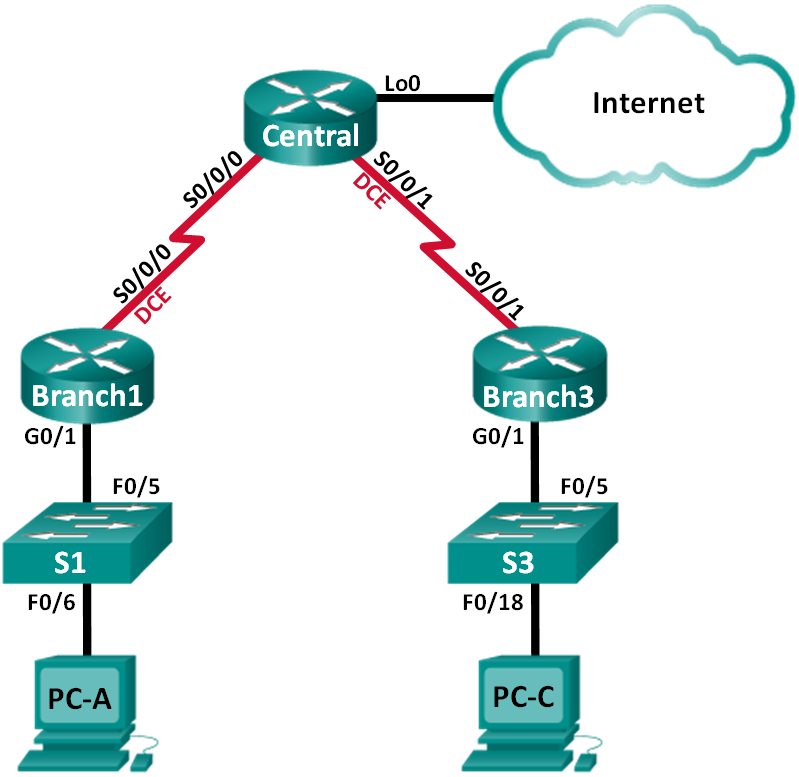
Lab – Configuring Basic PPP with Authentication

1. Topology

**

**PC-A**

**PC-B**

**INSTRUCTIONS**

**This may look like a long Lab document – 9 pages!…but not really!**

**Most of the doc is made up of example CLI output from running the PPP commands on the Routers.**

**Download this Lab doc.**

**Save the Lab doc with your student number in the filename.**

**Download the Packet Tracer file.**

**Save the Packet Tracer file with your student number in the filename.**

**You have to answer questions as you do the Lab. The questions are in RED text in this doc so that you can find them.**

**Answer the questions. Type the answers into this Lab doc.**

**Put completed Lab doc and the completed Packet Tracer file into one ZIP file.**

**Upload the ZIP file to Bright Space at end of Lab today.**

**Student No:** **Name:**

1. Addressing Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Device | Interface | IP Address | Subnet Mask | Default Gateway |
| Branch1 | G0/1 | 192.168.1.1 | 255.255.255.0 | N/A |
| S0/0/0 (DCE) | 10.1.1.1 | 255.255.255.252 | N/A |
| Central | S0/0/0 | 10.1.1.2 | 255.255.255.252 | N/A |
| S0/0/1 (DCE) | 10.2.2.2 | 255.255.255.252 | N/A |
| Lo0 | 209.165.200.225 | 255.255.255.224 | N/A |
| Branch3 | G0/1 | 192.168.3.1 | 255.255.255.0 | N/A |
| S0/0/1 | 10.2.2.1 | 255.255.255.252 | N/A |
| PC-A | NIC | 192.168.1.3 | 255.255.255.0 | 192.168.1.1 |
| PC-B | NIC | 192.168.3.3 | 255.255.255.0 | 192.168.3.1 |

1. Objectives

Part 1: Configure Basic Device Settings

Part 2: Configure PPP Encapsulation

Part 3: Configure PPP CHAP Authentication

1. Background / Scenario

The Point-to-Point Protocol (PPP) is a very common Layer 2 WAN protocol. PPP can be used to connect from LANs to service provider WANs and for connection of LAN segments within an enterprise network.

**In this lab, you will configure PPP encapsulation on dedicated serial links between the branch routers and a central router. You will configure PPP Challenge Handshake Authentication Protocol (CHAP) on the PPP serial links. You will also examine the effects of the encapsulation and authentication changes on the status of the serial link.**

**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. **Erasing devices does not apply here. This is a Packet Tracer exercise. You have been provided with the basic device settings (configs) and a clean Packet Tracer file.**

1. 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 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

1. Configure Basic Device Settings

In Part 1, you will set up the network topology and configure basic router settings, such as the interface IP addresses, routing, device access, and passwords.

* 1. Cable the network as shown in the topology.

Attach the devices as shown in the Topology, and cable as necessary. **Already done.**

* 1. Initialize and reload the routers and switches. Not necessary for this Lab.
  2. Configure basic settings for each router. Paste in the configs from Part-1-Base-Configs-&-OSPF.txt file in BrightSpace to config the basic settings.
     1. Disable DNS lookup.
     2. Configure the device name.
     3. ~~Encrypt plaintext passwords~~.
     4. ~~Create a message of the day (MOTD) banner warning users that unauthorized access is prohibited~~.
     5. ~~Assign~~ **~~class~~** ~~as the encrypted privileged EXEC mode password~~.
     6. ~~Assign~~ **~~cisco~~** ~~as the console and vty password and enable login.~~
     7. Set console logging to synchronous mode.
     8. Apply the IP addresses to Serial and Gigabit Ethernet interfaces according to the Addressing Table and activate the physical interfaces.
     9. Set the clock rate to **128000** for DCE serial interfaces.
     10. Create **Loopback0** on the Central router to simulate access to the Internet and assign an IP address according to the Addressing Table.
  3. Configure routing. Configs are in Part-1-Base-Configs-&-OSPF.txt
     1. Enable single-area OSPF on the routers and use a process ID of 1. Add all the networks, except 209.165.200.224/27 into the OSPF process.
     2. Configure a default route to the simulated Internet on the Central router using Lo0 as the exit interface and redistribute this route into the OSPF process.
     3. Issue the **show ip route ospf**, **~~show~~****~~ip ospf interface brief~~** and **show ip ospf neighbor** commands on all routers to verify that OSPF is configured correctly. Take note of the router ID for each router.
  4. Configure the PCs.

Assign IP addresses and default gateways to the PCs according to the Addressing Table.

* 1. Verify end-to-end connectivity.

All devices should be able to ping other devices in the Topology. If not, troubleshoot until you can establish end-to-end connectivity. At least ensure you can ping between PC-A and PC-B in both directions.

**Note**: It may be necessary to disable the PC firewall to ping between PCs. **Not relevant here.**

* 1. Save your configurations.

1. Configure PPP Encapsulation
   1. Display the default serial encapsulation.

On Branch1 and Central routers, issue **show interfaces s0/0/0** to display the current serial encapsulation.

Use the output from show interfaces output answer the question below.

What is the default serial encapsulation for a Cisco router? The Default is 10.1.1.2/30

* 1. Change the serial encapsulation to PPP.
     1. Issue the **encapsulation ppp** command on the S0/0/0 interface for the Branch1 router to change the encapsulation from HDLC to PPP.

Branch1(config)# **interface s0/0/0**

Branch1(config-if)# **encapsulation ppp**

Branch1(config-if)#

Jun 19 06:02:33.687: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.200.225 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

Branch1(config-if)#

Jun 19 06:02:35.687: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to down

* + 1. Issue the command to display the line status and line protocol for interface S0/0/0 on the Branch1 router. Document the command issued. What is current interface status for S0/0/0?

The status is currently off from admin

* + 1. Issue the **encapsulation ppp** command on interface S0/0/0 for the Central router to correct the serial encapsulation mismatch.

Central(config)# **interface s0/0/0**

Central(config-if)# **encapsulation ppp**

Central(config-if)#

.Jun 19 06:03:41.186: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

.Jun 19 06:03:41.274: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.1 on Serial0/0/0 from LOADING to FULL, Loading Done

* + 1. Verify that interface S0/0/0 on both Branch1 and Central routers is up/up and is configured with PPP encapsulation. Issue the **show interfaces s0/0/0** onBranch1 and Central routers. Use the output from show interfaces to answer the question below.

What is the status of the PPP Link Control Protocol (LCP)? Status is Offline

Which Network Control Protocol (NCP) protocols have been negotiated?

The protocols are LCP

* 1. Intentionally break the serial connection.

You will turn on debugging for PPP first, to watch debug PPP messages when traffic is flowing normally on the serial link between the Branch1 and Central routers. In Step 3 c. you will ‘break’ the serial link by changing the encapsulation on Branch1 serial interface s0/0/0 to HDLC. Different encapsulation at each end of the serial link means link goes down.

* + 1. Use the **debug** **ppp** commands to observe the effects of changing the PPP configuration on the Branch1 router. You can turn off debugging using **undebug all**.

Branch1# **debug ppp negotiation**

PPP protocol negotiation debugging is on

Branch1# **debug ppp packet**

PPP packet display debugging is on

Central# **debug ppp negotiation**

PPP protocol negotiation debugging is on

Branch1# **debug ppp packet**

PPP packet display debugging is on

* + 1. Observe the debug PPP messages when traffic is flowing on the serial link between the Branch1 and Central routers.

**Note**: O = an output packet, I = an input packet, pkt type 0xc021 = LCP, Link Control Protocol. Other packet types you might see are 0x0021 IP, Internet Protocol,  
0x0207 CDP, Cisco Discovery Protocol.

Branch1#

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: I pkt type 0xc021, datagramsize 104

Central#

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: I pkt type 0xc021, datagramsize 104

* + 1. Break the serial connection by returning the serial encapsulation to HDLC for interface S0/0/0 on the Branch1 router. Record the command used to change the encapsulation to HDLC.

**encapsulation hdlc**

* + 1. Observe the debug PPP messages on the Branch1 router. The serial connection has terminated, and the line protocol is down. The route to 10.1.1.2 (Central) has been removed from the routing table.

Branch1#

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to down

01:37:52: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.200.225 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

Serial0/0/0 PPP: Phase is TERMINATING

Serial0/0/0 LCP: State is Closed

Serial0/0/0 PPP: Phase is DOWN

* + 1. Observe the debug PPP messages on the Central router. The Central router continues to attempt to establish a connection with Branch1 as indicated by the debug messages. When the interfaces are unable to establish a connection, the interfaces go back down again. *(NB: This does not really happen in this Packet Tracer version of the Lab)*. Furthermore, OSPF cannot establish an adjacency with its neighbor due to the mismatched serial encapsulation.

Note: There are only output packets in the debug information below. No incoming packets, as the other end of the serial link is down.

Central#

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Central#

Serial0/0/0 PPP: O pkt type 0x0021, datagramsize 104

Central#

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Central#

Serial0/0/0 PPP: O pkt type 0x0021, datagramsize 104

Central#

Serial0/0/0 PPP: O pkt type 0x0021, datagramsize 104

What happens when one end of the serial link is encapsulated with PPP and the other end of the link is encapsulated with HDLC?

The link will go down

* + 1. Issue the **encapsulation ppp** command on the S0/0/0 interface for the Branch1 router to correct mismatched encapsulation.

Branch1(config)# **interface s0/0/0**

Branch1(config-if)# **encapsulation ppp**

* + 1. Observe the debug PPP messages from the Branch1 router as the Branch1 and Central routers establish a connection.

Branch1#

Serial0/0/0 PPP: Using default call direction

Serial0/0/0 PPP: Treating connection as a dedicated line

Serial0/0/0 PPP: Phase is ESTABLISHING, Active Open

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

%SYS-5-CONFIG\_I: Configured from console by console

Serial0/0/0 PPP: I pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 LCP: State is Open

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: O pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: I pkt type 0xc021, datagramsize 104

Serial0/0/0 PPP: Phase is FORWARDING, Attempting Forward

Serial0/0/0 Phase is ESTABLISHING, Finish LCP

Serial0/0/0 Phase is UP

...

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

...

01:38:57: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.200.225 on Serial0/0/0 from LOADING to FULL, Loading Done

From the debug message, what phases does PPP go through when the other end of the serial link on the Central router is configured with PPP encapsulation?

It goes into loading form

What happens when PPP encapsulation is configured on each end of the serial link?

The serial connection will work normally

* + 1. Issue the **undebug all** (or **u all**) command on the Branch1 and Central routers to turn off all debugging on both routers.
    2. Issue the **show ip interface brief** command on the Branch1 and Central routers after the network converges. What is the status for interface S0/0/0 on both routers?

Administratively

* + 1. Verify that the interface S0/0/0 on both Branch1 and Central routers are configured for PPP encapsulation.

Record the command to verify the PPP encapsulation in the space provided below.

Branch1# show interface s0/0/0

Central# show interface s0/0/0

* + 1. Change the serial encapsulation for the link between the Central and Branch3 routers to PPP encapsulation.

Central(config)# **interface s0/0/1**

Central(config-if)# **encapsulation ppp**

Central(config-if)#

Jun 20 03:17:15.933: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.3.1 on Serial0/0/1 from FULL to DOWN, Neighbor Down: Interface down or detached

Jun 20 03:17:17.933: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to down

Jun 20 03:17:23.741: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

Jun 20 03:17:23.825: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.3.1 on Serial0/0/1 from LOADING to FULL, Loading Done

Branch3(config)# **interface s0/0/1**

Branch3(config-if)# **encapsulation ppp**

Branch3(config-if)#

Jun 20 03:17:21.744: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.200.225 on Serial0/0/1 from FULL to DOWN, Neighbor Down: Interface down or detached

Jun 20 03:17:21.948: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to down

.Jun 20 03:17:21.964: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

.Jun 20 03:17:23.812: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.200.225 on Serial0/0/1 from LOADING to FULL, Loading Done

* + 1. Verify that end-to-end connectivity is restored before continuing to Part 3.

1. Configure PPP CHAP Authentication
   1. Verify that PPP encapsulation is configured on all serial interfaces.

Record the command used to verify that PPP encapsulation is configured.

Show interface (interface-id)

* 1. Configure PPP CHAP authentication for the link between the Central router and the Branch3 router.
     1. Configure a username for CHAP authentication.

Central(config)# **username Branch3 password cisco**

Branch3(config)# **username Central password cisco**

* + 1. Check interface status for S0/0/1 on Branch3 router using **show interfaces s0/0/1**. The current interface status for S0/0/1 should be line status 'up' and line protocol 'up'
    2. Configure the interface S0/0/1 on Branch3 for CHAP authentication.

Branch3(config)# **interface s0/0/1**

Branch3(config-if)# **ppp authentication chap**

Branch3#

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to down

00:10:22: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.200.225 on Serial0/0/1 from FULL to DOWN, Neighbor Down: Interface down or detached.

* + 1. Check interface status for S0/0/1 on Branch3 router again. The current interface status for S0/0/1 should be line status 'up' and line protocol 'down'.
    2. Configure the interface S0/0/1 on Central for CHAP authentication.

Central(config)# **interface s0/0/1**

Central(config-if)# **ppp authentication chap**

* + 1. Check interface status for S0/0/1 on Branch3 router again. The current interface status for S0/0/1 should be line status 'up' and line protocol 'up'.

**Note:** It may take a while for the line protocol on s0/0/1 to come back up in Packet Tracer (up to 40 secs).

* 1. Configure PPP CHAP authentication for the link between the Central router and the Branch1 router.
     1. Configure a username for CHAP authentication.

Central(config)# **username Branch1 password cisco**

Branch1(config)# **username Central password cisco**

* + 1. Configure the interface S0/0/0 on Branch1 for CHAP authentication.

Branch1 (config)# **interface s0/0/0**

Branch1 (config-if)# **ppp authentication chap**

* + 1. Configure the interface S0/0/0 on Central for CHAP authentication.

Central(config)# **interface s0/0/0**

Central(config-if)# **ppp authentication chap**

* + 1. When the serial interfaces on Branch1 and Central have come back up, verify connectivity between PC-A and PC-B, in both directions.

1. 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. | | | | |