P2p
Fa0/14	Desg	FWD	19	128.16	P2p
Fa0/15	Desg	FWD	19	128.17	P2p
Fa0/16	Root	FWD	19	128.18	P2p
Fa0/17	Altn	BLK	19	128.19	P2p
Fa0/18	Altn	BLK	19	128.20	P2p
Fa0/24	Desg	FWD	100	128.26	Shr

Interface	Role	Sts	Cost	Prio.Nbr	Type
Pol	Altn	BLK	9	128.56	P2p