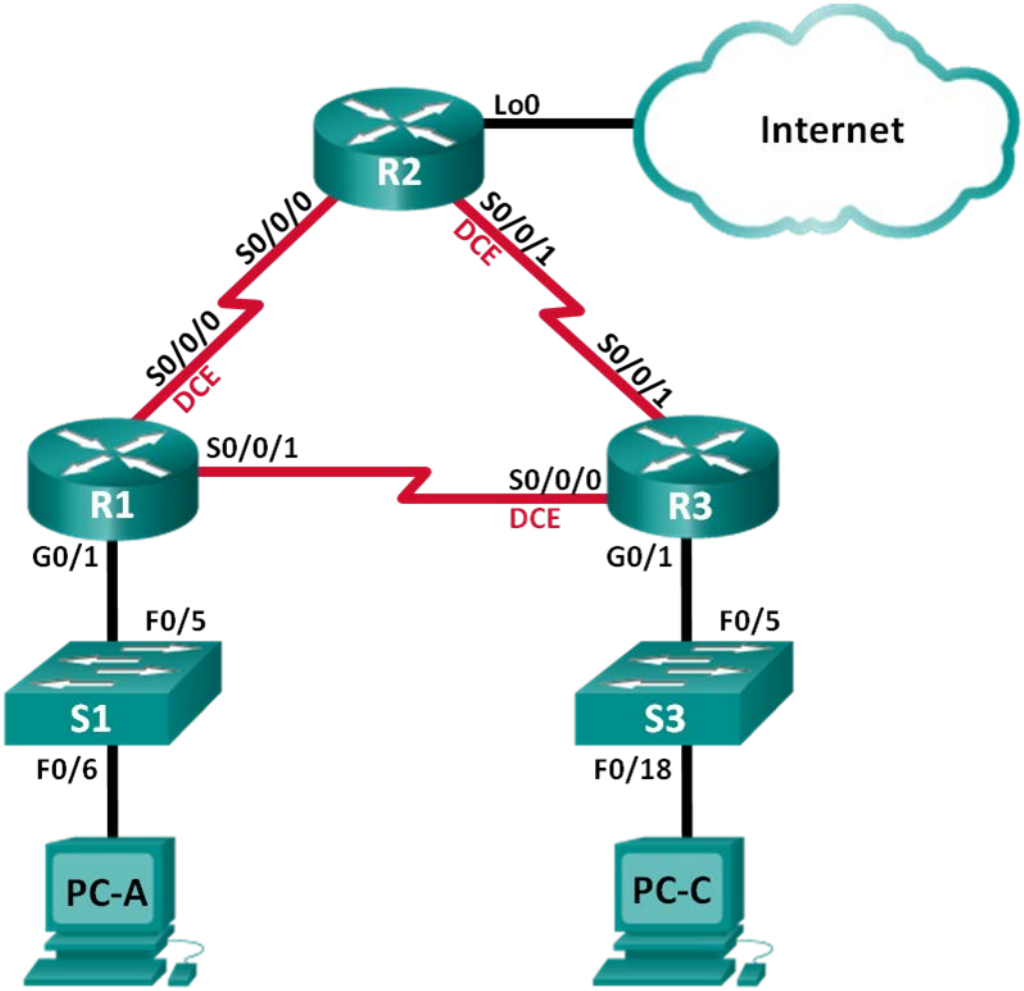
Lab – Troubleshooting Basic PPP with Authentication

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/1	192.168.1.1	255.255.255.0	N/A
	S0/0/0 (DCE)	192.168.12.1	255.255.255.252	N/A
	S0/0/1	192.168.13.1	255.255.255.252	N/A
R2	Lo0	209.165.200.225	255.255.255.252	N/A
	S0/0/0	192.168.12.2	255.255.255.252	N/A
	S0/0/1 (DCE)	192.168.23.1	255.255.255.252	N/A
R3	G0/1	192.168.3.1	255.255.255.0	N/A
	S0/0/0 (DCE)	192.168.13.2	255.255.255.252	N/A
	S0/0/1	192.168.23.2	255.255.255.252	N/A
PC-A	NIC	192.168.1.3	255.255.255.0	192.168.1.1
PC-C	NIC	192.168.3.3	255.255.255.0	192.168.3.1

Objectives

Part 1: Build the Network and Load Device Configurations

Part 2: Troubleshoot the Data Link Layer

Part 3: Troubleshoot the Network Layer

Background / Scenario

The routers at your company were configured by an inexperienced network engineer. Several errors in the configuration have resulted in connectivity issues. Your manager has asked you to troubleshoot and correct the configuration errors and document your work. Using your knowledge of PPP and standard testing methods, find and correct the errors. Ensure that all of the serial links use PPP CHAP authentication, and that all of the networks are reachable.

Note: The routers used with CCNA hands-on labs are Cisco 1941 Integrated Services Routers (ISRs) with Cisco IOS Release 15.2(4)M3 (universalk9 image). The switches used are Cisco Catalyst 2960s with Cisco IOS Release 15.0(2) (lanbasek9 image). Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of this lab for the correct interface identifiers.

Note: Make sure that the routers and switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

Required Resources

- 3 Routers (Cisco 1941 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
- 2 Switches (Cisco 2960 with Cisco IOS Release 15.0(2) lanbasek9 image or comparable)
- 2 PCs (Windows with a terminal emulation program, such as Tera Term)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet and serial cables as shown in the topology

Part 1: Build the Network and Load Device Configurations

In Part 1, you will set up the network topology, configure basic settings on the PC hosts, and load configurations on the routers.

Step 1: Cable the network as shown in the topology.

Step 2: Configure the PC hosts.

Step 3: Load router configurations.

Load the following configurations into the appropriate router. All routers have the same passwords. The privileged EXEC mode password is **class**. The password for console and vty access is **cisco**. All serial interfaces should be configured with PPP encapsulation and authenticated with CHAP using the password of **chap123**.

Router R1 Configuration:

```
hostname R1
enable secret class
no ip domain lookup
banner motd #Unauthorized Access is Prohibited!#
username R2 password chap123
username R3 password chap123
interface g0/1
 ip address 192.168.1.1 255.255.255.0
 no shutdown
interface s0/0/0
 ip address 192.168.12.1 255.255.255.252
 clock rate 128000
 encapsulation ppp
 ppp authentication chap
interface s0/0/1
 ip address 192.168.31.1 255.255.255.252
encapsulation ppp
 ppp authentication pap
exit
router ospf 1
 router-id 1.1.1.1
 network 192.168.1.0 0.0.0.255 area 0
 network 192.168.12.0 0.0.0.3 area 0
 network 192.168.13.0 0.0.0.3 area 0
 passive-interface g0/1
 exit
line con 0
 password cisco
 logging synchronous
 login
line vty 0 4
```

```
 password cisco
 login
```

Router R2 Configuration:

```
hostname R2
enable secret class
no ip domain lookup
banner motd #Unauthorized Access is Prohibited!#
username R1 password chap123
username r3 password chap123
interface lo0
 ip address 209.165.200.225 255.255.255.252
interface s0/0/0
 ip address 192.168.12.2 255.255.255.252
 encapsulation ppp
 ppp authentication chap
 no shutdown
interface s0/0/1
 ip address 192.168.23.1 255.255.255.252
 clock rate 128000
no shutdown
 exit
router ospf 1
 router-id 2.2.2.2
 network 192.168.12.0 0.0.0.3 area 0
 network 192.168.23.0 0.0.0.3 area 0
 default-information originate
 exit
ip route 0.0.0.0 0.0.0.0 loopback0
line con 0
 password cisco
 logging synchronous
 login
line vty 0 4
 password cisco
 login
```

Router R3 Configuration:

```
hostname R3
enable secret class
no ip domain lookup
banner motd #Unauthorized Access is Prohibited!#
username R2 password chap123
username R3 password chap123
interface g0/1
 ip address 192.168.3.1 255.255.255.0
```

```
 no shutdown
interface s0/0/0
 ip address 192.168.13.2 255.255.255.252
 clock rate 128000
 encapsulation ppp
 ppp authentication chap
 no shutdown
interface s0/0/1
 ip address 192.168.23.2 255.255.255.252
 encapsulation ppp
 ppp authentication chap
 no shutdown
 exit
router ospf 1
 router-id 3.3.3.3
network 192.168.13.0 0.0.0.3 area 0
 network 192.168.23.0 0.0.0.3 area 0
 passive-interface g0/1
line con 0
 password cisco
 logging synchronous
 login
line vty 0 4
 password cisco
 login
```

Step 4: Save your running configuration.

Part 2: Troubleshoot the Data Link Layer

In Part 2, you will use **show** commands to troubleshoot data link layer issues. Be sure to verify settings, such as clock rate, encapsulation, CHAP, and usernames/passwords.

Step 1: Examine the R1 configuration.

a. Use the **show interfaces** command to determine whether PPP has been established on both serial links.

From the **show interfaces** results for S0/0/0 and S0/0/1, what are possible issues with the PPP links?
The output indicates: Both S0/0/0 and S0/0/1 are shut down. PPP encapsulation has been applied to both S0/0/0 and S0/0/1 interfaces. Besides the fact that the serial interface are administratively down, there are still issues with the PPP configurations, such as mismatched authentication

b. Use the **debug ppp authentication** command to view real-time PPP authentication output during troubleshooting.

```
R1# debug ppp authentication
PPP authentication debugging is on
```

c. Use the **show run interface s0/0/0** command to examine the settings on S0/0/0.

Resolve all problems found for S0/0/0. Record the commands used to correct the configuration.

```
R1(config)# interface s0/0/0
R1(config-if)# no shutdown
```

After correcting the issue, what information does the debug output provide?

The debug output shows a successful CHAP negotiation process. PPP has been established on the link connecting R1 S0/0/0 and R2 S0/0/0.

d. Use the **show run interface s0/0/1** command to examine the settings on S0/0/1.

Resolve all problems found for S0/0/1. Record the commands used to correct the configuration.

```
R1(config)# interface s0/0/1
R1(config-if)# ppp authentication chap
R1(config-if)# no shutdown
```

After correcting the issue, what information does the debug output provide?

The debug output shows an unsuccessful CHAP negotiation process and the interface is going up and down. More configuration errors exist for the link connecting R1 S0/0/1 and R3 S0/0/0.

e. Use the **no debug ppp authentication** or **undebug all** command to turn off the debug PPP output.

f. Use the **show running-config | include username** command to verify the correct username and password configurations.

Resolve all problems found. Record the commands used to correct the configuration.

No problems exist.

Step 2: Examine the R2 configuration.

a. Use the **show interfaces** command to determine if PPP has been established on both serial links.

Have all links been established? No

If the answer is no, which links need to be examined? What are the possible issues?

The link between R2 and R3 has not been established because S0/0/1 interface is configured with HDLC encapsulation. Beside the encapsulation issue, authentication mismatch can also prevent link establishment.

b. Use the **show run interface** command to examine links that have not been established.

Resolve all problems found for the interfaces. Record the commands used to correct the configuration.

```
R2(config)# interface s0/0/1
R2(config-if)# encapsulation ppp
R2(config-if)# ppp authentication chap
```

c. Use the **show running-config | include username** command to verify the correct username and password configurations.

Resolve all problems found. Record the commands used to correct the configuration.

```
R2(config)# no username r3 password chap123
R2(config)# username R3 password chap123
```

d. Use the **show ppp interface serial** command for the serial interface that you are troubleshooting.

Has the link been established? Yes

Step 3: Examine the R3 configuration.

a. Use the **show interfaces** command to determine whether PPP has been established on both serial links.

Have all links been established?

If the answer is no, which links need to be examined? What are the possible issues?
The serial link between R1 and R3 has not been established. Serial0/0/0 is configured with PPP encapsulation, and the interface is enabled. Therefore, the possible issue is authentication mismatch.

b. Using the **show run interface** command to examine on any serial link that has not been established.

Resolve all problems found on the interfaces. Record the commands used to correct the configuration.
No problems exist with the S0/0/0 configuration.

c. Use the **show running-config | include username** command to verify the correct username and password configurations.

Resolve all problems found. Record the commands used to correct the configuration.
R3(config)# no username R3 password chap123
R3(config)# username R1 password chap123

d. Use the **show interface** command to verify that serial links have been established.

e. Have all PPP links been established? yes

f. Can PC-A ping Lo0? yes

g. Can PC-A ping PC-C? no

Note: It may be necessary to disable the PC firewall for pings between the PCs to succeed.

Part 3: Troubleshoot the Network Layer

In Part 3, you will verify that Layer 3 connectivity is established on all interfaces by examining IPv4 and OSPF configurations.

Step 1: Verify that the interfaces listed in the Addressing Table are active and configured with the correct IP address information.

Issue the **show ip interface brief** command on all routers to verify that the interfaces are in an up/up state.

Resolve all problems found. Record the commands used to correct the configuration.
R1(config)# interface s0/0/1
R1(config-if)# ip address 192.168.13.1 255.255.255.252

Step 2: Verify OSPF Routing

Issue the **show ip protocols** command to verify that OSPF is running and that all networks are advertised.

Resolve all problems found. Record the commands used to correct the configuration.
R3(config)# router ospf 1
R3(config-router)# network 192.168.3.0 0.0.0.255 area 0

Can PC-A ping PC-C? Yes

If connectivity does not exist between all hosts, then continue troubleshooting to resolve any remaining issues.

Note: It may be necessary to disable the PC firewall for pings between the PCs to succeed.

Router Interface Summary Table

Router Interface Summary				
Router Model	**Ethernet Interface #1**	**Ethernet Interface #2**	**Serial Interface #1**	**Serial Interface #2**
1800	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
1900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2801	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
2811	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)

Note: To find out how the router is configured, look at the interfaces to identify the type of router and how many interfaces the router has. There is no way to effectively list all the combinations of configurations for each router class. This table includes identifiers for the possible combinations of Ethernet and Serial interfaces in the device. The table does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.