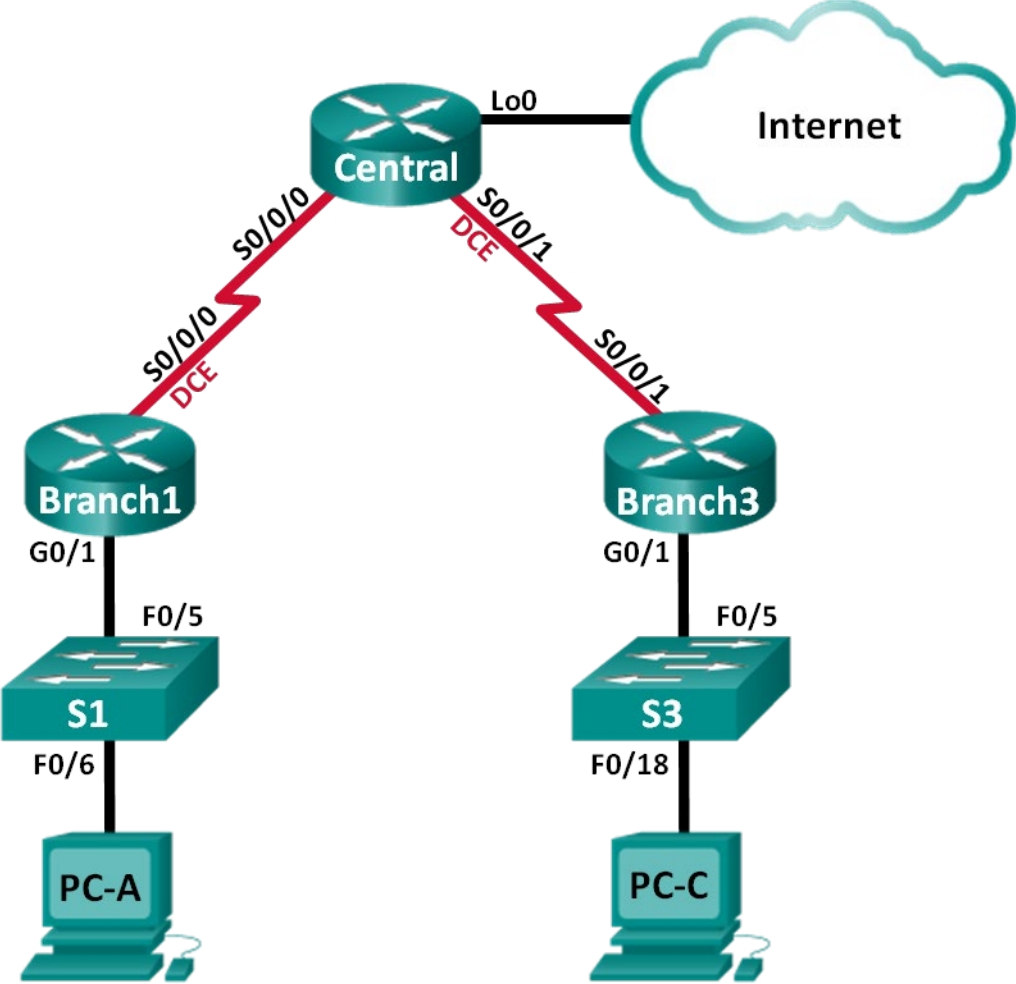


Lab 6 – Configuring Basic PPP with Authentication

Topology



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

Objectives

Part 1: Configure Basic Device Settings

Part 2: Configure PPP Encapsulation

Part 3: Configure PPP CHAP Authentication

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.

Part 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.

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

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

Step 2: 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.

Step 3: Configure basic settings for each router.

- Apply the Basic Settings to the devices as you have done in previous labs. You don't need to configure remote access.
- Apply the IP addresses to Serial and Gigabit Ethernet interfaces according to the Addressing Table and activate the physical interfaces.
- Set the clock rate to **128000** for DCE serial interfaces.
- Create **Loopback0** on the Central router to simulate access to the Internet and assign an IP address according to the Addressing Table.

Step 4: Configure routing.

- 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.
- 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.
- 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.

Step 5: Configure the PCs.

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

Step 6: 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.

Step 7: Save your configurations.

Part 2: Configure PPP Encapsulation

Step 1: Display the default serial encapsulation.

On the routers, issue **show interfaces serial interface-id** to display the current serial 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?

Step 2: Change the serial encapsulation to PPP.

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

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```
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
```

- b. 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 the current interface status for S0/0/0?**
- c. 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
```

- d. Verify that interface S0/0/0 on both Branch1 and Central routers is up/up and is configured with PPP encapsulation.

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

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

```
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
  Intentionally break the serial connection.
```

- e. Issue the **debug ppp** commands to observe the effects of changing the PPP configuration on the Branch1 router and the Central router.

```
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
Central# debug ppp packet
PPP packet display debugging is on
```

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

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Branch1#

```
Jun 20 02:20:45.795: Se0/0/0 PPP: 0 pkt type 0x0021, datagramsize 84
Jun 20 02:20:49.639: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 84 link[ip]
Jun 20 02:20:50.147: Se0/0/0 LCP-FS: I ECHOREQ [Open] id 45 len 12 magic 0x73885AF2
Jun 20 02:20:50.147: Se0/0/0 LCP-FS: O ECHOREP [Open] id 45 len 12 magic 0x8CE1F65F
Jun 20 02:20:50.159: Se0/0/0 LCP: O ECHOREQ [Open] id 45 len 12 magic 0x8CE1F65F
Jun 20 02:20:50.159: Se0/0/0 LCP-FS: I ECHOREP [Open] id 45 len 12 magic 0x73885AF2
Jun 20 02:20:50.159: Se0/0/0 LCP-FS: Received id 45, sent id 45, line up
```

Central#

```
Jun 20 02:20:49.636: Se0/0/0 PPP: 0 pkt type 0x0021, datagramsize 84
Jun 20 02:20:50.148: Se0/0/0 LCP: O ECHOREQ [Open] id 45 len 12 magic 0x73885AF2
Jun 20 02:20:50.148: Se0/0/0 LCP-FS: I ECHOREP [Open] id 45 len 12 magic 0x8CE1F65F
Jun 20 02:20:50.148: Se0/0/0 LCP-FS: Received id 45, sent id 45, line up
Jun 20 02:20:50.160: Se0/0/0 LCP-FS: I ECHOREQ [Open] id 45 len 12 magic 0x8CE1F65F
Jun 20 02:20:50.160: Se0/0/0 LCP-FS: O ECHOREP [Open] id 45 len 12 magic 0x73885AF2
Jun 20 02:20:55.552: Se0/0/0 PPP: I pkt type 0x0021, datagramsize 84 link[ip]
```

- g. 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.**
- h. 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.

```
Jun 20 02:29:50.295: Se0/0/0 PPP DISC: Lower Layer disconnected
Jun 20 02:29:50.295: PPP: NET STOP send to AAA.
Jun 20 02:29:50.299: Se0/0/0 IPCP: Event[DOWN] State[Open to Starting]
Jun 20 02:29:50.299: Se0/0/0 IPCP: Event[CLOSE] State[Starting to Initial]
Jun 20 02:29:50.299: Se0/0/0 CDPCP: Event[DOWN] State[Open to Starting]
Jun 20 02:29:50.299: Se0/0/0 CDPCP: Event[CLOSE] State[Starting to Initial]
Jun 20 02:29:50.299: Se0/0/0 LCP: O TERMREQ [Open] id 7 len 4
Jun 20 02:29:50.299: Se0/0/0 LCP: Event[CLOSE] State[Open to Closing]
Jun 20 02:29:50.299: Se0/0/0 PPP: Phase is TERMINATING
Jun 20 02:29:50.299: Se0/0/0 Deleted neighbor route from AVL tree: topoid 0, address 10.1.1.2
Jun 20 02:29:50.299: Se0/0/0 IPCP: Remove route to 10.1.1.2
Jun 20 02:29:50.299: Se0/0/0 LCP: Event[DOWN] State[Closing to Initial]
Jun 20 02:29:50.299: Se0/0/0 PPP: Phase is DOWN
```

Branch1(config-if)#

```
Jun 20 02:30:17.083: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to down
Jun 20 02:30:17.083: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.200.225 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached
```

- i. 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.

```
Jun 20 02:29:50.296: Se0/0/0 PPP: Sending cstate DOWN notification
Jun 20 02:29:50.296: Se0/0/0 PPP: Processing CstateDown message
Jun 20 02:29:50.296: Se0/0/0 PPP DISC: Lower Layer disconnected
Jun 20 02:29:50.296: PPP: NET STOP send to AAA.
```

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```
Jun 20 02:29:50.296: Se0/0/0 IPCP: Event[DOWN] State[Open to Starting]
Jun 20 02:29:50.296: Se0/0/0 IPCP: Event[CLOSE] State[Starting to Initial]
Jun 20 02:29:50.296: Se0/0/0 CDPCP: Event[DOWN] State[Open to Starting]
Jun 20 02:29:50.296: Se0/0/0 CDPCP: Event[CLOSE] State[Starting to Initial]
Jun 20 02:29:50.296: Se0/0/0 LCP: 0 TERMREQ [Open] id 2 len 4
Jun 20 02:29:50.296: Se0/0/0 LCP: Event[CLOSE] State[Open to Closing]
Jun 20 02:29:50.296: Se0/0/0 PPP: Phase is TERMINATING
Jun 20 02:29:50.296: Se0/0/0 Deleted neighbor route from AVL tree: topoid 0, address 10.1.1.1
Jun 20 02:29:50.296: Se0/0/0 IPCP: Remove route to 10.1.1.1
Jun 20 02:29:50.296: %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 02:29:50.296: Se0/0/0 LCP: Event[DOWN] State[Closing to Initial]
Jun 20 02:29:50.296: Se0/0/0 PPP: Phase is DOWN
Jun 20 02:29:52.296: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed
state to down
Jun 20 02:29:52.296: Se0/0/0 PPP: Sending cstate UP notification
Jun 20 02:29:52.296: Se0/0/0 PPP: Processing CstateUp message
Jun 20 02:29:52.296: PPP: Alloc Context [29F9F32C]
Jun 20 02:29:52.296: ppp3 PPP: Phase is ESTABLISHING
Jun 20 02:29:52.296: Se0/0/0 PPP: Using default call direction
Jun 20 02:29:52.296: Se0/0/0 PPP: Treating connection as a dedicated line
Jun 20 02:29:52.296: Se0/0/0 PPP: Session handle[60000003] Session id[3]
Jun 20 02:29:52.296: Se0/0/0 LCP: Event[OPEN] State[Initial to Starting]
Jun 20 02:29:52.296: Se0/0/0 LCP: 0 CONFREQ [Starting] id 1 len 10
Jun 20 02:29:52.296: Se0/0/0 LCP: MagicNumber 0x7397843B (0x05067397843B)
Jun 20 02:29:52.296: Se0/0/0 LCP: Event[UP] State[Starting to REQsent]
Jun 20 02:29:54.308: Se0/0/0 LCP: 0 CONFREQ [REQsent] id 2 len 10
Jun 20 02:29:54.308: Se0/0/0 LCP: MagicNumber 0x7397843B (0x05067397843B)
Jun 20 02:29:54.308: Se0/0/0 LCP: Event[Timeout+] State[REQsent to REQsent]
Jun 20 02:29:56.080: Se0/0/0 PPP: I pkt type 0x008F, datagramsize 24 link[illegal]
Jun 20 02:29:56.080: Se0/0/0 UNKNOWN(0x008F): Non-NCP packet, discarding
<output omitted>
Jun 20 02:30:10.436: Se0/0/0 LCP: 0 CONFREQ [REQsent] id 10 len 10
Jun 20 02:30:10.436: Se0/0/0 LCP: MagicNumber 0x7397843B (0x05067397843B)
Jun 20 02:30:10.436: Se0/0/0 LCP: Event[Timeout+] State[REQsent to REQsent]
Jun 20 02:30:12.452: Se0/0/0 PPP DISC: LCP failed to negotiate
Jun 20 02:30:12.452: PPP: NET STOP send to AAA.
Jun 20 02:30:12.452: Se0/0/0 LCP: Event[Timeout-] State[REQsent to Stopped]
Jun 20 02:30:12.452: Se0/0/0 LCP: Event[DOWN] State[Stopped to Starting]
Jun 20 02:30:12.452: Se0/0/0 PPP: Phase is DOWN
Jun 20 02:30:14.452: PPP: Alloc Context [29F9F32C]
Jun 20 02:30:14.452: ppp4 PPP: Phase is ESTABLISHING
Jun 20 02:30:14.452: Se0/0/0 PPP: Using default call direction
Jun 20 02:30:14.452: Se0/0/0 PPP: Treating connection as a dedicated line
Jun 20 02:30:14.452: Se0/0/0 PPP: Session handle[6E000004] Session id[4]
Jun 20 02:30:14.452: Se0/0/0 LCP: Event[OPEN] State[Initial to Starting]
Jun 20 02:30:14.452: Se0/0/0 LCP: 0 CONFREQ [Starting] id 1 len 10
Jun 20 02:30:14.452: Se0/0/0 LCP: MagicNumber 0x7397DADA (0x05067397DADA)
```

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```
Jun 20 02:30:14.452: Se0/0/0 LCP: Event[UP] State[Starting to REQsent]
Jun 20 02:30:16.080: Se0/0/0 PPP: I pkt type 0x008F, datagramsize 24 link[illegal]
Jun 20 02:30:16.080: Se0/0/0 UNKNOWN(0x008F): Non-NCP packet, discarding
<output omitted>
Jun 20 02:30:32.580: Se0/0/0 LCP: 0 CONFREQ [REQsent] id 10 len 10
Jun 20 02:30:32.580: Se0/0/0 LCP: MagicNumber 0x7397DADA (0x05067397DADA)
Jun 20 02:30:32.580: Se0/0/0 LCP: Event[Timeout+] State[REQsent to REQsent]
Jun 20 02:30:34.596: Se0/0/0 PPP DISC: LCP failed to negotiate
Jun 20 02:30:34.596: PPP: NET STOP send to AAA.
Jun 20 02:30:34.596: Se0/0/0 LCP: Event[Timeout-] State[REQsent to Stopped]
Jun 20 02:30:34.596: Se0/0/0 LCP: Event[DOWN] State[Stopped to Starting]
Jun 20 02:30:34.596: Se0/0/0 PPP: Phase is DOWN
Jun 20 02:30:36.080: Se0/0/0 PPP: I pkt type 0x008F, discarded, PPP not running
Jun 20 02:30:36.596: PPP: Alloc Context [29F9F32C]
Jun 20 02:30:36.596: ppp5 PPP: Phase is ESTABLISHING
Jun 20 02:30:36.596: Se0/0/0 PPP: Using default call direction
Jun 20 02:30:36.596: Se0/0/0 PPP: Treating connection as a dedicated line
Jun 20 02:30:36.596: Se0/0/0 PPP: Session handle[34000005] Session id[5]
Jun 20 02:30:36.596: 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?

- j. 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
```

- k. 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: 0 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: 0 CONFACK [REQsent] id 1 len 10
```


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```
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]
```

- I. 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]
```


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```
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: 0 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: 0 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]
```

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```
Jun 20 03:01:59.505: Se0/0/0 PPP: 0 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: 0 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: 0 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: 0 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: 0 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?

- m. Issue the **undebg all** (or **u all**) command on the Branch1 and Central routers to turn off all debugging on both routers.
- n. 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?**
- o. 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.
- p. 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
```

- q. Verify that end-to-end connectivity is restored before continuing to Part 3.

Part 3: Configure PPP CHAP Authentication

Step 1: Verify that PPP encapsulation is configured on all serial interfaces.

Step 2: Configure PPP CHAP authentication for the link between the Central router and the Branch3 router.

- a. Configure a username for CHAP authentication.

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

- b. 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
```

- c. Configure the interface S0/0/1 on Branch3 for CHAP authentication.

```
Branch3(config)# interface s0/0/1  
Branch3(config-if)# ppp authentication chap
```

- d. 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
```

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

- e. 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
```

- f. Configure CHAP authentication on S0/0/1 on the Central router.

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

- g. 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: 0 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 un stall
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: 0 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: 0 CONFREQ [Starting] id 1 len 10
```

- h. 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
```

Step 3: Intentionally break the serial link configured with authentication.

- a. On the Central router, configure a username for use with Branch1. Assign **cisco** as the password.

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

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- b. 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.

- c. 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.

- d. Issue the **undebug all** command on all routers to turn off debugging.
- e. Verify end-to-end connectivity.

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?