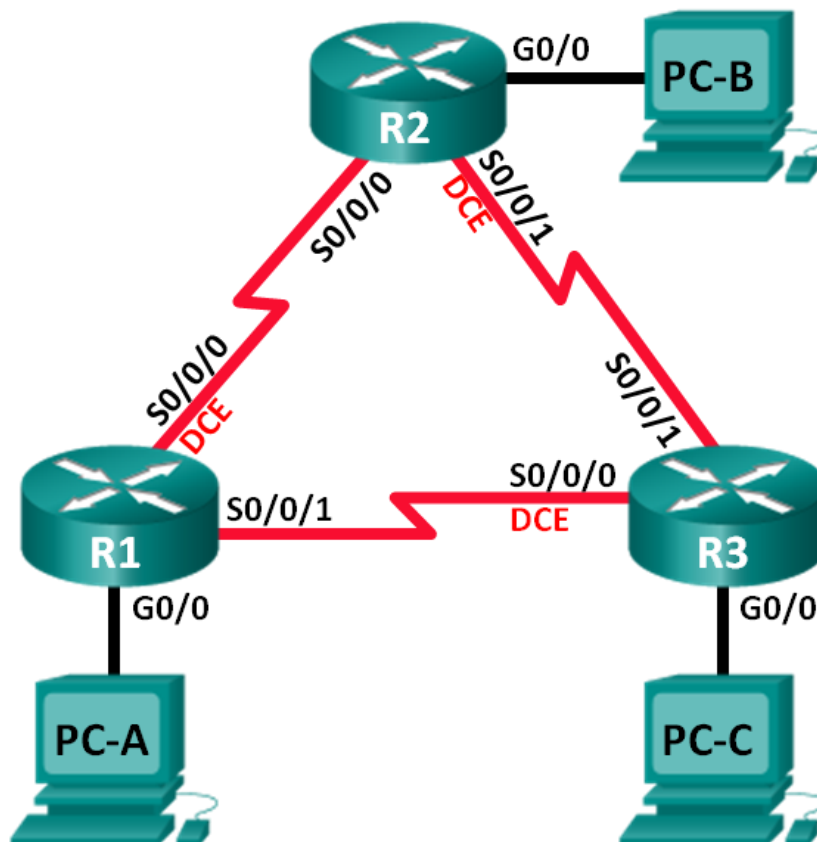


Lab - Configuring Basic EIGRP for IPv6 (Instructor Version)

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

Topology



Addressing Table

Device	Interface	IP Address	Default Gateway
R1	G0/0	2001:DB8:ACAD:A::1/64 FE80::1 link-local	N/A
	S0/0/0 (DCE)	2001:DB8:ACAD:12::1/64 FE80::1 link-local	N/A
	S0/0/1	2001:DB8:ACAD:13::1/64 FE80::1 link-local	N/A
R2	G0/0	2001:DB8:ACAD:B::1/64 FE80::2 link-local	N/A
	S0/0/0	2001:DB8:ACAD:12::2/64 FE80::2 link-local	N/A
	S0/0/1 (DCE)	2001:DB8:ACAD:23::2/64 FE80::2 link-local	N/A
R3	G0/0	2001:DB8:ACAD:C::1/64 FE80::3 link-local	N/A
	S0/0/0 (DCE)	2001:DB8:ACAD:13::3/64 FE80::3 link-local	N/A
	S0/0/1	2001:DB8:ACAD:23::3/64 FE80::3 link-local	N/A
PC-A	NIC	2001:DB8:ACAD:A::3/64	FE80::1
PC-B	NIC	2001:DB8:ACAD:B::3/64	FE80::2
PC-C	NIC	2001:DB8:ACAD:C::3/64	FE80::3

Objectives

Part 1: Build the Network and Verify Connectivity

Part 2: Configure EIGRP for IPv6 Routing

Part 3: Verify EIGRP for IPv6 Routing

Part 4: Configure and Verify Passive Interfaces

Background / Scenario

EIGRP for IPv6 has the same overall operation and features as EIGRP for IPv4. However, there are a few major differences between them:

- EIGRP for IPv6 is configured directly on the router interfaces.
- With EIGRP for IPv6, a router ID is required on each router or the routing process does not start.
- The EIGRP for IPv6 routing process uses a shutdown feature.

In this lab, you will configure the network with EIGRP routing for IPv6. You will also assign router IDs, configure passive interfaces, verify the network is fully converged, and display routing information using CLI **show** commands.

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). Other routers 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 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.

Required Resources

- 3 Routers (Cisco 1941 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
- 3 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

Part 1: Build the Network and Verify Connectivity

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

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

Step 2: Configure PC hosts.

Step 3: Initialize and reload the routers as necessary.

Step 4: Configure basic settings for each router.

- Disable DNS lookup.
- Configure IP addresses for the routers as listed in Addressing Table.
Note: Configure the FE80::x link-local address and the unicast address for each router interface.
- Configure the device name as shown in the topology.
- Assign **cisco** as the console and vty passwords.
- Assign **class** as the privileged EXEC password.
- Configure **logging synchronous** to prevent console and vty messages from interrupting command entry.
- Configure a message of the day.
- Copy the running configuration to the startup configuration.

Step 5: Verify connectivity.

The routers should be able to ping one another, and each PC should be able to ping its default gateway. The PCs will not be able to ping other PCs until EIGRP routing is configured. Verify and troubleshoot if necessary.

Part 2: Configure EIGRP for IPv6 Routing

Step 1: Enable IPv6 routing on the routers.

```
R1(config)# ipv6 unicast-routing
```

Step 2: Assign a router ID to each router.

- To begin the EIGRP for IPv6 routing configuration process, issue the **ipv6 router eigrp 1** command, where **1** is the AS number.

```
R1(config)# ipv6 router eigrp 1
```

- EIGRP for IPv6 requires a 32-bit address for the router ID. Use the **router-id** command to configure the router ID in the router configuration mode.

```
R1(config)# ipv6 router eigrp 1
```

```
R1(config-rtr)# router-id 1.1.1.1
```

```
R2(config)# ipv6 router eigrp 1
```

```
R2(config-rtr)# router-id 2.2.2.2
```

```
R3(config)# ipv6 router eigrp 1
```

```
R3(config-rtr)# router-id 3.3.3.3
```

Step 3: Enable EIGRP for IPv6 routing on each router.

The IPv6 routing process is shut down by default. Issue the **no shutdown** command to enable EIGRP for IPv6 routing on all routers.

```
R1(config)# ipv6 router eigrp 1
```

```
R1(config-rtr)# no shutdown
```

```
R2(config)# ipv6 router eigrp 1
```

```
R2(config-rtr)# no shutdown
```

```
R3(config)# ipv6 router eigrp 1
```

```
R3(config-rtr)# no shutdown
```

Step 4: Configure EIGRP for IPv6 using AS 1 on the Serial and Gigabit Ethernet interfaces on the routers.

- Issue the **ipv6 eigrp 1** command on the interfaces that participate in the EIGRP routing process. The AS number is 1 as assigned in Step 2. The configuration for R1 is displayed below as an example.

```
R1(config)# interface g0/0
```

```
R1(config-if)# ipv6 eigrp 1
```

```
R1(config-if)# interface s0/0/0
```

```
R1(config-if)# ipv6 eigrp 1
```

```
R1(config-if)# interface s0/0/1
```

```
R1(config-if)# ipv6 eigrp 1
```

- b. Assign EIGRP participating interfaces on R2 and R3. You will see neighbor adjacency messages as interfaces are added to the EIGRP routing process. The messages on R1 are displayed below as an example.

```
R1(config-if)#
```

```
*Apr 12 00:25:49.183: %DUAL-5-NBRCHANGE: EIGRP-IPv6 1: Neighbor FE80::2 (Serial0/0/0) is up: new adjacency
```

```
*Apr 12 00:26:15.583: %DUAL-5-NBRCHANGE: EIGRP-IPv6 1: Neighbor FE80::3 (Serial0/0/1) is up: new adjacency
```

What address is used to indicate the neighbor in the adjacency messages? _____

The link-local address (FE80::x) of the neighbor's interface, which was assigned in Part 1 Step 4.

Step 5: Verify end-to-end connectivity.

Part 3: Verify EIGRP for IPv6 Routing

Step 1: Examine the neighbor adjacencies.

On R1, issue the **show ipv6 eigrp neighbors** command to verify that the adjacency has been established with its neighboring routers. The link-local addresses of the neighboring routers are displayed in the adjacency table.

```
R1# show ipv6 eigrp neighbors
```

```
EIGRP-IPv6 Neighbors for AS(1)
```

H	Address	Interface	Hold (sec)	Uptime	SRTT (ms)	RTO	Q Cnt	Seq Num
1	Link-local address: FE80::3	Se0/0/1	13	00:02:42	1	100	0	7
0	Link-local address: FE80::2	Se0/0/0	13	00:03:09	12	100	0	9

Step 2: Examine the IPv6 EIGRP routing table.

Use the **show ipv6 route eigrp** command to display IPv6 specific EIGRP routes on all the routers.

```
R1# show ipv6 route eigrp
```

```
IPv6 Routing Table - default - 10 entries
```

```
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
```

```
B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2
```

```
IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external
```

```
ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect
```

```
O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
```

```
ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
```

```
D 2001:DB8:ACAD:B::/64 [90/2172416]
   via FE80::2, Serial0/0/0
D 2001:DB8:ACAD:C::/64 [90/2172416]
   via FE80::3, Serial0/0/1
D 2001:DB8:ACAD:23::/64 [90/2681856]
   via FE80::2, Serial0/0/0
   via FE80::3, Serial0/0/1
```

Step 3: Examine the EIGRP topology.

```
R1# show ipv6 eigrp topology
EIGRP-IPv6 Topology Table for AS(1)/ID(1.1.1.1)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 2001:DB8:ACAD:A::/64, 1 successors, FD is 28160
   via Connected, GigabitEthernet0/0
P 2001:DB8:ACAD:C::/64, 1 successors, FD is 2172416
   via FE80::3 (2172416/28160), Serial0/0/1
P 2001:DB8:ACAD:12::/64, 1 successors, FD is 2169856
   via Connected, Serial0/0/0
P 2001:DB8:ACAD:B::/64, 1 successors, FD is 2172416
   via FE80::2 (2172416/28160), Serial0/0/0
P 2001:DB8:ACAD:23::/64, 2 successors, FD is 2681856
   via FE80::2 (2681856/2169856), Serial0/0/0
   via FE80::3 (2681856/2169856), Serial0/0/1
P 2001:DB8:ACAD:13::/64, 1 successors, FD is 2169856
   via Connected, Serial0/0/1
```

Compare the highlighted entries to the routing table. What can you conclude from the comparison?

The topology table lists all the available routes to a destination. The routing table lists the best path to a destination.

Step 4: Verify the parameters and current state of the active IPv6 routing protocol processes.

Issue the **show ipv6 protocols** command to verify the configured parameter. From the output, EIGRP is the configured IPv6 routing protocol with 1.1.1.1 as the router ID for R1. This routing protocol is associated with autonomous system 1 with three active interfaces: G0/0, S0/0/0, and S0/0/1.

```
R1# show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 1"
EIGRP-IPv6 Protocol for AS(1)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  NSF-aware route hold timer is 240
  Router-ID: 1.1.1.1
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1

Interfaces:
```

```
GigabitEthernet0/0
Serial0/0/0
Serial0/0/1
Redistribution:
None
```

Part 4: Configure and Verify Passive Interfaces

A passive interface does not allow outgoing and incoming routing updates over the configured interface. The **passive-interface** *interface* command causes the router to stop sending and receiving Hello packets over an interface.

Step 1: Configure interface G0/0 as passive on R1 and R2.

```
R1(config)# ipv6 router eigrp 1
R1(config-rtr)# passive-interface g0/0

R2(config)# ipv6 router eigrp 1
R2(config-rtr)# passive-interface g0/0
```

Step 2: Verify the passive interface configuration.

Issue the **show ipv6 protocols** command on R1 and verify that G0/0 has been configured as passive.

```
R1# show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 1"
EIGRP-IPv6 Protocol for AS(1)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  NSF-aware route hold timer is 240
  Router-ID: 1.1.1.1
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1

Interfaces:
  Serial0/0/0
  Serial0/0/1
  GigabitEthernet0/0 (passive)
Redistribution:
None
```

Step 3: Configure the G0/0 passive interface on R3.

If a few interfaces are configured as passive, use the **passive-interface default** command to configure all the interfaces on the router as passive. Use the **no passive-interface** *interface* command to allow EIGRP Hello messages in and out of the router interface.

- a. Configure all interfaces as passive on R3.

```
R3(config)# ipv6 router eigrp 1
R3(config-rtr)# passive-interface default
R3(config-rtr)#
*Apr 13 00:07:03.267: %DUAL-5-NBRCHANGE: EIGRP-IPv6 1: Neighbor FE80::1 (Serial0/0/0)
is down: interface passive
*Apr 13 00:07:03.267: %DUAL-5-NBRCHANGE: EIGRP-IPv6 1: Neighbor FE80::2 (Serial0/0/1)
is down: interface passive
```

- b. After you have issued the **passive-interface default** command, R3 no longer participates in the routing process. What command can you use to verify it?

show ipv6 route eigrp or show ipv6 route

```
R3# show ipv6 route eigrp
IPv6 Routing Table - default - 7 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
        B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2
        IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external
        ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect
        O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
        ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
```

- c. What command can you use to display the passive interfaces on R3?

show ipv6 protocols

```
R3# show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 1"
EIGRP-IPv6 Protocol for AS(1)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  NSF-aware route hold timer is 240
  Router-ID: 3.3.3.3
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1

Interfaces:
  GigabitEthernet0/0 (passive)
  Serial0/0/0 (passive)
  Serial0/0/1 (passive)
Redistribution:
  None
```

- d. Configure the serial interfaces to participate in the routing process.

```
R3(config)# ipv6 router eigrp 1
R3(config-rtr)# no passive-interface s0/0/0
```



```
R3(config-rtr)# no passive-interface s0/0/1
R3(config-rtr)#
*Apr 13 00:21:23.807: %DUAL-5-NBRCHANGE: EIGRP-IPv6 1: Neighbor FE80::1 (Serial0/0/0)
is up: new adjacency
*Apr 13 00:21:25.567: %DUAL-5-NBRCHANGE: EIGRP-IPv6 1: Neighbor FE80::2 (Serial0/0/1)
is up: new adjacency
```

- e. The neighbor relationships have been established again with R1 and R2. Verify that only G0/0 has been configured as passive. What command do you use to verify the passive interface?

show ipv6 protocols

```
R3# show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 1"
EIGRP-IPv6 Protocol for AS(1)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  NSF-aware route hold timer is 240
  Router-ID: 3.3.3.3
  Topology : 0 (base)
  Active Timer: 3 min
  Distance: internal 90 external 170
  Maximum path: 16
  Maximum hopcount 100
  Maximum metric variance 1

Interfaces:
  Serial0/0/0
  Serial0/0/1
  GigabitEthernet0/0 (passive)
Redistribution:
  None
```

Reflection

1. Where would you configure passive interfaces? Why?

Passive interfaces are usually configured on router interfaces that are not connected to other routers. Passive interfaces limit the amount of unnecessary protocol traffic in the network because no router devices are receiving the messages on the other side of the link.

2. What are some advantages with using EIGRP as the routing protocol in your network?

EIGRP routing protocol can be used with almost any size network using IPv4 or IPv6. It also uses less CPU than other dynamic routing protocols, such as OSPF. It requires little bandwidth for routing updates.

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.

Device Configs

Router R1

```
R1# show run
Building configuration...

Current configuration : 1632 bytes
!
version 15.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname R1
!
boot-start-marker
boot-end-marker
!
!
enable secret 4 06YFDUHH61wAE/kLkDq9BGho1QM5EnRtoyr8cHAUg.2
!
no aaa new-model
```



```
no ip address
ipv6 address FE80::1 link-local
ipv6 address 2001:DB8:ACAD:13::1/64
ipv6 eigrp 1
!
ip forward-protocol nd
!
no ip http server
no ip http secure-server
!
!
ipv6 router eigrp 1
  passive-interface GigabitEthernet0/0
  eigrp router-id 1.1.1.1
!
!
!
!
control-plane
!
!
!
line con 0
  password cisco
  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 cisco
  login
  transport input all
line vty 5 15
  password cisco
  login
  transport input all
!
scheduler allocate 20000 1000
!
end
```

Router R2

```
R2# show run
Building configuration...
```


Lab - Configuring Basic EIGRP for IPv6

```
ipv6 address 2001:DB8:ACAD:B::1/64
ipv6 eigrp 1
!
interface GigabitEthernet0/1
no ip address
shutdown
duplex auto
speed auto
!
interface Serial0/0/0
no ip address
ipv6 address FE80::2 link-local
ipv6 address 2001:DB8:ACAD:12::2/64
ipv6 eigrp 1
!
interface Serial0/0/1
no ip address
ipv6 address FE80::2 link-local
ipv6 address 2001:DB8:ACAD:23::2/64
ipv6 eigrp 1
clock rate 2000000
!
ip forward-protocol nd
!
no ip http server
no ip http secure-server
!
!
ipv6 router eigrp 1
passive-interface GigabitEthernet0/0
eigrp router-id 2.2.2.2
!
!
!
!
control-plane
!
!
!
line con 0
password cisco
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 cisco
login
transport input all
line vty 5 15
password cisco
login
transport input all
!
scheduler allocate 20000 1000
!
end
```

Router R3

```
R3# show run
Building configuration...
```

```
Current configuration : 1672 bytes
!
version 15.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname R3
!
boot-start-marker
boot-end-marker
!
!
enable secret 4 06YFDUHH61wAE/kLkDq9BGho1QM5EnRtoyr8cHAUg.2
!
no aaa new-model
memory-size iomem 15
!
ip cef
!
!
!
!
!
!
!
ipv6 unicast-routing
ipv6 cef
multilink bundle-name authenticated
!
!
!
```

```
!  
!  
!  
!  
!  
!  
interface Embedded-Service-Engine0/0  
  no ip address  
  shutdown  
!  
interface GigabitEthernet0/0  
  no ip address  
  duplex auto  
  speed auto  
  ipv6 address FE80::3 link-local  
  ipv6 address 2001:DB8:ACAD:C::1/64  
  ipv6 eigrp 1  
!  
interface GigabitEthernet0/1  
  no ip address  
  shutdown  
  duplex auto  
  speed auto  
!  
interface Serial0/0/0  
  no ip address  
  ipv6 address FE80::3 link-local  
  ipv6 address 2001:DB8:ACAD:13::3/64  
  ipv6 eigrp 1  
  clock rate 2000000  
!  
interface Serial0/0/1  
  no ip address  
  ipv6 address FE80::3 link-local  
  ipv6 address 2001:DB8:ACAD:23::3/64  
  ipv6 eigrp 1  
!  
ip forward-protocol nd  
!  
no ip http server  
no ip http secure-server  
!  
!  
ipv6 router eigrp 1  
  passive-interface default  
  no passive-interface Serial0/0/0  
  no passive-interface Serial0/0/1  
  eigrp router-id 3.3.3.3  
!
```



```
!  
!  
!  
control-plane  
!  
!  
!  
line con 0  
  password cisco  
  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 cisco  
  login  
  transport input all  
line vty 5 15  
  password cisco  
  login  
  transport input all  
!  
scheduler allocate 20000 1000  
!  
end
```