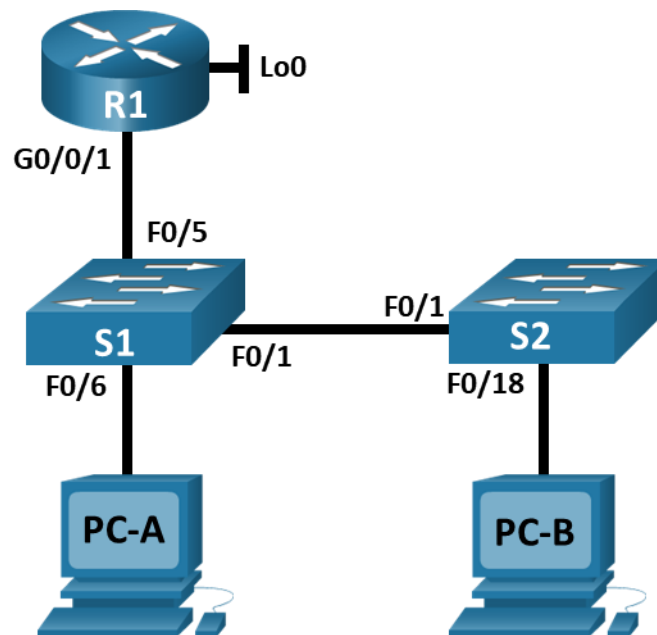


## Lab - Switch Security Configuration

### Topology



### Addressing Table

Device	Interface / VLAN	IP Address	Subnet Mask
R1	G0/0/1	192.168.10.1	255.255.255.0
	Loopback 0	10.10.1.1	255.255.255.0
S1	VLAN 10	192.168.10.201	255.255.255.0
S2	VLAN 10	192.168.10.202	255.255.255.0
PC – A	NIC	DHCP	255.255.255.0
PC – B	NIC	DHCP	255.255.255.0

### Objectives

#### Part 1: Configure the Network Devices.

- Cable the network.
- Configure R1.
- Configure and verify basic switch settings.

#### Part 2: Configure VLANs on Switches.

- Configure VLAN 10.

- Configure the SVI for VLAN 10.
- Configure VLAN 333 with the name Native on S1 and S2.
- Configure VLAN 999 with the name ParkingLot on S1 and S2.

### Part 3: Configure Switch Security.

- Implement 802.1Q trunking.
- Configure access ports.
- Secure and disable unused switchports.
- Document and implement port security features.
- Implement DHCP snooping security.
- Implement PortFast and BPDU guard.
- Verify end-to-end-connectivity.

## Background / Scenario

This is a comprehensive lab to review previously covered Layer 2 security features.

**Note:** The routers used with CCNA hands-on labs are Cisco 4221 with Cisco IOS XE Release 16.9.3 (universalk9 image). The switches used in the labs 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 the 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 switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

## Required Resources

- 1 Router (Cisco 4221 with Cisco IOS XE Release 16.9.3 universal image or comparable)
- 2 Switches (Cisco 2960 with Cisco IOS Release 15.0(2) lanbasek9 image or comparable)
- 2 PCs (Windows with a 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

## Instructions

### Part 1: Configure the Network Devices.

#### Step 1: Cable the network.

- a. Cable the network as shown in the topology.
- b. Initialize the devices.

#### Step 2: Configure R1.

- a. Erase Startup Configuration.
- b. Load the following configuration script on R1.

```
hostname R1
no ip domain lookup
ip dhcp excluded-address 192.168.10.1 192.168.10.9
ip dhcp excluded-address 192.168.10.201 192.168.10.202
!
ip dhcp pool Students
network 192.168.10.0 255.255.255.0
default-router 192.168.10.1
domain-name CCNA2.Lab-11.6.1
!
interface Loopback0
ip address 10.10.1.1 255.255.255.0
!
interface GigabitEthernet0/0/1
description Link to S1 Port 5
ip dhcp relay information trusted
ip address 192.168.10.1 255.255.255.0
no shutdown
!
line con 0
logging synchronous
exec-timeout 0 0
```

- c. Verify the running-configuration on R1 using the following command:

```
R1# show ip interface brief
```

- c. Verify IP addressing and interfaces are in an up / up state (troubleshoot as necessary).

### Step 3: Configure and verify basic switch settings.

- Erase Startup Configuration.
- Delete VLAN database (vlan.dat)
- Configure the hostname for switches S1 and S2.
- Prevent unwanted DNS lookups on both switches.
- Configure interface descriptions for the ports that are in use in S1 and S2.
- Set the default-gateway for the Management VLAN to 192.168.10.1 on both switches.

## Part 2: Configure VLANs on Switches.

### Step 1: Configure VLAN 10.

Add VLAN 10 to S1 and S2 and name the VLAN **Management**.

### Step 2: Configure the SVI for VLAN 10.

Configure the IP address according to the Addressing Table for SVI for VLAN 10 on S1 and S2. Enable the SVI interfaces and provide a description for the interface.

**Step 3: Configure VLAN 333 with the name Native on S1 and S2.**

**Step 4: Configure VLAN 999 with the name ParkingLot on S1 and S2.**

### Part 3: Configure Switch Security.

**Step 1: Implement 802.1Q trunking.**

- On both switches, configure trunking on F0/1 to use VLAN 333 as the native VLAN.
- Verify that trunking is configured on both switches.

S1# **show interface trunk**

Port	Mode	Encapsulation	Status	Native vlan
Fa0/1	on	802.1q	trunking	333

Port	Vlans allowed on trunk
Fa0/1	1-4094

Port	Vlans allowed and active in management domain
Fa0/1	1,10,333,999

Port	Vlans in spanning tree forwarding state and not pruned
Fa0/1	1,10,333,999

S2# **show interface trunk**

Port	Mode	Encapsulation	Status	Native vlan
Fa0/1	on	802.1q	trunking	333

Port	Vlans allowed on trunk
Fa0/1	1-4094

Port	Vlans allowed and active in management domain
Fa0/1	1,10,333,999

Port	Vlans in spanning tree forwarding state and not pruned
Fa0/1	1,10,333,999

- Disable DTP negotiation on F0/1 on S1 and S2.
- Verify with the **show interfaces** command.

S1# **show interfaces f0/1 switchport | include Negotiation**  
Negotiation of Trunking: **Off**

S2# **show interfaces f0/1 switchport | include Negotiation**  
Negotiation of Trunking: **Off**

**Step 2: Configure access ports.**

- On S1, configure F0/5 and F0/6 as access ports that are associated with VLAN 10.

- b. On S2, configure F0/18 as an access port that is associated with VLAN 10.

### Step 3: Secure and disable unused switchports.

- a. On S1 and S2, move the unused ports from VLAN 1 to VLAN 999 and disable the unused ports.  
b. Verify that unused ports are disabled and associated with VLAN 999 by issuing the **show** command.

S1# **show interfaces status**

Port	Name	Status	Vlan	Duplex	Speed	Type
Fa0/1	Link to S2	connected	trunk	a-full	a-100	10/100BaseTX
Fa0/2		disabled	999	auto	auto	10/100BaseTX
Fa0/3		disabled	999	auto	auto	10/100BaseTX
Fa0/4		disabled	999	auto	auto	10/100BaseTX
Fa0/5	Link to R1	connected	10	a-full	a-100	10/100BaseTX
Fa0/6	Link to PC-A	connected	10	a-full	a-100	10/100BaseTX
Fa0/7		disabled	999	auto	auto	10/100BaseTX
Fa0/8		disabled	999	auto	auto	10/100BaseTX
Fa0/9		disabled	999	auto	auto	10/100BaseTX
Fa0/10		disabled	999	auto	auto	10/100BaseTX

<output omitted>

S2# **show interfaces status**

Port	Name	Status	Vlan	Duplex	Speed	Type
Fa0/1	Link to S1	connected	trunk	a-full	a-100	10/100BaseTX
Fa0/2		disabled	999	auto	auto	10/100BaseTX
Fa0/3		disabled	999	auto	auto	10/100BaseTX
<output omitted>						
Fa0/14		disabled	999	auto	auto	10/100BaseTX
Fa0/15		disabled	999	auto	auto	10/100BaseTX
Fa0/16		disabled	999	auto	auto	10/100BaseTX
Fa0/17		disabled	999	auto	auto	10/100BaseTX
Fa0/18	Link to PC-B	connected	10	a-full	a-100	10/100BaseTX
Fa0/19		disabled	999	auto	auto	10/100BaseTX
Fa0/20		disabled	999	auto	auto	10/100BaseTX
Fa0/21		disabled	999	auto	auto	10/100BaseTX
Fa0/22		disabled	999	auto	auto	10/100BaseTX
Fa0/23		disabled	999	auto	auto	10/100BaseTX
Fa0/24		disabled	999	auto	auto	10/100BaseTX
Gi0/1		disabled	999	auto	auto	10/100/1000BaseTX
Gi0/2		disabled	999	auto	auto	10/100/1000BaseTX

### Step 4: Document and implement port security features.

The interfaces F0/6 on S1 and F0/18 on S2 are configured as access ports. In this step, you will also configure port security on these two access ports.

- a. On S1, issue the **show port-security interface f0/6** command to display the default port security settings for interface F0/6. Record your answers in the table below.

Default Port Security Configuration	
Feature	Default Setting
Port Security	
Maximum number of MAC addresses	
Violation Mode	
Aging Time	
Aging Type	
Secure Static Address Aging	
Sticky MAC Address	

b. On S1, enable port security on F0/6 with the following settings:

- Maximum number of MAC addresses: **3**
- Violation type: **restrict**
- Aging time: **60 min**
- Aging type: **inactivity**

```
S1(config)# interface f0/6
S1(config-if)# switchport port-security
S1(config-if)# switchport port-security maximum 3
S1(config-if)# switchport port-security violation restrict
S1(config-if)# switchport port-security aging time 60
S1(config-if)# switchport port-security aging type inactivity
```

c. Verify port security on S1 F0/6.

```
S1# show port-security interface f0/6
Port Security           : Enabled
Port Status             : Secure-up
Violation Mode          : Restrict
Aging Time              : 60 mins
Aging Type              : Inactivity
SecureStatic Address Aging : Disabled
Maximum MAC Addresses   : 3
Total MAC Addresses     : 1
Configured MAC Addresses : 0
Sticky MAC Addresses    : 0
Last Source Address:Vlan : 0022.5646.3411:10
Security Violation Count : 0
```

```
S1# show port-security address
```

Secure Mac Address Table

```
-----
Vlan    Mac Address      Type               Ports    Remaining Age
```

				(mins)
----	-----	----	-----	-----
10	0022.5646.3411	SecureDynamic	Fa0/6	60 (I)
-----				

Total Addresses in System (excluding one mac per port) : 0  
 Max Addresses limit in System (excluding one mac per port) : 8192

- d. Enable port security for F0/18 on S2. Configure the port to add MAC addresses learned on the port automatically to the running configuration.

```
S2(config)# interface f0/18
S2(config-if)# switchport port-security
S2(config-if)# switchport port-security mac-address sticky
```

- e. Configure the following port security settings on S2 F/18:

- o Maximum number of MAC addresses: **2**
- o Violation type: **Protect**
- o Aging time: **60 min**

```
S2(config)# interface f0/18
S2(config-if)# switchport port-security aging time 60
S2(config-if)# switchport port-security maximum 2
S2(config-if)# switchport port-security violation protect
```

- f. Verify port security on S2 F0/18.

```
S2# show port-security interface f0/18
Port Security           : Enabled
Port Status             : Secure-up
Violation Mode          : Protect
Aging Time              : 60 mins
Aging Type              : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses   : 2
Total MAC Addresses     : 1
Configured MAC Addresses : 0
Sticky MAC Addresses    : 0
Last Source Address:Vlan : 0022.5646.3413:10
Security Violation Count : 0
```

```
S2# show port-security address
```

Secure Mac Address Table

-----				
Vlan	Mac Address	Type	Ports	Remaining Age (mins)
----	-----	----	-----	-----
10	0022.5646.3413	SecureSticky	Fa0/18	-
-----				

Total Addresses in System (excluding one mac per port) : 0  
 Max Addresses limit in System (excluding one mac per port) : 8192

### Step 5: Implement DHCP snooping security.

- a. On S2, enable DHCP snooping and configure DHCP snooping on VLAN 10.

```
S2(config)# ip dhcp snooping
S2(config)# ip dhcp snooping vlan 10
```

- b. Configure the trunk port on S2 as a trusted port.

```
S2(config)# interface f0/1
S2(config-if)# ip dhcp snooping trust
```

- c. Limit the untrusted port, F18 on S2, to five DHCP packets per second.

```
S2(config)# interface f0/18
S2(config-if)# ip dhcp snooping limit rate 5
```

- d. Verify DHCP Snooping on S2.

```
S2# show ip dhcp snooping
Switch DHCP snooping is enabled
DHCP snooping is configured on following VLANs:
10
DHCP snooping is operational on following VLANs:
10
DHCP snooping is configured on the following L3 Interfaces:
Insertion of option 82 is enabled
  circuit-id default format: vlan-mod-port
  remote-id: 0cd9.96d2.3f80 (MAC)
Option 82 on untrusted port is not allowed
Verification of hwaddr field is enabled
Verification of giaddr field is enabled
DHCP snooping trust/rate is configured on the following Interfaces:
```

Interface	Trusted	Allow option	Rate limit (pps)
FastEthernet0/1	yes	yes	unlimited
FastEthernet0/18	no	no	5

Custom circuit-ids:

- e. From the command prompt on PC-B, release and then renew the IP address.

```
C:\Users\Student> ipconfig /release
C:\Users\Student> ipconfig /renew
```

- f. Verify the DHCP snooping binding using the **show ip dhcp snooping binding** command.

```
S2# show ip dhcp snooping binding
```

MacAddress	IpAddress	Lease(sec)	Type	VLAN	Interface
00:50:56:90:D0:8E	192.168.10.11	86213	dhcp-snooping	10	FastEthernet0/18

Total number of bindings: 1

### Step 6: Implement PortFast and BPDU guard.

- a. Configure PortFast on all the access ports that are in use on both switches.



```
S1(config)# interface range f0/5 - 6
S1(config-if)# spanning-tree portfast
S2(config)# interface f0/18
S2(config-if)# spanning-tree portfast
```

- b. Enable BPDU guard on S1 and S2 VLAN 10 access ports connected to PC-A and PC-B.

```
S1(config)# interface f0/6
S1(config-if)# spanning-tree bpduguard enable
S2(config)# interface f0/18
S2(config-if)# spanning-tree bpduguard enable
```

- c. Verify that BPDU guard and PortFast are enabled on the appropriate ports.

```
S1# show spanning-tree interface f0/6 detail
Port 8 (FastEthernet0/6) of VLAN0010 is designated forwarding
  Port path cost 19, Port priority 128, Port Identifier 128.6.
  <output omitted for brevity>
  Number of transitions to forwarding state: 1
  The port is in the portfast mode
  Link type is point-to-point by default
  Bpdu guard is enabled
  BPDU: sent 128, received 0
```

### Step 7: Verify end-to-end connectivity.

Verify PING connectivity between all devices in the IP Addressing Table. If the pings fail, you may need to disable the firewall on the PC hosts.

### Reflection Questions

1. In reference to Port Security on S2, why is there no timer value for the remaining age in minutes when sticky learning was configured?
2. In reference to Port Security on S2, if you load the running-config script on S2, why will PC-B on port 18 never get an IP address via DHCP?
3. In reference to Port Security, what is the difference between the absolute aging type and inactivity aging type?