Lab – Configuring Basic PPP with Authentication (Instructor Version)

**Instructor Note**: Red font color or Gray highlights indicate text that appears in the instructor copy only.

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 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.

**Instructor Note**: Refer to the Instructor Lab Manual for the procedures to initialize and reload devices.

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 7, Vista, or XP 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.

* 1. Initialize and reload the routers and switches.
	2. Configure basic settings for each router.
		1. Disable DNS lookup.
		2. Configure the device name.
		3. Encrypt plain text 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.
		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.

**Branch1:**

Branch1# **show ip route ospf**

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

 D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

 N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

 E1 - OSPF external type 1, E2 - OSPF external type 2

 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

 ia - IS-IS inter area, \* - candidate default, U - per-user static route

 o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

 + - replicated route, % - next hop override

Gateway of last resort is 10.1.1.2 to network 0.0.0.0

O\*E2 0.0.0.0/0 [110/1] via 10.1.1.2, 00:04:10, Serial0/0/0

 10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks

O 10.2.2.0/30 [110/128] via 10.1.1.2, 00:04:20, Serial0/0/0

O 192.168.3.0/24 [110/129] via 10.1.1.2, 00:03:21, Serial0/0/0

Branch1# **show ip ospf interface brief**

Interface PID Area IP Address/Mask Cost State Nbrs F/C

Se0/0/0 1 0 10.1.1.1/30 64 P2P 1/1

Gi0/1 1 0 192.168.1.1/24 1 DR 0/0

Branch1# **show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface

209.165.200.225 0 FULL/ - 00:00:33 10.1.1.2 Serial0/0/0

**Central:**

Central# **show ip route ospf**

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

 D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

 N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

 E1 - OSPF external type 1, E2 - OSPF external type 2

 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

 ia - IS-IS inter area, \* - candidate default, U - per-user static route

 o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

 + - replicated route, % - next hop override

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

O 192.168.1.0/24 [110/65] via 10.1.1.1, 00:07:43, Serial0/0/0

O 192.168.3.0/24 [110/65] via 10.2.2.1, 00:06:38, Serial0/0/1

Central# **show ip ospf interface brief**

Interface PID Area IP Address/Mask Cost State Nbrs F/C

Se0/0/1 1 0 10.2.2.2/30 64 P2P 1/1

Se0/0/0 1 0 10.1.1.2/30 64 P2P 1/1

Central# **show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface

192.168.3.1 0 FULL/ - 00:00:33 10.2.2.1 Serial0/0/1

192.168.1.1 0 FULL/ - 00:00:36 10.1.1.1 Serial0/0/0

**Branch3:**

Branch3# **show ip route ospf**

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

 D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

 N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

 E1 - OSPF external type 1, E2 - OSPF external type 2

 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

 ia - IS-IS inter area, \* - candidate default, U - per-user static route

 o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

 + - replicated route, % - next hop override

Gateway of last resort is 10.2.2.2 to network 0.0.0.0

O\*E2 0.0.0.0/0 [110/1] via 10.2.2.2, 00:08:14, Serial0/0/1

 10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks

O 10.1.1.0/30 [110/128] via 10.2.2.2, 00:08:14, Serial0/0/1

O 192.168.1.0/24 [110/129] via 10.2.2.2, 00:08:14, Serial0/0/1

Branch3# **show ip ospf interface brief**

Interface PID Area IP Address/Mask Cost State Nbrs F/C

Se0/0/1 1 0 10.2.2.1/30 64 P2P 1/1

Gi0/1 1 0 192.168.3.1/24 1 DR 0/0

Branch3# **show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface

209.165.200.225 0 FULL/ - 00:00:37 10.2.2.2 Serial0/0/1

* 1. 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.

**Note**: It may be necessary to disable the PC firewall to ping between PCs.

* 1. Save your configurations.
1. Configure PPP Encapsulation
	1. Display the default serial encapsulation.

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

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 HDLC, loopback not set

 Keepalive set (10 sec)

 Last input 00:00:02, output 00:00:05, output hang never

 Last clearing of "show interface" counters never

 Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0

 Queueing strategy: fifo

 Output queue: 0/40 (size/max)

 5 minute input rate 0 bits/sec, 0 packets/sec

 5 minute output rate 0 bits/sec, 0 packets/sec

 1003 packets input, 78348 bytes, 0 no buffer

 Received 527 broadcasts (0 IP multicasts)

 0 runts, 0 giants, 0 throttles

 0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort

 1090 packets output, 80262 bytes, 0 underruns

 0 output errors, 0 collisions, 3 interface resets

 0 unknown protocol drops

 0 output buffer failures, 0 output buffers swapped out

 2 carrier transitions

 DCD=up DSR=up DTR=up RTS=up CTS=up

What is the default serial encapsulation for a Cisco router? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ HDLC

* 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?

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Branch1# **show ip interface brief**

Line status is up, and line protocol is down.

Branch1# **show ip interface brief**

Interface IP-Address OK? Method Status Protocol

Embedded-Service-Engine0/0 unassigned YES unset administratively down down

GigabitEthernet0/0 unassigned YES unset administratively down down

GigabitEthernet0/1 192.168.1.1 YES manual up up

Serial0/0/0 10.1.1.1 YES manual up down

Serial0/0/1 unassigned YES unset administratively down down

* + 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.

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

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

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Internet Protocol Control Protocol (IPCP) and Cisco Discovery Protocol Control Protocol (CDPCP)

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

 Keepalive set (10 sec)

 Last input 00:00:00, output 00:00:00, output hang never

 Last clearing of "show interface" counters 00:03:58

 Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0

 Queueing strategy: fifo

 Output queue: 0/40 (size/max)

 5 minute input rate 0 bits/sec, 0 packets/sec

 5 minute output rate 0 bits/sec, 0 packets/sec

 77 packets input, 4636 bytes, 0 no buffer

 Received 0 broadcasts (0 IP multicasts)

 0 runts, 0 giants, 0 throttles

 0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort

 117 packets output, 5800 bytes, 0 underruns

 0 output errors, 0 collisions, 8 interface resets

 22 unknown protocol drops

 0 output buffer failures, 0 output buffers swapped out

 18 carrier transitions

 DCD=up DSR=up DTR=up RTS=up CTS=up

Central# **show interfaces s0/0/0**

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

 Hardware is WIC MBRD Serial

 Internet address is 10.1.1.2/30

 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

 Keepalive set (10 sec)

 Last input 00:00:02, output 00:00:03, output hang never

 Last clearing of "show interface" counters 00:01:20

 Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0

 Queueing strategy: fifo

 Output queue: 0/40 (size/max)

 5 minute input rate 0 bits/sec, 0 packets/sec

 5 minute output rate 0 bits/sec, 0 packets/sec

 41 packets input, 2811 bytes, 0 no buffer

 Received 0 broadcasts (0 IP multicasts)

 0 runts, 0 giants, 0 throttles

 0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort

 40 packets output, 2739 bytes, 0 underruns

 0 output errors, 0 collisions, 0 interface resets

 0 unknown protocol drops

 0 output buffer failures, 0 output buffers swapped out

 0 carrier transitions

 DCD=up DSR=up DTR=up RTS=up CTS=up

* 1. Intentionally break the serial connection.
		1. 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

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

Branch1#

Jun 20 02:20:45.795: Se0/0/0 PPP: O 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: O 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]

* + 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.

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

Branch1(config-if)# **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.

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 02:29:50.29

Branch1(config-if)#9: 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

* + 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. 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.

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: O 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: O 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: O 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: O 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: O CONFREQ [Starting] id 1 len 10

.Jun 20 02:30:14.452: Se0/0/0 LCP: MagicNumber 0x7397DADA (0x05067397DADA)

.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: O 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?

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The link goes down, and the OSPF adjacency is broken. PPP keeps trying to establish a connection with the opposite end of the link as indicated by the message “Phase is ESTABLISHING”. However, because it keeps receiving a non-NCP packet, LCP fails to negotiate and the link stays 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(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?

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PPP goes through the following phases: DOWN, ESTABLISHING, and UP.

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

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The link comes up, and the OSPF adjacency is restored.

* + 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?

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Serial 0/0/0 has status up and protocol up.

Branch1# **show ip interface brief**

Interface IP-Address OK? Method Status Protocol

Embedded-Service-Engine0/0 unassigned YES unset administratively down down

GigabitEthernet0/0 unassigned YES unset administratively down down

GigabitEthernet0/1 192.168.1.1 YES manual up up

Serial0/0/0 10.1.1.1 YES manual up up

Serial0/0/1 unassigned YES unset administratively down down

Central# **show ip interface brief**

Interface IP-Address OK? Method Status Protocol

Embedded-Service-Engine0/0 unassigned YES unset administratively down down

GigabitEthernet0/0 unassigned YES unset administratively down down

GigabitEthernet0/1 unassigned YES unset administratively down down

Serial0/0/0 10.1.1.2 YES manual up up

Serial0/0/1 10.2.2.2 YES manual up up

Loopback0 209.165.200.225 YES manual up up

* + 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.

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

Central# **show interfaces 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.

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**show running-config** with output modifiers or **show interfaces** *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. 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]

<output omitted>

.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

<output omitted>

.Jun 20 04:25:02.143: Se0/0/1 CDPCP: I CONFACK [ACKsent] id 1 len 4

.Jun 20 04:25:02.143: Se0/0/1 CDPCP: Event[Receive ConfAck] State[ACKsent to Open]

.Jun 20 04:25:02.155: Se0/0/1 IPCP: State is Open

.Jun 20 04:25:02.155: Se0/0/1 CDPCP: State is Open

.Jun 20 04:25:02.155: Se0/0/1 Added to neighbor route AVL tree: topoid 0, address 10.2.2.2

.Jun 20 04:25:02.155: Se0/0/1 IPCP: Install route to 10.2.2.2

.Jun 20 04:25:02.155: Se0/0/1 PPP: O pkt type 0x0021, datagramsize 80

.Jun 20 04:25:02.155: Se0/0/1 PPP: I pkt type 0x0021, datagramsize 80 link[ip]

.Jun 20 04:25:02.155: Se0/0/1 PPP: O pkt type 0x0021, datagramsize 84

.Jun 20 04:25:02.167: Se0/0/1 PPP: I pkt type 0x0021, datagramsize 84 link[ip]

.Jun 20 04:25:02.167: Se0/0/1 PPP: O pkt type 0x0021, datagramsize 68

.Jun 20 04:25:02.171: Se0/0/1 PPP: I pkt type 0x0021, datagramsize 68 link[ip]

.Jun 20 04:25:02.171: Se0/0/1 PPP: O pkt type 0x0021, datagramsize 148

.Jun 20 04:25:02.191: Se0/0/1 PPP: I pkt type 0x0021, datagramsize 148 link[ip]

.Jun 20 04:25:02.191: %OSPF-5-ADJCHG: Process 1, Nbr 209.165.200.225 on Serial0/0/1 from LOADING to FULL, Loading Done

.Jun 20 04:25:02.191: Se0/0/1 PPP: O pkt type 0x0021, datagramsize 68

.Jun 20 04:25:02.571: Se0/0/1 PPP: O pkt type 0x0021, datagramsize 80

.Jun 20 04:25:03.155: Se0/0/1 PPP: I pkt type 0x0207, datagramsize 333 link[cdp]

.Jun 20 04:25:03.155: Se0/0/1 PPP: O pkt type 0x0207, datagramsize 339

.Jun 20 04:25:04.155: Se0/0/1 PPP: O pkt type 0x0207, datagramsize 339

From the PPP debug messages, what phases did the Branch3 router go through before the link is up with the Central router?

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PPP goes through the following phases: DOWN, ESTABLISHING, AUTHENTICATING, and UP.

* + 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 05:05:16.057: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to down

.Jun 20 05:05:16.061: %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 05:05:16.061: Se0/0/1 PPP: Using default call direction

.Jun 20 05:05:16.061: Se0/0/1 PPP: Treating connection as a dedicated line

.Jun 20 05:05:16.061: Se0/0/1 PPP: Session handle[12000078] Session id[112]

.Jun 20 05:05:16.081: Se0/0/1 CHAP: O CHALLENGE id 1 len 28 from "Central"

.Jun 20 05:05:16.089: Se0/0/1 CHAP: I CHALLENGE id 1 len 28 from "Branch3"

.Jun 20 05:05:16.089: Se0/0/1 PPP: Sent CHAP SENDAUTH Request

.Jun 20 05:05:16.089: Se0/0/1 PPP: Received SENDAUTH Response PASS

.Jun 20 05:05:16.089: Se0/0/1 CHAP: Using hostname from configured hostname

.Jun 20 05:05:16.089: Se0/0/1 CHAP: Using password from AAA

.Jun 20 05:05:16.089: Se0/0/1 CHAP: O RESPONSE id 1 len 28 from "Central"

.Jun 20 05:05:16.093: Se0/0/1 CHAP: I RESPONSE id 1 len 28 from "Branch3"

.Jun 20 05:05:16.093: Se0/0/1 PPP: Sent CHAP LOGIN Request

.Jun 20 05:05:16.093: Se0/0/1 PPP: Received LOGIN Response PASS

.Jun 20 05:05:16.093: Se0/0/1 CHAP: O SUCCESS id 1 len 4

.Jun 20 05:05:16.097: Se0/0/1 CHAP: I SUCCESS id 1 len 4

.Jun 20 05:05:16.097: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

.Jun 20 05:05:16.165: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.3.1 on Serial0/0/1 from LOADING to FULL, Loading Done

* + 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?

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The interface S0/0/0 is going up and down.

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

.Jun 20 05:23:55.032: %LINK-3-UPDOWN: Interface Serial0/0/0, changed state to up

Central(config-if)#

.Jun 20 05:23:57.064: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

.Jun 20 05:23:57.076: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to down

Central(config-if)#

.Jun 20 05:24:03.144: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

.Jun 20 05:24:03.156: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to down

Central(config-if)#

* + 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.

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The link terminated because the CHAP handshake cannot be completed without the correct user credential on Branch1.

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

* + 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?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Some of the indicators are: the network is no longer converged because some of the routes are removed and the line protocol for the link is down.

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

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Some of the indicators are: the route is removed from the routing table and the line protocol goes up and down.

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. |

1. Device Configs
2. Branch1

Branch1# show run

Building configuration...

Current configuration : 1832 bytes

version 15.2

service timestamps debug datetime msec

service timestamps log datetime msec

service password-encryption

!

hostname Branch1

!

boot-start-marker

boot-end-marker

!

!

enable secret 4 06YFDUHH61wAE/kLkDq9BGho1QM5EnRtoyr8cHAUg.2

!

no aaa new-model

memory-size iomem 15

!

ip cef

!

!

!

!

!

no ip domain lookup

no ipv6 cef

multilink bundle-name authenticated

!

!

!

!

username Central password 7 1511021F0725

!

!

!

!

!

!

interface Embedded-Service-Engine0/0

 no ip address

 shutdown

!

interface GigabitEthernet0/0

 no ip address

 shutdown

 duplex auto

 speed auto

!

interface GigabitEthernet0/1

 ip address 192.168.1.1 255.255.255.0

 duplex auto

 speed auto

!

interface Serial0/0/0

 ip address 10.1.1.1 255.255.255.252

 encapsulation ppp

 ppp authentication chap

 clock rate 128000

!

interface Serial0/0/1

 no ip address

 shutdown

!

router ospf 1

 network 10.1.1.0 0.0.0.3 area 0

 network 192.168.1.0 0.0.0.255 area 0

!

ip forward-protocol nd

!

no ip http server

no ip http secure-server

!

!

!

!

!

control-plane

!

!

banner motd ^C

 Unauthorized Access Prohibited.^C

!

line con 0

 password 7 094F471A1A0A

 logging synchronous

 login

line aux 0

line 2

 no activation-character

 no exec

 transport preferred none

 transport input all

 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh

 stopbits 1

line vty 0 4

 password 7 121A0C041104

 login

 transport input all

line vty 5 15

 password 7 110A1016141D

 login

 transport input all

!

scheduler allocate 20000 1000

!

end

1. Central

Central#show run

Building configuration...

Current configuration : 1964 bytes

version 15.2

service timestamps debug datetime msec

service timestamps log datetime msec

service password-encryption

!

hostname Central

!

boot-start-marker

boot-end-marker

!

!

enable secret 4 06YFDUHH61wAE/kLkDq9BGho1QM5EnRtoyr8cHAUg.2

!

no aaa new-model

memory-size iomem 15

!

ip cef

!

!

!

!

!

!

no ip domain lookup

no ipv6 cef

!

multilink bundle-name authenticated

!

!

!

!

username Branch3 password 7 1511021F0725

username Branch1 password 7 05080F1C2243

!

redundancy

!

!

!

!

!

!

!

!

!

!

!

!

!

!

interface Loopback0

 ip address 209.165.200.225 255.255.255.224

!

interface Embedded-Service-Engine0/0

 no ip address

 shutdown

!

interface GigabitEthernet0/0

 no ip address

 shutdown

 duplex auto

 speed auto

!

interface GigabitEthernet0/1

 no ip address

 shutdown

 duplex auto

 speed auto

!

interface Serial0/0/0

 ip address 10.1.1.2 255.255.255.252

 encapsulation ppp

 ppp authentication chap

!

interface Serial0/0/1

 ip address 10.2.2.2 255.255.255.252

 encapsulation ppp

 ppp authentication chap

 clock rate 128000

!

router ospf 1

 network 10.1.1.0 0.0.0.3 area 0

 network 10.2.2.0 0.0.0.3 area 0

 default-information originate

!

ip forward-protocol nd

!

no ip http server

no ip http secure-server

!

ip route 0.0.0.0 0.0.0.0 Loopback0

!

!

!

!

control-plane

!

!

banner motd ^C

 Unauthorized Access Prohibited.^C

!

line con 0

 password 7 00071A150754

 logging synchronous

 login

line aux 0

line 2

 no activation-character

 no exec

 transport preferred none

 transport input all

 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh

 stopbits 1

line vty 0 4

 password 7 060506324F41

 login

 transport input all

line vty 5 15

 password 7 14141B180F0B

 login

 transport input all

!

scheduler allocate 20000 1000

!

end

1. Branch3

Branch3# show run

Building configuration...

Current configuration : 1929 bytes

!

version 15.2

service timestamps debug datetime msec

service timestamps log datetime msec

service password-encryption

!

hostname Branch3

!

boot-start-marker

boot-end-marker

!

!

enable secret 4 06YFDUHH61wAE/kLkDq9BGho1QM5EnRtoyr8cHAUg.2

!

no aaa new-model

memory-size iomem 15

!

ip cef

!

!

!

!

!

no ip domain lookup

no ipv6 cef

!

multilink bundle-name authenticated

!

!

username Central password 7 0822455D0A16

!

redundancy

!

!

!

!

!

!

!

!

!

interface Embedded-Service-Engine0/0

 no ip address

 shutdown

!

interface GigabitEthernet0/0

 no ip address

 shutdown

 duplex auto

 speed auto

!

interface GigabitEthernet0/1

 ip address 192.168.3.1 255.255.255.0

 duplex auto

 speed auto

!

interface Serial0/0/0

 no ip address

 shutdown

 clock rate 2000000

!

interface Serial0/0/1

 ip address 10.2.2.1 255.255.255.252

 encapsulation ppp

 ppp authentication chap

!

router ospf 1

 network 10.2.2.0 0.0.0.3 area 0

 network 192.168.3.0 0.0.0.255 area 0

!

ip forward-protocol nd

!

no ip http server

no ip http secure-server

!

!

!

!

!

control-plane

!

!

banner motd ^C

 Unauthorized Access Prohibited.^C

!

line con 0

 password 7 13061E010803

 logging synchronous

 login

line aux 0

line 2

 no activation-character

 no exec

 transport preferred none

 transport input all

 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh

 stopbits 1

line vty 0 4

 password 7 045802150C2E

 login

 transport input all

line vty 5 15

 password 7 13061E010803

 login

 transport input all

!

scheduler allocate 20000 1000

!

end