

CCENT Study Guide 2

Section 9.2 Troubleshooting Layer 1 and Layer 2 Issues

As you work through this troubleshooting section, you can review the material necessary to prepare you to obtain a CCENT certification. To obtain a CCENT certification, you must pass the 640-822 ICND1 examination. These study guides provide a method to organize your review based on the ICND1 exam objectives.

Physical Layer Networking

Objective: Select the appropriate media, cables, ports, and connectors to connect switches to other network devices and hosts

Discovery 1 Review Chapters:

Connecting to the Network: Review the *Plan and Connect A Local Network* section in this chapter.

Connecting to the Internet Through an ISP: The section *Cables and Connectors* provides a good description of the different types of networking cables (twisted pair, coaxial, and fiber optic) and where each type is used. It is important to understand the difference between the different categories of twisted pair cable, and what types of communication can be supported by each category. The topic *UTP Cables* contains valuable information about how to build Ethernet cables. It is important to know the differences between the straight-through wiring pattern and cross-over wiring pattern.

Discovery 2 Review Chapters:

Planning the Network Upgrade: In the *Planning* section, the different types of UTP cable are reviewed. The topic *Cabling Considerations* describes when each type of is used. Review the structured cabling considerations and the explanations of the functions of the IDF and MDF.

Troubleshooting: The topics *Troubleshooting Cable and Device Port Errors* and *Troubleshooting LAN Connectivity Issues* describe problems that might occur when there are cabling issues in the network. It is very important to be familiar with the information provided by various Cisco IOS show commands that can help isolate a network problem to a Physical Layer issue.

Practice Activities:

1. Create a chart of the various types of cabling. Categorize each type by how it used, what the features are of each type (resistance to interference, ease of installation, relative cost, and maximum allowable cable lengths).
2. Practice terminating Category 5 UTP cables and memorize the various wiring patterns.
3. List the places where you would use a straight-through cable, a cross-over cable, and when you would use a serial console cable.
4. Use an incorrect cable type to connect two switches to each other (a straight-through cable or a console cable). Observe the LEDs and the show command output. Test connectivity.
5. Draw a diagram of the network in your classroom, school or place of work. Label each type of cable used to connect the various devices (routers, switches, end user devices).

Data Link Layer Networking

Objective: Explain the technology and media access control method for Ethernet technologies

Discovery 1 Review Chapters:

Connecting to the Network: The section *Communicating on a Local Wired Network* has four topics that discuss the technologies and protocols associated with Ethernet networks. Review the different Ethernet standards. In the section *Building the Access Layer of an Ethernet Network* the problem of collisions on an Ethernet network is described. It is important to understand the difference between how information is transmitted between devices using a shared media hub and using an Ethernet switch.

Discovery 2 Review Chapters:

Troubleshooting: The topic *Layer 1 and 2 Problems* in the *Troubleshooting Layer 1 and Layer 2 Issues* section describes problems that occur in an Ethernet network that can cause excessive collisions to occur. Pay attention to the different Cisco IOS show commands that provide information about the number of collisions, late collisions, and runt frames.

Objective: Explain network segmentation and basic traffic management concepts

Discovery 1 Review Chapters:

Connecting to the Network: The topic *Hierarchical Design of Ethernet Networks* in the *Communicating on a Local Wired Network* section describes how good network design segments the network into manageable sections, based on the traffic flow. The function of the Access Layer and Distribution Layer of a network is to manage traffic and reduce the size of collision and broadcast domains. It is important to understand the role of switches in reducing the size of collision domains, and the role of routers in reducing the size of broadcast domains. Review the material contained in the *Broadcast Messaging* topic, to ensure that you understand how broadcasts are used in a network, and why it is necessary to segment the network to limit the amount of broadcast traffic.

Discovery 2 Review Chapters:

Planning the Network Upgrade: The section *Purchasing and Maintaining Equipment* introduces the term failure domain and describes how to design a network in order to limit the effects of equipment failure. In the topic *Selecting Internetworking Devices*, the use of routers as a method to reduce the size of broadcast domains is reviewed.

Objective: Explain the operation of Cisco switches and basic switching concepts

Discovery 1 Review Chapters:

Connecting to the Network: It is critical to understand how switches forward traffic based on MAC address information. The topic *The Function of Switches* in the *Building the Access Layer of an Ethernet Network* explains how switches learn the MAC addresses of attached devices and how forwarding decisions are made.

Discovery 2 Review Chapters:

Planning the Network Upgrade: The topic *Selecting LAN Devices* describes different types of switches and how to select the correct switch for a particular network design.

Objective: Perform, save and verify initial switch configuration tasks including remote access management

Discovery 1 Review Chapters: none

Discovery 2 Review Chapters:

Configuring Network Devices: The section *Initial Cisco 2960 Switch Configuration* introduces the Cisco Switch CLI and describes how to configure and manage a Cisco 2960 switch. Review all of the material contained in this section and practice all of the activities. Pay close attention to the information provided by the output of all of the various Cisco IOS commands.

Objective: Verify network status and switch operation using basic utilities (including: ping, traceroute, telnet, SSH, arp, ipconfig), SHOW & DEBUG commands

Discovery 1 Review Chapters:

Connecting to the Network: Review the functionality of the Address Resolution Protocol in mapping an IP address to MAC address. The topic *Address Resolution Protocol (ARP)* introduces this protocol and describes how it is used. More information is contained in the *Tables Maintained by Routers* topic which describes how routers use ARP.

Connecting to the Internet through an ISP: Review the topic *Forwarding Packets Across the Internet* in the *Sending Information Across the Internet* section in order to understand the function of the traceroute command. The Packet Tracer activity for this topic provides practice using the ping and traceroute utilities.

Discovery 2 Review Chapters:

The Internet and Its Uses: The topic *Using Tools to Map the Internet* provides review on the functions of the ping and traceroute commands.

Help Desk: The topic *Troubleshooting the OSI Model* contains information on how to use the ping, traceroute, and ipconfig utilities to troubleshoot network connectivity issues. It is critical to understand the output of these various commands.

Configuring Network Devices: The topic *Connecting the LAN Switch to the Router* contains information on how to verify that the network is operational. Practice the labs and PT activity in this section. Another important topic to review in this chapter is the *Cisco Discovery Protocol* topic. CDP is a Layer 2 protocol that can provide valuable troubleshooting and verification information.

Objective: Implement and verify basic security for a Cisco switch (port security, deactivate ports)

Discovery 1 Review Chapters: none

Discovery 2 Review Chapters:

Configuring Network Devices: The topic *Connecting the LAN Switch to the Router* contains all of the commands and procedures to implement port security on a Cisco switch. Review how port security works, how to interpret the output of the show commands that verify that it is operational and what happens when an unauthorized or new device is plugged into the switch.

Objective: Identify, prescribe, and resolve common switched network media issues, configuration issues, autonegotiation, and switch hardware failures

Discovery 1 Review Chapters: none

Discovery 2 Review Chapters:

Configuring Network Devices: Autonegotiation is introduced in the *Initial Cisco 2960 Switch Configuration* section. The animation in the *Standalone Switches* topic shows the difference between half and full duplex operation.

Troubleshooting: Problems that can arise from mismatched speed and duplex settings are outlined in the in the *Troubleshooting LAN Connectivity* topic within the section *Troubleshooting Layer 1 and Layer 2 Issues*. Review the command output from the various switch show commands that could indicate a duplex mismatch between the switch and a connected device.

Practice Activities:

1. Create a diagram that shows how a switch forwards traffic in each of three different conditions:
 - a. when the MAC address of the destination host is in the switch table
 - b. when the MAC address of the destination network is not known
 - c. when the frame is a broadcast frame
2. Use Packet Tracer to create a small switched network consisting of two or more switches wired in a star topology. Configure all of the necessary switch parameters: hostname, passwords, management IP address information, and autonegotiation. Test the connectivity using ping, cdp and telnet.
3. Create a chart listing all of the switch configuration and show commands. Indicate what information you can obtain from each command.
4. Configure the various types of port security on a Cisco switch. Observe the results when an unknown device is attached to the protected port.
5. Intentionally create a duplex mismatch by configuring one device to autonegotiate and configure the connected device as full duplex. Use show commands to identify the symptoms of this problem.
6. Using a previously created diagram of your classroom, school, or work network, circle all of the collision and broadcast domains.
7. Create a diagram that shows the process a host uses to obtain the MAC address associated with a destination IP address using ARP.

WAN Technologies

Objective: Describe Different Methods of Connecting to a WAN

Discovery 1 Review Chapters:

Connecting to the Internet Through an ISP: WAN Technologies are introduced in the *Options for Connecting to the ISP* topic. The differences between asymmetric and symmetric transmission rates are described and illustrated.

Discovery 2 Review Chapters:

The Internet and Its Uses: The topic *Delivering Internet Services to End Users* within the *ISP* section describes various technologies available to connect networks over large geographic distances. The text and graphics in this section provide information on types of connections and the various speeds at which information can be transmitted.

Configuring Network Devices: The section *Connecting the CPE to the ISP* contains material on how to choose the appropriate WAN connectivity options. There is a chart illustrating the various relative costs and speeds associated with the different WAN connectivity options. It is important to understand the differences between the various types of connections, which ones use a serial connection and which ones use an Ethernet connection between the WAN equipment and the LAN edge devices.

Objective: Configure and Verify a Basic WAN Serial Connection

Discovery 1 Review Chapters: none

Discovery 2 Review Chapters:

Configuring Network Devices: The necessary commands to configure and verify WAN serial connections are located within three sections in this chapter. The first topic that explains how to configure serial connectivity is *Configuring WAN Connections using SDM Express* within the *Using Cisco SDM Express and SDM* section. The different types of available WAN encapsulations (HDLC, PPP and Frame Relay) are introduced in this topic. More information about serial connections is contained in the *Configuring an Interface* topic within the *Configuring a Router using the IOS CLI* section. It is important to understand that serial connectivity requires a DCE device to provide a clock signal on the line. Usually a CSU/DSU or modem provides this signal, although in certain situations a Cisco router can be configured to provide the clock signal. Practice configuring a serial WAN connection is also provided in the *Configuring WAN Connections* topic within the *Connecting the CPE to the ISP* section.

Troubleshooting: The topic *Troubleshooting WAN Connectivity Issues* explains how to interpret the output of the show interface commands to determine the causes of WAN connectivity issues occurring at Layer 1 or Layer 2.

Practice Activities:

1. Create a chart of available WAN connectivity options. List the features and benefits of each option. Determine which type of interface would be required on a Cisco router or switch to connect to each of the WAN options.

2. Use Packet Tracer to create a small WAN prototype network consisting of three routers connected using serial cables. Configure one of the routers to provide the clock signal on the serial links. Use the show interface commands to verify that the links are operational.
3. Intentionally remove the clock signals from the serial connections. Analyze the show interface command output on the various routers to determine how this error affects the output. Re-configure the clock rate and observe the change in the show command output.
4. Intentionally change the serial encapsulation on one side of the serial link to create a mismatch. Analyze the show interface command output on the various routers to determine how this error affects the output. Correct the error and observe the change in the show command output.

Device Hardware and Boot Errors

Objective: Describe the operation of Cisco routers (including: router bootup process, POST, router components)

Discovery 1 Review Chapters: none

Discovery 2 Review Chapters:

Configuring Network Devices: The initial ISR bootup process is described in **Bootup Process** topic of the **Initial ISR Router Configuration** section. The show version command and the ROMmon mode are explained. Be sure that you understand the process that a Cisco IOS device uses to locate and load both the operating system and the configuration files.

Troubleshooting: In the **Troubleshooting Device Hardware and Boot Errors** topic, the common symptoms indicating boot system failures are explained. Pay close attention to the information provided in the output of the show version command.

Practice Activities:

1. Using Packet Tracer, or actual router and switch equipment, connect to the devices using a console cable. Power on each device and watch the messages that appear on the console screen. Note any differences between the messages displayed on a Cisco switch and the messages displayed on an ISR router.
2. Review the output of the show version command on various Cisco devices to ensure that you are familiar with the information provided.