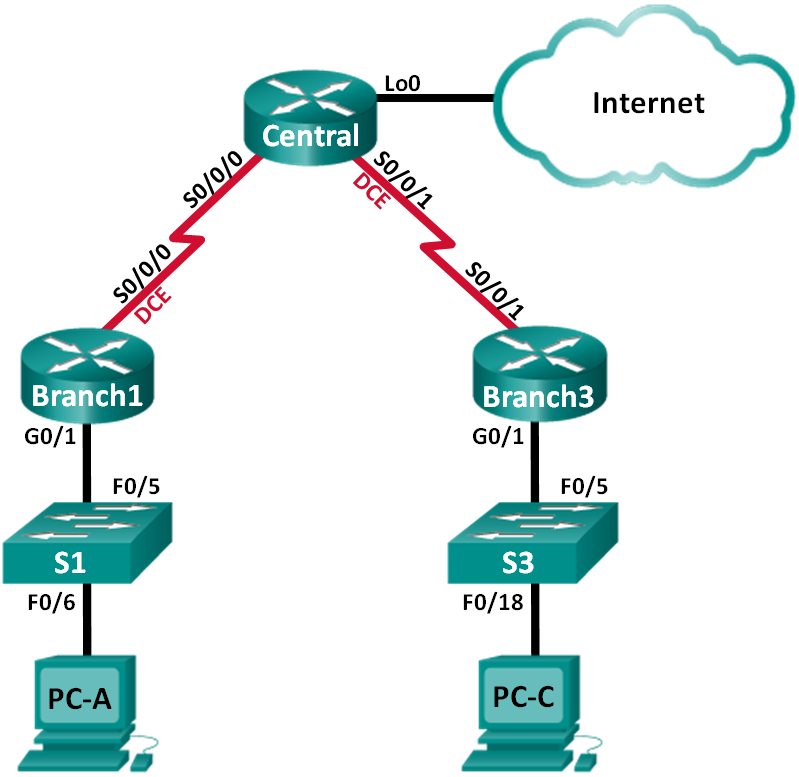
Lab 6 – Configuring Basic PPP with Authentication

1. Topology



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-C | 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 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 the 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.

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*. In Packet Tracer use the 1941 routers and the 2960 switches. These devices have gigabit Ethernet interfaces, allowing you to match the interface names on the devices to those in the addressing table above.

Note that the topology diagram shows the routers connected to the F0/5 interfaces on the switches. However, it makes more sense to connect them to the G0/1 interface on the switches to take full advantage of the gigabit speeds allowed by the router.

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

Attach the devices as shown in the Topology and cable as necessary.

* 1. Initialize and reload the routers and switches.

This step is only needed if you are using real devices. If you are using Packet Tracer, the devices will be in their initial state when you add them to your network simulation.

* 1. Configure basic settings for each router and configure all interfaces.
     1. Apply the Basic Settings to the devices as you have done in previous labs. You don’t need to configure remote access.
     2. Apply the IP addresses to Serial and Gigabit Ethernet interfaces according to the Addressing Table and activate the physical interfaces.
     3. Set the clock rate to **128000** for DCE serial interfaces.
     4. To simulate access to the Internet, create **Loopback0** on the Central router, as shown in the addressing table.
     5. At this point it should be possible to ping across each link. However, end-to-end pings will fail because routing is not yet configured.
  2. Configure routing.
     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 as appropriate for each router.
     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 of each router.
  3. 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.

* 1. Save the configurations on the three routers.

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

On the Branch1 router, issue **show interfaces serial** *interface-name* to display the encapsulation.

Branch1# **show interfaces serial 0/0/0**

Serial0/0/0 is up, line protocol is up

Hardware is WIC MBRD Serial

Internet address is 10.1.1.1/30

MTU 1500 bytes, BW 1544 Kbit/sec, DLY 20000 usec,

reliability 255/255, txload 1/255, rxload 1/255

Encapsulation HDLC, loopback not set

…

What is the default serial encapsulation for a Cisco router?

* 1. Change the serial encapsulation to PPP.
     1. Issue the command to display the line status and protocol for interface S0/0/0 on the Branch1 router. Document the command issued. What is the current interface status for S0/0/0?
     2. 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)#

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

00:49:05: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.200.225 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

* + 1. What is the current interface status for S0/0/0?
    2. 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)#

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

00:55:12: %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 using the command below.

Branch1# **show interfaces s0/0/0**

Serial0/0/0 is up, line protocol is up

Hardware is WIC MBRD Serial

Internet address is 10.1.1.1/30

MTU 1500 bytes, BW 1544 Kbit/sec, DLY 20000 usec,

reliability 255/255, txload 1/255, rxload 1/255

Encapsulation PPP, LCP Open

Open: IPCP, CDPCP, loopback not set

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

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

* 1. Intentionally break the serial connection.
     1. On the central router, issue the following **debug** **ppp** commands.

Central# **debug ppp negotiation**

PPP protocol negotiation debugging is on

Central# **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. For example, ping Central from Branch1 in a separate window.

Central#

Se0/0/0 PPP: O pkt type 0x0021, datagramsize 84

Se0/0/0 LCP: O ECHOREQ [Open] id 45 len 12 magic 0x73885AF2

Se0/0/0 LCP-FS: I ECHOREP [Open] id 45 len 12 magic 0x8CE1F65F

Se0/0/0 LCP-FS: Received id 45, sent id 45, line up

Se0/0/0 LCP-FS: I ECHOREQ [Open] id 45 len 12 magic 0x8CE1F65F

Se0/0/0 LCP-FS: O ECHOREP [Open] id 45 len 12 magic 0x73885AF2

Se0/0/0 PPP: I pkt type 0x0021, datagramsize 84 link[ip]

* + 1. Break the serial connection by returning the serial encapsulation to HDLC for interface S0/0/0 on the Branch1 router. Record the commands used to change the encapsulation to HDLC.
    2. 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. Furthermore, OSPF cannot establish an adjacency with its neighbor due to the mismatched serial encapsulation.

Se0/0/0 PPP: Sending cstate DOWN notification

Se0/0/0 PPP: Processing CstateDown message

Se0/0/0 PPP DISC: Lower Layer disconnected

PPP: NET STOP send to AAA.

Se0/0/0 IPCP: Event[DOWN] State[Open to Starting]

Se0/0/0 IPCP: Event[CLOSE] State[Starting to Initial]

Se0/0/0 CDPCP: Event[DOWN] State[Open to Starting]

Se0/0/0 CDPCP: Event[CLOSE] State[Starting to Initial]

Se0/0/0 LCP: O TERMREQ [Open] id 2 len 4

Se0/0/0 LCP: Event[CLOSE] State[Open to Closing]

Se0/0/0 PPP: Phase is TERMINATING

Se0/0/0 Deleted neighbor route from AVL tree: topoid 0, address 10.1.1.1

Se0/0/0 IPCP: Remove route to 10.1.1.1

%OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.1 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

Se0/0/0 LCP: Event[DOWN] State[Closing to Initial]

Se0/0/0 PPP: Phase is DOWN

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

Se0/0/0 PPP: Sending cstate UP notification

Se0/0/0 PPP: Processing CstateUp message

PPP: Alloc Context [29F9F32C]

ppp3 PPP: Phase is ESTABLISHING

Se0/0/0 PPP: Using default call direction

Se0/0/0 PPP: Treating connection as a dedicated line

Se0/0/0 PPP: Session handle[60000003] Session id[3]

Se0/0/0 LCP: Event[OPEN] State[Initial to Starting]

Se0/0/0 LCP: O CONFREQ [Starting] id 1 len 10

Se0/0/0 LCP: MagicNumber 0x7397843B (0x05067397843B)

Se0/0/0 LCP:Event[UP] State[Starting to REQsent]

Se0/0/0 LCP: O CONFREQ [REQsent] id 2 len 10

Se0/0/0 LCP: MagicNumber 0x7397843B (0x05067397843B)

Se0/0/0 LCP: Event[Timeout+] State[REQsent to REQsent]

Se0/0/0 PPP: I pkt type 0x008F, datagramsize 24 link[illegal]

Se0/0/0 UNKNOWN(0x008F): Non-NCP packet, discarding

<output omitted>

Se0/0/0 LCP: O CONFREQ [REQsent] id 10 len 10

Se0/0/0 LCP: MagicNumber 0x7397843B (0x05067397843B)

Se0/0/0 LCP: Event[Timeout+] State[REQsent to REQsent]

Se0/0/0 PPP DISC: LCP failed to negotiate

PPP: NET STOP send to AAA.

Se0/0/0 LCP: Event[Timeout-] State[REQsent to Stopped]

Se0/0/0 LCP: Event[DOWN] State[Stopped to Starting]

Se0/0/0 PPP: Phase is DOWN

PPP: Alloc Context [29F9F32C]

ppp4 PPP: Phase is ESTABLISHING

Se0/0/0 PPP: Using default call direction

Se0/0/0 PPP: Treating connection as a dedicated line

Se0/0/0 PPP: Session handle[6E000004] Session id[4]

Se0/0/0 LCP: Event[OPEN] State[Initial to Starting]

Se0/0/0 LCP: O CONFREQ [Starting] id 1 len 10

Se0/0/0 LCP: MagicNumber 0x7397DADA (0x05067397DADA)

Se0/0/0 LCP: Event[UP] State[Starting to REQsent]

Se0/0/0 PPP: I pkt type 0x008F, datagramsize 24 link[illegal]

Se0/0/0 UNKNOWN(0x008F): Non-NCP packet, discarding

<output omitted>

Se0/0/0 LCP: O CONFREQ [REQsent] id 10 len 10

Se0/0/0 LCP: MagicNumber 0x7397DADA (0x05067397DADA)

Se0/0/0 LCP: Event[Timeout+] State[REQsent to REQsent]

Se0/0/0 PPP DISC: LCP failed to negotiate

PPP: NET STOP send to AAA.

Se0/0/0 LCP: Event[Timeout-] State[REQsent to Stopped]

Se0/0/0 LCP: Event[DOWN] State[Stopped to Starting]

Se0/0/0 PPP: Phase is DOWN

Se0/0/0 PPP: I pkt type 0x008F, discarded, PPP not running

PPP: Alloc Context [29F9F32C]

ppp5 PPP: Phase is ESTABLISHING

Se0/0/0 PPP: Using default call direction

Se0/0/0 PPP: Treating connection as a dedicated line

Se0/0/0 PPP: Session handle[34000005] Session id[5]

Se0/0/0 LCP: Event[OPEN] State[Initial to Starting]

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

* + 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(config-if)#

Jun 20 03:01:57.399: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.200.225 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

Jun 20 03:01:59.399: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to down

Jun 20 03:01:59.399: Se0/0/0 PPP: Sending cstate UP notification

Jun 20 03:01:59.399: Se0/0/0 PPP: Processing CstateUp message

Jun 20 03:01:59.399: PPP: Alloc Context [30F8D4F0]

Jun 20 03:01:59.399: ppp9 PPP: Phase is ESTABLISHING

Jun 20 03:01:59.399: Se0/0/0 PPP: Using default call direction

Jun 20 03:01:59.399: Se0/0/0 PPP: Treating connection as a dedicated line

Jun 20 03:01:59.399: Se0/0/0 PPP: Session handle[BA000009] Session id[9]

Jun 20 03:01:59.399: Se0/0/0 LCP: Event[OPEN] State[Initial to Starting]

Jun 20 03:01:59.399: Se0/0/0 LCP: O CONFREQ [Starting] id 1 len 10

Jun 20 03:01:59.399: Se0/0/0 LCP: MagicNumber 0x8D0EAC44 (0x05068D0EAC44)

Jun 20 03:01:59.399: Se0/0/0 LCP: Event[UP] State[Starting to REQsent]

Jun 20 03:01:59.407: Se0/0/0 PPP: I pkt type 0xC021, datagramsize 14 link[ppp]

Jun 20 03:01:59.407: Se0/0/0 LCP: I CONFREQ [REQsent] id 1 len 10

Jun 20 03:01:59.407: Se0/0/0 LCP: MagicNumber 0x73B4F1AF (0x050673B4F1AF)

Jun 20 03:01:59.407: Se0/0/0 LCP: O CONFACK [REQsent] id 1 len 10

Jun 20 03:01:59.407: Se0/0/0 LCP: MagicNumber 0x73B4F1AF (0x050673B4F1AF)

Jun 20 03:01:59.407: Se0/0/0 LCP: Event[Receive ConfReq+] State[REQsent to ACKsent]

Jun 20 03:01:59.407: Se0/0/0 PPP: I pkt type 0xC021, datagramsize 14 link[ppp]

Jun 20 03:01:59.407: Se0/0/0 LCP: I CONFACK [ACKsent] id 1 len 10

Jun 20 03:01:59.407: Se0/0/0 LCP: MagicNumber 0x8D0EAC44 (0x05068D0EAC44)

Jun 20 03:01:59.407: Se0/0/0 LCP: Event[Receive ConfAck] State[ACKsent to Open]

Jun 20 03:01:59.439: Se0/0/0 PPP: Phase is FORWARDING, Attempting Forward

Jun 20 03:01:59.439: Se0/0/0 LCP: State is Open

Jun 20 03:01:59.439: Se0/0/0 PPP: Phase is ESTABLISHING, Finish LCP

Jun 20 03:01:59.439: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

Jun 20 03:01:59.439: Se0/0/0 PPP: Outbound cdp packet dropped, line protocol not up

Jun 20 03:01:59.439: Se0/0/0 PPP: Phase is UP

Jun 20 03:01:59.439: Se0/0/0 IPCP: Protocol configured, start CP. state[Initial]

Jun 20 03:01:59.439: Se0/0/0 IPCP: Event[OPEN] State[Initial to Starting]

Jun 20 03:01:59.439: Se0/0/0 IPCP: O CONFREQ [Starting] id 1 len 10

Jun 20 03:01:59.439: Se0/0/0 IPCP: Address 10.1.1.1 (0x03060A010101)

Jun 20 03:01:59.439: Se0/0/0 IPCP: Event[UP] State[Starting to REQsent]

Jun 20 03:01:59.439: Se0/0/0 CDPCP: Protocol configured, start CP. state[Initial]

<output omitted>

Jun 20 03:01:59.471: Se0/0/0 Added to neighbor route AVL tree: topoid 0, address 10.1.1.2

Jun 20 03:01:59.471: Se0/0/0 IPCP: Install route to 10.1.1.2

Jun 20 03:01:59.471: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 80

Jun 20 03:01:59.479: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 80 link[ip]

Jun 20 03:01:59.479: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 84

Jun 20 03:01:59.483: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 84 link[ip]

Jun 20 03:01:59.483: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 68

Jun 20 03:01:59.491: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 68 link[ip]

Jun 20 03:01:59.491: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 148

Jun 20 03:01:59.511: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 148 link[ip]

Jun 20 03:01:59.511: %OSPF-5-ADJCHG:Process 1, Nbr 209.165.200.225 on Serial0/0/0 from LOADING to FULL, Loading Done

Jun 20 03:01:59.511: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 68

Jun 20 03:01:59.519: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 60 link[ip]

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

Jun 20 03:01:59.393: Se0/0/0 PPP: I pkt type 0xC021, datagramsize 14 link[ppp]

Jun 20 03:01:59.393: Se0/0/0 LCP: I CONFREQ [Open] id 1 len 10

Jun 20 03:01:59.393: Se0/0/0 LCP: MagicNumber 0x8D0EAC44 (0x05068D0EAC44)

Jun 20 03:01:59.393: Se0/0/0 PPP DISC: PPP Renegotiating

Jun 20 03:01:59.393: PPP: NET STOP send to AAA.

Jun 20 03:01:59.393: Se0/0/0 LCP: Event[LCP Reneg] State[Open to Open]

Jun 20 03:01:59.393: Se0/0/0 IPCP: Event[DOWN] State[Open to Starting]

Jun 20 03:01:59.393: Se0/0/0 IPCP: Event[CLOSE] State[Starting to Initial]

Jun 20 03:01:59.393: Se0/0/0 CDPCP: Event[DOWN] State[Open to Starting]

Jun 20 03:01:59.393: Se0/0/0 CDPCP: Event[CLOSE] State[Starting to Initial]

Jun 20 03:01:59.393: Se0/0/0 LCP: Event[DOWN] State[Open to Starting]

Jun 20 03:01:59.393: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to down

Jun 20 03:01:59.393: Se0/0/0 PPP: Outbound cdp packet dropped, NCP not negotiated

Jun 20 03:01:59.393: Se0/0/0 PPP: Phase is DOWN

Jun 20 03:01:59.393: Se0/0/0 Deleted neighbor route from AVL tree: topoid 0, address 10.1.1.1

Jun 20 03:01:59.393: Se0/0/0 IPCP: Remove route to 10.1.1.1

Jun 20 03:01:59.393: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.1 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

Jun 20 03:01:59.397: PPP: Alloc Context [29F9F32C]

Jun 20 03:01:59.397: ppp38 PPP: Phase is ESTABLISHING

Jun 20 03:01:59.397: Se0/0/0 PPP: Using default call direction

Jun 20 03:01:59.397: Se0/0/0 PPP: Treating connection as a dedicated line

<output omitted>

Jun 20 03:01:59.401: Se0/0/0 LCP: MagicNumber 0x73B4F1AF (0x050673B4F1AF)

Jun 20 03:01:59.401: Se0/0/0 LCP: Event[Receive ConfAck] State[ACKsent to Open]

Jun 20 03:01:59.433: Se0/0/0 PPP: Phase is FORWARDING, Attempting Forward

Jun 20 03:01:59.433: Se0/0/0 LCP: State is Open

Jun 20 03:01:59.433: Se0/0/0 PPP: I pkt type 0x8021, datagramsize 14 link[ip]

Jun 20 03:01:59.433: Se0/0/0 PPP: Queue IPCP code[1] id[1]

Jun 20 03:01:59.433: Se0/0/0 PPP: I pkt type 0x8207, datagramsize 8 link[cdp]

Jun 20 03:01:59.433: Se0/0/0 PPP: Discarded CDPCP code[1] id[1]

Jun 20 03:01:59.433: Se0/0/0 PPP: Phase is ESTABLISHING, Finish LCP

Jun 20 03:01:59.433: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

Jun 20 03:01:59.433: Se0/0/0 PPP: Outbound cdp packet dropped, line protocol not up

Jun 20 03:01:59.433: Se0/0/0 PPP: Phase is UP

Jun 20 03:01:59.433: Se0/0/0 IPCP: Protocol configured, start CP. state[Initial]

Jun 20 03:01:59.433: Se0/0/0 IPCP: Event[OPEN] State[Initial to Starting]

Jun 20 03:01:59.433: Se0/0/0 IPCP: O CONFREQ [Starting] id 1 len 10

Jun 20 03:01:59.433: Se0/0/0 IPCP: Address 10.1.1.2 (0x03060A010102)

Jun 20 03:01:59.433: Se0/0/0 IPCP: Event[UP] State[Starting to REQsent]

Jun 20 03:01:59.433: Se0/0/0 CDPCP: Protocol configured, start CP. state[Initial]

Jun 20 03:01:59.433: Se0/0/0 CDPCP: Event[OPEN] State[Initial to Starting]

Jun 20 03:01:59.433: Se0/0/0 CDPCP: O CONFREQ [Starting] id 1 len 4

Jun 20 03:01:59.433: Se0/0/0 CDPCP: Event[UP] State[Starting to REQsent]

<output omitted>

Jun 20 03:01:59.465: Se0/0/0 IPCP: State is Open

Jun 20 03:01:59.465: Se0/0/0 Added to neighbor route AVL tree: topoid 0, address 10.1.1.1

Jun 20 03:01:59.465: Se0/0/0 IPCP: Install route to 10.1.1.1

Jun 20 03:01:59.465: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 80

Jun 20 03:01:59.465: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 80 link[ip]

Jun 20 03:01:59.469: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 84

Jun 20 03:01:59.477: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 84 link[ip]

Jun 20 03:01:59.477: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 68

Jun 20 03:01:59.481: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 68 link[ip]

Jun 20 03:01:59.489: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 148 link[ip]

Jun 20 03:01:59.493: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 148

Jun 20 03:01:59.505: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 68 link[ip]

Jun 20 03:01:59.505: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 60

Jun 20 03:01:59.517: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 88 link[ip]

Jun 20 03:01:59.517: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.1 on Serial0/0/0 from LOADING to FULL, Loading Done

Jun 20 03:01:59.561: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 80

Jun 20 03:01:59.569: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 80 link[ip]

Jun 20 03:02:01.445: Se0/0/0 PPP: I pkt type 0x8207, datagramsize 8 link[cdp]

Jun 20 03:02:01.445: Se0/0/0 CDPCP: I CONFREQ [ACKrcvd] id 2 len 4

Jun 20 03:02:01.445: Se0/0/0 CDPCP: O CONFACK [ACKrcvd] id 2 len 4

Jun 20 03:02:01.445: Se0/0/0 CDPCP: Event[Receive ConfReq+] State[ACKrcvd to Open]

Jun 20 03:02:01.449: Se0/0/0 CDPCP: State is Open

Jun 20 03:02:01.561: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 80

Jun 20 03:02:01.569: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 80 link[ip]

Jun 20 03:02:02.017: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 68

Jun 20 03:02:02.897: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 112 link[ip]

Jun 20 03:02:03.561: Se0/0/0 PPP: O pkt type 0x0021, datagramsize 80

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?

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

* + 1. Issue the **undebug all** (or **u all**) command on the Branch1 and Central routers to turn off all debugging on both routers.
    2. After the network converges, issue the **show ip interface brief** command on the Branch1 and Central routers. What is the status of interface S0/0/0 on both routers?
    3. 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.

* + 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.
   2. 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. Issue the **debug ppp** commands on the Branch3 router to observe the process, which is associated with authentication.

Branch3# **debug ppp negotiation**

PPP protocol negotiation debugging is on

Branch3# **debug ppp packet**

PPP packet display debugging is on

* + 1. Configure the interface S0/0/1 on Branch3 for CHAP authentication.

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

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

* + 1. Examine the debug PPP messages on the Branch3 router during the negotiation with the Central router.

Branch3(config-if)#

Jun 20 04:25:02.079: Se0/0/1 PPP DISC: Authentication configuration changed

Jun 20 04:25:02.079: PPP: NET STOP send to AAA.

Jun 20 04:25:02.079: Se0/0/1 IPCP: Event[DOWN] State[Open to Starting]

Jun 20 04:25:02.079: Se0/0/1 IPCP: Event[CLOSE] State[Starting to Initial]

Jun 20 04:25:02.079: Se0/0/1 CDPCP: Event[DOWN] State[Open to Starting]

Jun 20 04:25:02.079: Se0/0/1 CDPCP: Event[CLOSE] State[Starting to Initial]

Jun 20 04:25:02.079: Se0/0/1 LCP: Event[DOWN] State[Open to Starting]

Jun 20 04:25:02.079: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to down

Jun 20 04:25:02.079: Se0/0/1 PPP: Outbound cdp packet dropped, NCP not negotiated

Jun 20 04:25:02.079: Se0/0/1 PPP: Phase is DOWN

Jun 20 04:25:02.079: Se0/0/1 Deleted neighbor route from AVL tree: topoid 0, address 10.2.2.2

Jun 20 04:25:02.079: Se0/0/1 IPCP: Remove route to 10.2.2.2

Jun 20 04:25:02.079: %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 04:25:02.083: PPP: Alloc Context [29F4DA8C]

Jun 20 04:25:02.083: ppp73 PPP: Phase is ESTABLISHING

Jun 20 04:25:02.083: Se0/0/1 PPP: Using default call direction

Jun 20 04:25:02.083: Se0/0/1 PPP: Treating connection as a dedicated line

Jun 20 04:25:02.083: Se0/0/1 PPP: Session handle[2700004D] Session id[73]

* + 1. Issue the **debug ppp authentication** command to observe the CHAP authentication messages on the Central router.

Central# **debug ppp authentication**

PPP authentication debugging is on

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

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

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

* + 1. Observe the debug PPP messages relating to CHAP authentication on the Central router.

Central(config-if)#

Jun 20 04:25:02.091: Se0/0/1 PPP: I pkt type 0xC021, datagramsize 19 link[ppp]

Jun 20 04:25:02.091: Se0/0/1 LCP: I CONFACK [ACKsent] id 1 len 15

Jun 20 04:25:02.091: Se0/0/1 LCP: AuthProto CHAP (0x0305C22305)

Jun 20 04:25:02.091: Se0/0/1 LCP: MagicNumber 0xF7B20F10 (0x0506F7B20F10)

Jun 20 04:25:02.091: Se0/0/1 LCP: Event[Receive ConfAck] State[ACKsent to Open]

Jun 20 04:25:02.123: Se0/0/1 PPP: Phase is AUTHENTICATING, by this end

Jun 20 04:25:02.123: Se0/0/1 CHAP: O CHALLENGE id 1 len 28 from "Branch3"

Jun 20 04:25:02.123: Se0/0/1 LCP: State is Open

Jun 20 04:25:02.127: Se0/0/1 PPP: I pkt type 0xC223, datagramsize 32 link[ppp]

Jun 20 04:25:02.127: Se0/0/1 CHAP: I RESPONSE id 1 len 28 from "Central"

Jun 20 04:25:02.127: Se0/0/1 PPP: Phase is FORWARDING, Attempting Forward

Jun 20 04:25:02.127: Se0/0/1 PPP: Phase is AUTHENTICATING, Unauthenticated User

Jun 20 04:25:02.127: Se0/0/1 PPP: Sent CHAP LOGIN Request

Jun 20 04:25:02.127: Se0/0/1 PPP: Received LOGIN Response PASS

Jun 20 04:25:02.127: Se0/0/1 IPCP: Authorizing CP

Jun 20 04:25:02.127: Se0/0/1 IPCP: CP stalled on event[Authorize CP]

Jun 20 04:25:02.127: Se0/0/1 IPCP: CP unstall

Jun 20 04:25:02.127: Se0/0/1 PPP: Phase is FORWARDING, Attempting Forward

Jun 20 04:25:02.135: Se0/0/1 PPP: Phase is AUTHENTICATING, Authenticated User

Jun 20 04:25:02.135: Se0/0/1 CHAP: O SUCCESS id 1 len 4

Jun 20 04:25:02.135: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

Jun 20 04:25:02.135: Se0/0/1 PPP: Outbound cdp packet dropped, line protocol not up

Jun 20 04:25:02.135: Se0/0/1 PPP: Phase is UP

Jun 20 04:25:02.135: Se0/0/1 IPCP: Protocol configured, start CP. state[Initial]

Jun 20 04:25:02.135: Se0/0/1 IPCP: Event[OPEN] State[Initial to Starting]

Jun 20 04:25:02.135: Se0/0/1 IPCP: O CONFREQ [Starting] id 1 len 10

* + 1. Issue the **undebug all** (or **u all**) command on the Central and Branch3 routers to turn off all debugging.

Central# **undebug all**

All possible debugging has been turned off

* 1. Intentionally break the serial link configured with authentication.
     1. On the Central router, configure a username for use with Branch1. Assign **cisco** as the password.

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

* + 1. On the Central and Branch1 routers, configure CHAP authentication on interface S0/0/0. What is happening with the interface?

**Note**: To speed up the process, shut down the interface and enable it again.

* + 1. Use a **debug ppp negotiation** command to examine what is happening.

Central# **debug ppp negotiation**

PPP protocol negotiation debugging is on

Central(config-if)#

Jun 20 05:25:26.229: Se0/0/0 PPP: Missed a Link-Up transition, starting PPP

Jun 20 05:25:26.229: Se0/0/0 PPP: Processing FastStart message

Jun 20 05:25:26.229: PPP: Alloc Context [29F9F32C]

Jun 20 05:25:26.229: ppp145 PPP: Phase is ESTABLISHING

Jun 20 05:25:26.229: Se0/0/0 PPP: Using default call direction

Jun 20 05:25:26.229: Se0/0/0 PPP: Treating connection as a dedicated line

Jun 20 05:25:26.229: Se0/0/0 PPP: Session handle[6000009C] Session id[145]

Jun 20 05:25:26.229: Se0/0/0 LCP: Event[OPEN] State[Initial to Starting]

Jun 20 05:25:26.229: Se0/0/0 LCP: O CONFREQ [Starting] id 1 len 15

Jun 20 05:25:26.229: Se0/0/0 LCP: AuthProto CHAP (0x0305C22305)

Jun 20 05:25:26.229: Se0/0/0 LCP: MagicNumber 0x74385C31 (0x050674385C31)

Jun 20 05:25:26.229: Se0/0/0 LCP: Event[UP] State[Starting to REQsent]

Jun 20 05:25:26.229: Se0/0/0 LCP: I CONFREQ [REQsent] id 1 len 10

Jun 20 05:25:26.229: Se0/0/0 LCP: MagicNumber 0x8D920101 (0x05068D920101)

Jun 20 05:25:26.229: Se0/0/0 LCP: O CONFACK [REQsent] id 1 len 10

Jun 20 05:25:26.229: Se0/0/0 LCP: MagicNumber 0x8D920101 (0x05068D920101)

Jun 20 05:25:26.229: Se0/0/0 LCP: Event[Receive ConfReq+] State[REQsent to ACKsent]

Jun 20 05:25:26.233: Se0/0/0 LCP: I CONFACK [ACKsent] id 1 len 15

Jun 20 05:25:26.233: Se0/0/0 LCP: AuthProto CHAP (0x0305C22305)

Jun 20 05:25:26.233: Se0/0/0 LCP: MagicNumber 0x74385C31 (0x050674385C31)

Jun 20 05:25:26.233: Se0/0/0 LCP: Event[Receive ConfAck] State[ACKsent to Open]

Jun 20 05:25:26.261: Se0/0/0 PPP: Phase is AUTHENTICATING, by this end

Jun 20 05:25:26.261: Se0/0/0 CHAP: O CHALLENGE id 1 len 28 from "Central"

Jun 20 05:25:26.261: Se0/0/0 LCP: State is Open

Jun 20 05:25:26.265: Se0/0/0 LCP: I TERMREQ [Open] id 2 len 4

Jun 20 05:25:26.265: Se0/0/0 PPP DISC: Received LCP TERMREQ from peer

Jun 20 05:25:26.265: PPP: NET STOP send to AAA.

Jun 20 05:25:26.265: Se0/0/0 PPP: Phase is TERMINATING

Jun 20 05:25:26.265: Se0/0/0 LCP: O TERMACK [Open] id 2 len 4

Jun 20 05:25:26.265: Se0/0/0 LCP: Event[Receive TermReq] State[Open to Stopping]

Jun 20 05:25:26.265: Se0/0/0 PPP: Sending cstate DOWN notification

Jun 20 05:25:26.265: Se0/0/0 PPP: Processing CstateDown message

Jun 20 05:25:26.265: Se0/0/0 LCP: Event[CLOSE] State[Stopping to Closing]

Jun 20 05:25:26.265: Se0/0/0 LCP: Event[DOWN] State[Closing to Initial]

Jun 20 05:25:26.265: Se0/0/0 PPP: Phase is DOWN

Explain what is causing the link to terminate. Correct the issue and document the command issued to correct the issue in the space provided below.

* + 1. Issue the **undebug all** command on all routers to turn off debugging.
    2. Verify end-to-end connectivity.

1. Reflection
   1. What are the indicators that you may have a serial encapsulation mismatch on a serial link?
   2. What are the indicators that you may have an authentication mismatch on a serial link?