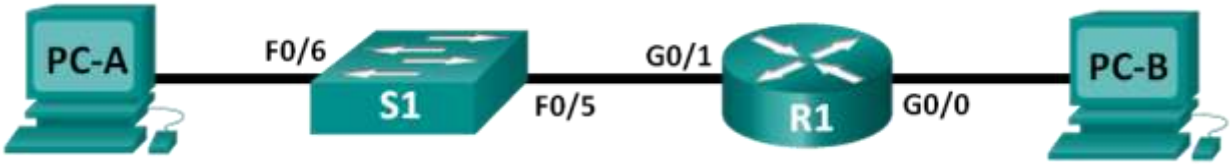
Lab – Configuring and Verifying VTY Restrictions

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0	192.168.0.1	255.255.255.0	N/A
	G0/1	192.168.1.1	255.255.255.0	N/A
S1	VLAN 1	192.168.1.2	255.255.255.0	192.168.1.1
PC-A	NIC	192.168.1.3	255.255.255.0	192.168.1.1
PC-B	NIC	192.168.0.3	255.255.255.0	192.168.0.1

Objectives

Part 1: Configure Basic Device Settings

Part 2: Configure and Apply the Access Control List on R1

Part 3: Verify the Access Control List Using Telnet

Part 4: Challenge - Configure and Apply the Access Control List on S1

Background / Scenario

It is a good practice to restrict access to the router management interfaces, such as the console and vty lines. An access control list (ACL) can be used to allow access for specific IP addresses, ensuring that only the administrator PCs have permission to telnet or SSH into the router.

Note: In the Cisco device outputs, ACL are abbreviated as access-list.

In this lab, you will create and apply a named standard ACL to restrict remote access to the router vty lines.

After the ACL has been created and applied, you will test and verify the ACL by accessing the router from different IP addresses using Telnet.

This lab will provide the commands necessary for creating and applying the ACL.

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 the 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.

Required Resources

- 1 Router (Cisco 1941 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
- 1 Switch (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 cables as shown in the topology

Note: The Gigabit Ethernet interfaces on Cisco 1941 routers are autosensing and an Ethernet straight-through cable may be used between the router and PC-B. If using another model Cisco router, it may be necessary to use an Ethernet crossover cable.

Part 1: Configure Basic Device Settings

In Part 1, you will set up the network topology and configure the interface IP addresses, device access, and passwords on the router.

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

Step 2: Configure the PC-A and PC-B network settings according to the Addressing Table.

Step 3: Initialize and reload the router and switch.

a. Disable DNS lookup.

b. Configure device names according to the Topology diagram.

c. Assign **class** as the privileged EXEC encrypted password.

d. Assign **cisco** as the console password, activate logging synchronous, and enable login.

e. Assign **cisco** as the vty password, activate logging synchronous, and enable login.

f. Encrypt the plain text passwords.

g. Create a banner that warns anyone accessing the device that unauthorized access is prohibited.

h. Configure IP addresses on the interfaces listed in the Addressing Table.

i. Configure the default gateway for the switch.

j. Save the running configuration to the startup configuration file.

Part 2: Configure and Apply the Access Control List on R1

In Part 2, you will configure a named standard ACL and apply it to the router virtual terminal lines to restrict remote access to the router.

Step 1: Configure and apply a standard named ACL.

a. Console into the router R1 and enable privileged EXEC mode.

b. From global configuration mode, view the command options under **ip access-list** by using a space and a question mark.

```
R1(config)# ip access-list ?
  extended    Extended Access List
  helper      Access List acts on helper-address
  log-update  Control access list log updates
```

```
  logging     Control access list logging
  resequence  Resequence Access List
  standard    Standard Access List
```

c. View the command options under **ip access-list standard** by using a space and a question mark.

```
R1(config)# ip access-list standard ?
  <1-99>       Standard IP access-list number
  <1300-1999>  Standard IP access-list number (expanded range)
  WORD         Access-list name
```

d. Add **ADMIN-MGT** to the end of the **ip access-list standard** command and press Enter. You are now in the standard named access-list configuration mode (config-std-nacl).

```
R1(config)# ip access-list standard ADMIN-MGT
R1(config-std-nacl)#
```

e. Enter your ACL permit or deny access control entry (ACE), also known as an ACL statement, one line at a time. Remember that there is an implicit **deny any** at the end of the ACL, which effectively denies all traffic. Enter a question mark to view your command options.

```
R1(config-std-nacl)# ?
Standard Access List configuration commands:
  <1-2147483647>  Sequence Number
  default         Set a command to its defaults
  deny            Specify packets to reject
  exit            Exit from access-list configuration mode
  no              Negate a command or set its defaults
  permit          Specify packets to forward
  remark          Access list entry comment
```

f. Create a permit ACE for Administrator PC-A at 192.168.1.3, and an additional permit ACE to allow other reserved administrative IP addresses from 192.168.1.4 to 192.168.1.7. Notice how the first permit ACE signifies a single host, by using the **host** keyword, the ACE **permit 192.168.1.3 0.0.0.0** could have been used instead. The second permit ACE allows hosts 192.168.1.4 through 192.168.1.7, by using the 0.0.0.3 wildcard, which is the inverse of a 255.255.255.252 subnet mask.

```
R1(config-std-nacl)# permit host 192.168.1.3
R1(config-std-nacl)# permit 192.168.1.4 0.0.0.3
R1(config-std-nacl)# exit
```

You do not need to enter a deny ACE because there is an implicit **deny any** ACE at the end of the ACL.

g. Now that the named ACL is created, apply it to the vty lines.

```
R1(config)# line vty 0 15
R1(config-line)# access-class ADMIN-MGT in
R1(config-line)# exit
```

Part 3: Verify the Access Control List Using Telnet

In Part 3, you will use Telnet to access the router, verifying that the named ACL is functioning correctly.

Note: SSH is more secure than Telnet; however, SSH requires that the network device be configured to accept SSH connections. Telnet is used with this lab for convenience.

a. Open a command prompt on PC-A and verify that you can communicate with the router by issuing a **ping** command.

```
C:\Users\user1> ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:
Reply from 192.168.1.1: bytes=32 time=5ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 5ms, Average = 2ms
C:\Users\user1>
```

b. Using the command prompt on PC-A, launch the Telnet client program to telnet into the router. Enter the login and then the enable passwords. You should be successfully logged in, see the banner message, and receive an R1 router command prompt.

```
C:\Users\user1> telnet 192.168.1.1

Unauthorized access is prohibited!

User Access Verification

Password:
R1>enable
Password:
R1#
```

Was the Telnet connection successful?

c. Type **exit** at the command prompt and press Enter to exit the Telnet session.

d. Change your IP address to test if the named ACL blocks non-permitted IP addresses. Change the IPv4 address to 192.168.1.100 on PC-A.

e. Attempt to telnet into R1 at 192.168.1.1 again. Was the Telnet session successful?

What message was received?

f. Change the IP address on PC-A to test if the named ACL permits a host with an IP address from the 192.168.1.4 to 192.168.1.7 range to telnet into the router. After changing the IP address on PC-A, open a Windows command prompt and attempt to telnet into router R1.

Was the Telnet session successful?

g. From privileged EXEC mode on R1, type the **show ip access-lists** command and press Enter. From the command output, notice how the Cisco IOS automatically assigns line numbers to the ACL ACEs in increments of 10 and shows the number of times each permit ACE has been successfully matched (in parenthesis).

```
R1# show ip access-lists
Standard IP access list ADMIN-MGT
    10 permit 192.168.1.3 (2 matches)
    20 permit 192.168.1.4, wildcard bits 0.0.0.3 (2 matches)
```

Because two successful Telnet connections to the router were established, and each Telnet session was initiated from an IP address that matches one of the permit ACEs, there are matches for each permit ACE.

Why do you think that there are two matches for each permit ACE when only one connection from each IP address was initiated?

How would you determine at what point the Telnet protocol causes the two matches during the Telnet connection?

h. On R1, enter into global configuration mode.

i. Enter into access-list configuration mode for the ADMIN-MGT named access list and add a **deny any** ACE to the end of the access list.

```
R1(config)# ip access-list standard ADMIN-MGT
R1(config-std-nacl)# deny any
R1(config-std-nacl)# exit
```

Note: Because there is an implicit **deny any** ACE at the end of all ACLs, adding an explicit **deny any** ACE is unnecessary, yet can still be useful to the network administrator to log or simply know how many times the **deny any** access-list ACE was matched.

j. Try to telnet from PC-B to R1. This creates a match to the **deny any** ACE in the ADMIN-MGT named access list.

k. From privileged EXEC mode, type **show ip access-lists** command and press Enter. You should now see multiple matches to the **deny any** ACE.

```
R1# show ip access-lists
Standard IP access list ADMIN-MGT
    10 permit 192.168.1.3 (2 matches)
    20 permit 192.168.1.4, wildcard bits 0.0.0.3 (2 matches)
    30 deny any (3 matches)
```

The failed Telnet connection produces more matches to the explicit deny ACE than a successful one. Why do you think this happens?

Part 4: Challenge - Configure and Apply the Access Control List on S1

Step 1: Configure and apply a standard named ACL for the vty lines on S1.

a. Without referring back to the R1 configuration commands, try to configure the ACL on S1, allowing only the PC-A IP address.

b. Apply the ACL to the S1 vty lines. Remember that there are more vty lines on a switch than a router.

Step 2: Test the vty ACL on S1.

Telnet from each of the PCs to verify that the vty ACL is working properly. You should be able to telnet to S1 from PC-A, but not from PC-B.

Reflection

1. As evidenced by the remote vty access, ACLs are powerful content filters that can be applied to more than just inbound and outbound network interfaces. It what other ways might ACLs be applied?

2. Does an ACL applied to a vty remote management interface improve the security of Telnet connection? Does this make Telnet a more viable remote access management tool?

3. Why does it make sense to apply an ACL to vty lines instead of specific interfaces?

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.