33-1 WAN Configuration - Answer Key

In this lab you will configure Wide Area Network connectivity for a company with offices in New York and Boston.

You will configure PPP with PAP authentication for a single leased line in New York site 1.
You will configure MultiLink PPP with CHAP authentication for New York site 2.
You will configure PPPoE for the DSL connection in the Boston office.
Finally you will configure a GRE tunnel between New York site 1 and Boston.

The SP1 and SP2 routers have already been configured at the service provider.

EXT_S1 is an external server at 203.0.113.18 which can be used to test Internet connectivity.

Host Setup

1) Configure the IP address and default gateway on PC1, PC2 and Ext_S1 as shown:

```
PC1> ip 10.0.0.10/24 10.0.0.1

PC2> ip 10.0.1.10/24 10.0.1.1

EXT_S1> ip 203.0.113.18/30 203.0.113.17
```

PPP with PAP Authentication

2) Configure the leased line from router NY-CPE1 to the service provider router SP1 according to the network topology diagram.
   Interface Serial 4/0 is used on both sides of the link.
   The service provider has instructed you to configure PPP with PAP authentication using the username **NY1** and password **Flackbox**.
   Configure one way authentication, do not authenticate the service provider.
   Configure a bandwidth of 128kbps.

```
NY-CPE1(config)#int s4/0
NY-CPE1(config-if)#ip add 203.0.113.2 255.255.255.252
NY-CPE1(config-if)#encapsulation ppp
NY-CPE1(config-if)#ppp pap sent-username NY1 password Flackbox
NY-CPE1(config-if)#bandwidth 128
NY-CPE1(config-if)#no shutdown
```

3) Verify the interface is up.

```
NY-CPE1#show ip int brief
Interface              IP-Address      OK? Method Status
Protocol
FastEthernet0/0        unassigned      YES NVRAM  administratively down down
FastEthernet1/0        10.0.0.1        YES NVRAM  up                    up
FastEthernet2/0        unassigned      YES NVRAM  administratively down down
FastEthernet3/0        unassigned      YES NVRAM  administratively down down
Serial4/0              203.0.113.2     YES manual up                    up
```

4) Ping the service provider to verify connectivity.

```
NY-CPE1#ping 203.0.113.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.1, timeout is 2
seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
48/52/56 ms
```

5) Configure a default static route for Internet access over the leased line.

```
NY-CPE1(config)#ip route 0.0.0.0 0.0.0.0 203.0.113.1
```

6) Ping the external server at 203.0.113.18 from NY-CPE1 to verify Internet access.

```
NY-CPE1#ping 203.0.113.18
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.18, timeout is
2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max =
72/157/404 ms
```

7) Do you expect PC1 to be able to ping the external server at 203.0.113.18? Why or why not? Verify this.

PC1 is using a private IP address and NAT has not been configured so it will not be able to ping the external server.

```
PC1> ping 203.0.113.18
203.0.113.18 icmp_seq=1 timeout
203.0.113.18 icmp_seq=2 timeout
203.0.113.18 icmp_seq=3 timeout
203.0.113.18 icmp_seq=4 timeout
203.0.113.18 icmp_seq=5 timeout
```

At this point we would normally configure NAT to allow Internet connectivity from the PCs in New York site 1 (and also configure security) but it is not required in this lab.

MultiLink PPP with CHAP Authentication

8) Configure a MultiLink PPP leased line from router BOS-CPE to the service provider router SP2 according to the network topology diagram.
Interfaces Serial 4/0 and 4/1 are used on both sides of the link.
The service provider has instructed you to configure PPP with two way CHAP authentication using the password **Flackbox2**. The service provider router's hostname is **SP2**.
Configure a bandwidth of 256kbps.

```
BOS-CPE(config)#username SP2 password Flackbox2

BOS-CPE(config)#interface multilink 1
BOS-CPE(config-if)#ip address 203.0.113.10 255.255.255.252
BOS-CPE(config-if)#ppp multilink
BOS-CPE(config-if)#ppp multilink group 1
BOS-CPE(config-if)#ppp authentication chap
BOS-CPE(config-if)#bandwidth 256
BOS-CPE(config-if)#exit

BOS-CPE(config)#interface serial 4/0
BOS-CPE(config-if)#no ip address
BOS-CPE(config-if)#encapsulation ppp
BOS-CPE(config-if)#ppp multilink
BOS-CPE(config-if)#ppp multilink group 1
BOS-CPE(config-if)#no shutdown
BOS-CPE(config-if)#exit

BOS-CPE(config)#interface serial 4/1
BOS-CPE(config)#no ip address
BOS-CPE(config-if)#encapsulation ppp
BOS-CPE(config-if)#ppp multilink
BOS-CPE(config-if)#ppp multilink group 1
BOS-CPE(config-if)#no shutdown
```

9) Verify the interface is up.

```
BOS-CPE#show ip int brief
Interface              IP-Address      OK? Method Status
Protocol
FastEthernet0/0        unassigned      YES NVRAM  administratively down down
FastEthernet1/0        10.0.1.1        YES NVRAM  up                    up
FastEthernet2/0        unassigned      YES NVRAM  administratively down down
FastEthernet3/0        unassigned      YES NVRAM  administratively down down
Serial4/0              unassigned      YES unset  up                    up
Serial4/1              unassigned      YES unset  up                    up
Serial4/2              unassigned      YES unset  administratively down down
Serial4/3              unassigned      YES unset  administratively down down
Multilink1             203.0.113.10    YES manual up                    up
```

10) Ping the service provider to verify connectivity.

```
BOS-CPE#ping 203.0.113.9
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.9, timeout is 2
seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
48/52/60 ms
```

11) Configure a default static route for Internet access over the leased line.

```
BOS-CPE(config)#ip route 0.0.0.0 0.0.0.0 203.0.113.9
```

12) Ping the external server at 203.0.113.18 from BOS-CPE to verify Internet access.

```
BOS-CPE#ping 203.0.113.18
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.18, timeout is
2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max =
52/139/388 ms
```

PPPoE

13) Configure PPPoE from router NY-CPE2 to the service provider router SP1 according to the network topology diagram.
Interface FastEthernet 0/0 is used on both sides of the link.
The service provider has instructed you to configure PPP with CHAP authentication using the password **Flackbox3**.
Configure one way authentication, do not authenticate the service provider.

```
NY-CPE2(config)#interface dialer1
NY-CPE2(config-if)#dialer pool 1
NY-CPE2(config-if)#encapsulation ppp
NY-CPE2(config-if)#ip address negotiated
NY-CPE2(config-if)#ppp chap password Flackbox3

NY-CPE2(config)#interface f0/0
NY-CPE2(config-if)#no ip address
NY-CPE2(config-if)#pppoe-client dial-pool-number 1
NY-CPE2(config-if)#no shutdown
```

14) Verify the interface is up.

```
NY-CPE2#sh ip int brief
Interface              IP-Address      OK? Method Status
Protocol
FastEthernet0/0        unassigned      YES unset  up                    up
FastEthernet1/0        unassigned      YES unset  administratively down down
FastEthernet2/0        unassigned      YES unset  administratively down down
FastEthernet3/0        unassigned      YES unset  administratively down down
Serial4/0              unassigned      YES unset  administratively down down
Serial4/1              unassigned      YES unset  administratively down down
Serial4/2              unassigned      YES unset  administratively down down
Serial4/3              unassigned      YES unset  administratively down down
Dialer1                203.0.113.6     YES IPCP   up                    up
Virtual-Access1        unassigned      YES unset  up                    up
```

15) Ping the service provider to verify connectivity.

```
NY-CPE2#ping 203.0.113.5
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.5, timeout is 2
seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
48/54/68 ms
```

16) Configure a default static route for Internet access.

```
NY-CPE2(config)#ip route 0.0.0.0 0.0.0.0 203.0.113.5
```

17) Ping the external server at 203.0.113.18 from NY-CPE2 to verify Internet access.

```
NY-CPE2#ping 203.0.113.18
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.18, timeout is
2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max =
52/178/512 ms
```

GRE

18) Configure a GRE tunnel between NY-CPE1 and BOS-CPE. Use IP addresses in the 192.168.0.0/30 subnet for the tunnel interfaces.

```
NY-CPE1(config)#interface Tunnel1
NY-CPE1(config-if)#ip address 192.168.0.1 255.255.255.252
NY-CPE1(config-if)#tunnel source 203.0.113.2
NY-CPE1(config-if)#tunnel destination 203.0.113.10

BOS-CPE(config)#interface Tunnel1
BOS-CPE(config-if)#ip address 192.168.0.2 255.255.255.252
BOS-CPE(config-if)#tunnel source 203.0.113.10
BOS-CPE(config-if)#tunnel destination 203.0.113.2
```

19) The tunnel interfaces will be up as long as the underlying physical interfaces are up. Verify the tunnel setup and connectivity by pinging the tunnel interface on BOS-CPE from NY-CPE1.

```
NY-CPE1#ping 192.168.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.2, timeout is 2
seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
80/89/104 ms
```

20) Do you expect PC1 in New York to be able to ping PC2 in Boston? Why or why not? Verify this.

PC1 will not be able to ping PC2. The GRE tunnel is up but routing has not been configured to send any traffic over the tunnel.

```
PC1> ping 10.0.1.10
10.0.1.10 icmp_seq=1 timeout
10.0.1.10 icmp_seq=2 timeout
10.0.1.10 icmp_seq=3 timeout
10.0.1.10 icmp_seq=4 timeout
10.0.1.10 icmp_seq=5 timeout
```

21) Verify the tunnel interface appears in the routing tables on NY-CPE1 and BOS-CPE.

```
NY-CPE1#sh ip route
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 203.0.113.1 to network 0.0.0.0

S*    0.0.0.0/0 [1/0] via 203.0.113.1
      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        10.0.0.0/24 is directly connected, FastEthernet1/0
L        10.0.0.1/32 is directly connected, FastEthernet1/0
      192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/30 is directly connected, Tunnel1
L        192.168.0.1/32 is directly connected, Tunnel1
      203.0.113.0/24 is variably subnetted, 3 subnets, 2 masks
C        203.0.113.0/30 is directly connected, Serial4/0
C        203.0.113.1/32 is directly connected, Serial4/0
L        203.0.113.2/32 is directly connected, Serial4/0

BOS-CPE#sh ip route
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 203.0.113.9 to network 0.0.0.0

S*    0.0.0.0/0 [1/0] via 203.0.113.9
      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        10.0.1.0/24 is directly connected, FastEthernet1/0
L        10.0.1.1/32 is directly connected, FastEthernet1/0
      192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/30 is directly connected, Tunnel1
L        192.168.0.2/32 is directly connected, Tunnel1
      203.0.113.0/24 is variably subnetted, 3 subnets, 2 masks
C        203.0.113.8/30 is directly connected, Multilink1
C        203.0.113.9/32 is directly connected, Multilink1
L        203.0.113.10/32 is directly connected, Multilink1
```

22) Enable single area OSPF on NY-CPE1 and BOS-CPE. Ensure that the PCs in New York site 1 and Boston have connectivity to each other. Do not enable OSPF on the Internet facing FastEthernet 0/0 interface.

```
NY-CPE1(config)#router ospf 1
NY-CPE1(config-router)#network 10.0.0.0 0.0.255.255 area 0
NY-CPE1(config-router)#network 192.168.0.0 0.0.0.3 area 0

BOS-CPE(config)#router ospf 1
BOS-CPE(config-router)#network 10.0.0.0 0.0.255.255 area 0
BOS-CPE(config-router)#network 192.168.0.0 0.0.0.3 area 0
```

You can use different wildcard masks in the network statements as long as the FastEthernet1/0 and Tunnel1 interfaces are matched.

23) Ping PC2 from PC1 to verify connectivity through the GRE tunnel.

```
PC1> ping 10.0.1.10
84 bytes from 10.0.1.10 icmp_seq=1 ttl=62 time=150.103 ms
84 bytes from 10.0.1.10 icmp_seq=2 ttl=62 time=71.048 ms
84 bytes from 10.0.1.10 icmp_seq=3 ttl=62 time=80.053 ms
84 bytes from 10.0.1.10 icmp_seq=4 ttl=62 time=78.053 ms
84 bytes from 10.0.1.10 icmp_seq=5 ttl=62 time=80.056 ms
```