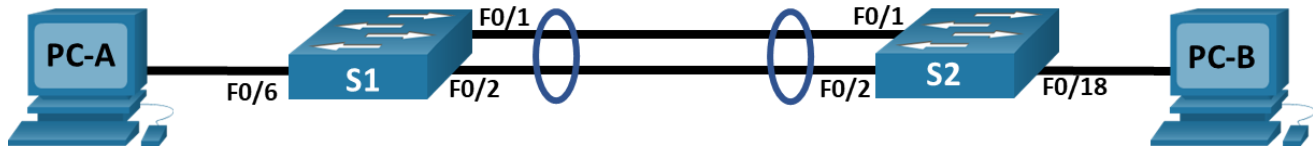


## Lab - Implement EtherChannel

### Topology



### Addressing Table

Device	Interface	IP Address	Subnet Mask
S1	VLAN 10	192.168.10.11	255.255.255.0
S2	VLAN 10	192.168.10.12	255.255.255.0
PC-A	NIC	192.168.20.3	255.255.255.0
PC-B	NIC	192.168.20.4	255.255.255.0

### VLAN Table

VLAN	Name	Interface Assigned
10	Management	VLAN 10
20	Clients	S1: F0/6 S2: F0/18
999	Parking_Lot	S1: F0/3-5, F0/7-24, G0/1-2 S2: F0/3-17, F0/19-24, G0/1-2
1000	Native	N/A

### Objectives

**Part 1: Build the Network and Configure Basic Device Settings**

**Part 2: Create VLANs and Assign Switch Ports**

**Part 3: Configure 802.1Q Trunks between the Switches**

**Part 4: Implement and Verify an EtherChannel between the switches**

### Background / Scenario

Link aggregation allows the creation of logical links that are comprised of two or more physical links. This provides increased throughput beyond using only one physical link. Link aggregation also provides redundancy if one of the links fails.

In this lab, you will configure EtherChannel, a form of link aggregation used in switched networks. You will configure EtherChannel using Link Aggregation Control Protocol (LACP).

**Note:** LACP is a link aggregation protocol that is defined by IEEE 802.3ad, and it is not associated with any specific vendor.

LACP allows Cisco switches to manage Ethernet channels between switches that conform to the 802.3ad protocol. You can configure up to 16 ports to form a channel. Eight of the ports are in active mode and the other eight are in standby mode. When any of the active ports fail, a standby port becomes active. Standby mode works only for LACP, not for PAgP.

**Note:** The switches used with CCNA hands-on labs are Cisco Catalyst 2960s with Cisco IOS Release 15.2(2) (lanbasek9 image). Other 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.

**Note:** Make sure that the switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

### Required Resources

- 2 Switches (Cisco 2960 with Cisco IOS Release 15.2(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: Build the Network and Configure Basic Device Settings

In Part 1, you will set up the network topology and configure basic settings on the PC hosts and switches.

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

Attach the devices as shown in the topology diagram, and cable as necessary.

##### Step 2: Configure basic settings for each switch.

- a. Assign a device name to the switch.

```
switch(config)# hostname S1
```

- b. Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.

```
S1(config)# no ip domain-lookup
```

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

```
S1(config)# enable secret class
```

- d. Assign **cisco** as the console password and enable login.

```
S1(config)# line console 0
```

```
S1(config-line)# password cisco
```

```
S1(config-line)# login
```

- e. Assign **cisco** as the VTY password and enable login.

```
S1(config)# line vty 0 15
```

```
S1(config-line)# password cisco
```

```
S1(config-line)# login
```

- f. Encrypt the plaintext passwords.

```
S1(config)# service password-encryption
```

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

```
S1(config)# banner motd $ Authorized Users Only! $
```

- h. Save the running configuration to the startup configuration file.

```
S1# copy running-config startup-config
```

- i. Set the clock on the switch to today's time and date.

```
S1# clock set 15:30:00 27 Aug 2019
```

**Note:** Use the question mark (?) to help with the correct sequence of parameters needed to execute this command.

- j. Copy the running configuration to the startup configuration.

### Step 3: Configure PC hosts.

Refer to the Addressing Table for PC host address information.

## Part 2: Create VLANs and Assign Switch Ports

In Part 2, you will create VLANs as specified in the table above on both switches. You will then assign the VLANs to the appropriate interface and verify your configuration settings. Complete the following tasks on each switch.

### Step 1: Create VLANs on the switches.

- a. On both switches create and name the required VLANs from the VLAN Table above.

```
S1(config)# vlan 10
S1(config-vlan)# name Management
S1(config-vlan)# vlan 20
S1(config-vlan)# name Clients
S1(config-vlan)# vlan 999
S1(config-vlan)# name Parking_Lot
S1(config-vlan)# vlan 1000
S1(config-vlan)# name Native
S1(config-vlan)# exit
```

```
S2(config)# vlan 10
S2(config-vlan)# name Management
S2(config-vlan)# vlan 20
S2(config-vlan)# name Clients
S2(config-vlan)# vlan 999
S2(config-vlan)# name Parking_Lot
S2(config-vlan)# vlan 1000
S2(config-vlan)# name Native
S2(config-vlan)# exit
```

- b. Configure and activate the management interface on each switch using the IP address information in the Addressing Table.

```
S1(config)# interface vlan 10
```

```
S1(config-if)# ip address 192.168.10.11 255.255.255.0
S1(config-if)# no shutdown
S1(config-if)# exit
```

```
S2(config)# interface vlan 10
S2(config-if)# ip address 192.168.10.12 255.255.255.0
S2(config-if)# no shutdown
S2(config-if)# exit
```

- c. Assign all unused ports on the switch to the Parking\_Lot VLAN, configure them for static access mode, and administratively deactivate them.

```
S1(config)# interface range f0/3 - 4, f0/7 - 24, g0/1 - 2
S1(config-if-range)# switchport mode access
S1(config-if-range)# switchport access vlan 999
S1(config-if-range)# shutdown
```

```
S2(config)# interface range f0/3 - 17, f0/19 - 24, g0/1 - 2
S2(config-if-range)# switchport mode access
S2(config-if-range)# switchport access vlan 999
S2(config-if-range)# shutdown
```

### Step 2: Assign VLANs to the correct switch interfaces.

- a. Assign used ports to the appropriate VLAN (specified in the VLAN table above) and configure them for static access mode.

```
S1(config)# interface f0/6
S1(config-if)# switchport mode access
S1(config-if)# switchport access vlan 20
```

```
S2(config)# interface f0/18
S2(config-if)# switchport mode access
S2(config-if)# switchport access vlan 20
```

- b. Issue the **show vlan brief** command and verify that the VLANs are assigned to the correct ports.

```
S1# show vlan brief
```

VLAN Name	Status	Ports
1 default	active	Fa0/1, Fa0/2
10 Management	active	
20 Sales	active	Fa0/6
999 Parking_Lot	active	Fa0/3, Fa0/4, Fa0/5, Fa0/7 Fa0/8, Fa0/9, Fa0/10, Fa0/11 Fa0/12, Fa0/13, Fa0/14, Fa0/15 Fa0/16, Fa0/17, Fa0/18, Fa0/19 Fa0/20, Fa0/21, Fa0/22, Fa0/23 Fa0/24, Gi0/1, Gi0/2
1000 Native	active	
1002 fddi-default	act/unsup	

```
1003 token-ring-default      act/unsup
1004 fddinet-default         act/unsup
1005 trnet-default           act/unsup
```

```
S2# show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2
10	Management	active	
20	Clients	active	Fa0/18
999	Parking_Lot	active	Fa0/3, Fa0/4, Fa0/5, Fa0/6 Fa0/7, Fa0/8, Fa0/9, Fa0/10 Fa0/11, Fa0/12, Fa0/13, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/19 Fa0/20, Fa0/21, Fa0/22, Fa0/23 Fa0/24, Gi0/1, Gi0/2
1000	Native	active	
1002	fddi-default	act/unsup	
1003	token-ring-default	act/unsup	
1004	fddinet-default	act/unsup	
1005	trnet-default	act/unsup	

### Part 3: Configure 802.1Q trunks between the switches.

In Part 3, you will manually configure interfaces F0/1 and F0/2 as 802.1Q trunks.

- Change the switchport mode on the interfaces to force trunking. Use the **interface range** command to reduce the number of commands required. Make sure to do this on both switches.

```
S1(config)# interface range f0/1-2
S1(config-if-range)# switchport mode trunk
```

```
S2(config)# interface range f0/1-2
S2(config-if-range)# switchport mode trunk
```

- As a part of the trunk configuration, set the native VLAN to 1000 on both switches. You may see error messages temporarily while the two interfaces are configured for different native VLANs.

```
S1(config-if-range)# switchport trunk native vlan 1000
```

```
S2(config-if-range)# switchport trunk native vlan 1000
```

- As another part of trunk configuration, specify that VLANs 10, 20, and 1000 are allowed to cross the trunk.

```
S1(config-if-range)# switchport trunk allowed vlan 10,20,1000
```

```
S2(config-if-range)# switchport trunk allowed vlan 10,20,1000
```

- Issue the **show interfaces trunk** command to verify the trunking ports, Native VLAN and allowed VLANs across the trunk.

```
S1# show interfaces trunk
```

Port	Mode	Encapsulation	Status	Native vlan
Fa0/1	on	802.1q	trunking	1000
Fa0/2	on	802.1q	trunking	1000

Port	Vlans allowed on trunk
Fa0/1	10,20,1000
Fa0/2	10,20,1000

Port	Vlans allowed and active in management domain
Fa0/1	10,20,1000
Fa0/2	10,20,1000

Port	Vlans in spanning tree forwarding state and not pruned
Fa0/1	10,20,1000
Fa0/2	none

S2# **show interfaces trunk**

Port	Mode	Encapsulation	Status	Native vlan
Fa0/1	on	802.1q	trunking	1000
Fa0/2	on	802.1q	trunking	1000

Port	Vlans allowed on trunk
Fa0/1	10,20,1000
Fa0/2	10,20,1000

Port	Vlans allowed and active in management domain
Fa0/1	10,20,1000
Fa0/2	10,20,1000

Port	Vlans in spanning tree forwarding state and not pruned
Fa0/1	10,20,1000
Fa0/2	10,20,1000

Why is the “Vlans in spanning tree forwarding state and not pruned” entry different for F0/1 and F0/2?

**In the example above spanning tree has placed F0/2 in the blocking state.**

### Part 4: Implement and Verify an EtherChannel between the switches.

- Create a LACP-based EtherChannel using F0/1 and F0/2 using group number 1, with both switches actively negotiating the EtherChannel protocol. Use the **interface range** command to reduce the number of commands required.

```
S1(config)# interface range f0/1-2  
S1(config-if-range)# channel-group 1 mode active  
S1(config-if-range)# exit
```

```
S2(config)# interface range f0/1-2
```

```
S2(config-if-range)# channel-group 1 mode active
S2(config-if-range)# exit
```

- b. After the EtherChannel is configured, a virtual Port-Channel interface is automatically created. Now interface Port-Channel 1 represents the logical interface of the bundled physical ports F0/1 and F0/2. Additionally, the Port-Channel will inherit the configuration of the first physical port added to the EtherChannel.
- c. Issue the **show interfaces trunk** command to verify trunking is still in place

```
S1# show interfaces trunk
```

Port	Mode	Encapsulation	Status	Native vlan
Po1	on	802.1q	trunking	1000

Port	Vlans allowed on trunk
Po1	10,20,1000

Port	Vlans allowed and active in management domain
Po1	10,20,1000

Port	Vlans in spanning tree forwarding state and not pruned
Po1	10,20,1000

```
S2# show interfaces trunk
```

Port	Mode	Encapsulation	Status	Native vlan
Po1	on	802.1q	trunking	1000

Port	Vlans allowed on trunk
Po1	10,20,1000

Port	Vlans allowed and active in management domain
Po1	10,20,1000

Port	Vlans in spanning tree forwarding state and not pruned
Po1	10,20,1000

What does the port 'Po1' represent?

**The logical grouping of physical interfaces F0/1 and F0/2 is now seen as Port-channel 1 or Po1.**

- d. Use the **show etherchannel summary** command to verify the EtherChannel configuration.

```
S1# show etherchannel summary
```

```
Flags:  D - down          P - bundled in port-channel
        I - stand-alone  s - suspended
        H - Hot-standby  (LACP only)
        R - Layer3       S - Layer2
        U - in use       f - failed to allocate aggregator

        M - not in use, minimum links not met
```

## Lab - Implement EtherChannel

u - unsuitable for bundling  
w - waiting to be aggregated  
d - default port

Number of channel-groups in use: 1  
Number of aggregators: 1

Group	Port-channel	Protocol	Ports
1	Po1 (SU)	LACP	Fa0/1 (P) Fa0/2 (P)

### S2# show etherchannel summary

Flags: D - down P - bundled in port-channel  
I - stand-alone s - suspended  
H - Hot-standby (LACP only)  
R - Layer3 S - Layer2  
U - in use f - failed to allocate aggregator

M - not in use, minimum links not met  
u - unsuitable for bundling  
w - waiting to be aggregated  
d - default port

Number of channel-groups in use: 1  
Number of aggregators: 1

Group	Port-channel	Protocol	Ports
1	Po1 (SU)	LACP	Fa0/1 (P) Fa0/2 (P)

## Device Configs - Final

### Switch S1

```
S1# show run
```

```
Building configuration...
```

```
Current configuration : 3276 bytes
```

```
!  
version 15.0  
no service pad  
service timestamps debug datetime msec  
service timestamps log datetime msec  
service password-encryption  
!  
hostname S1  
!  
boot-start-marker
```



## Lab - Implement EtherChannel

---

```
boot-end-marker
!
enable secret 4 06YFDUHH6lwAE/kLkDq9BGholQM5EnRtoyr8cHAUg.2
!
no aaa new-model
system mtu routing 1500
!
!
no ip domain-lookup
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
vlan internal allocation policy ascending
!
!
interface Port-channel1
 switchport trunk native vlan 1000
 switchport trunk allowed vlan 10,20,1000
 switchport mode trunk
!
interface FastEthernet0/1
 switchport trunk native vlan 1000
 switchport trunk allowed vlan 10,20,1000
 switchport mode trunk
 channel-group 1 mode active
!
interface FastEthernet0/2
 switchport trunk native vlan 1000
 switchport trunk allowed vlan 10,20,1000
 switchport mode trunk
 channel-group 1 mode active
!
interface FastEthernet0/3
 switchport access vlan 999
 switchport mode access
 shutdown
!
interface FastEthernet0/4
 switchport access vlan 999
 switchport mode access
 shutdown
!
interface FastEthernet0/5
 switchport access vlan 999
 switchport mode access
 shutdown
!
interface FastEthernet0/6
```

## Lab - Implement EtherChannel

---

```
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/7
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/8
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/9
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/10
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/11
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/12
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/13
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/14
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/15
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/16
switchport access vlan 999
```

## Lab - Implement EtherChannel

---

```
switchport mode access
shutdown
!
interface FastEthernet0/17
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/18
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/19
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/20
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/21
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/22
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/23
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/24
switchport access vlan 999
switchport mode access
shutdown
!
interface GigabitEthernet0/1
switchport access vlan 999
switchport mode access
shutdown
!
interface GigabitEthernet0/2
switchport access vlan 999
```

## Lab - Implement EtherChannel

---

```
switchport mode access
shutdown
!
interface Vlan1
no ip address
!
interface Vlan10
ip address 192.168.10.11 255.255.255.0
!
ip http server
ip http secure-server
!
banner motd ^C Authorized Users Only! ^C
!
line con 0
password 7 14141B180F0B
login
line vty 0 4
password 7 14141B180F0B
login
line vty 5 15
login
vlan 10
name Management
vlan 20
name Clients
vlan 999
name Parking_Lot
vlan 1000
name Native
exit
end
```

### Switch S2

```
S2# show run
Building configuration...

Current configuration : 3276 bytes
!
version 15.0
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
service password-encryption
!
hostname S2
!
boot-start-marker
boot-end-marker
```

## Lab - Implement EtherChannel

---

```
!  
enable secret 4 06YFDUHH61wAE/kLkDq9BGholQM5EnRtoyr8cHAUg.2  
!  
no aaa new-model  
system mtu routing 1500  
!  
!  
no ip domain-lookup  
!  
!  
spanning-tree mode pvst  
spanning-tree extend system-id  
!  
vlan internal allocation policy ascending  
!  
!  
interface Port-channel1  
    switchport trunk native vlan 1000  
    switchport trunk allowed vlan 10,20,1000  
    switchport mode trunk  
!  
interface FastEthernet0/1  
    switchport trunk native vlan 1000  
    switchport trunk allowed vlan 10,20,1000  
    switchport mode trunk  
    channel-group 1 mode active  
!  
interface FastEthernet0/2  
    switchport trunk native vlan 1000  
    switchport trunk allowed vlan 10,20,1000  
    switchport mode trunk  
    channel-group 1 mode active  
!  
interface FastEthernet0/3  
    switchport access vlan 999  
    switchport mode access  
    shutdown  
!  
interface FastEthernet0/4  
    switchport access vlan 999  
    switchport mode access  
    shutdown  
!  
interface FastEthernet0/5  
    switchport access vlan 999  
    switchport mode access  
    shutdown  
!  
interface FastEthernet0/6  
    switchport access vlan 20
```

## Lab - Implement EtherChannel

---

```
switchport mode access
!
interface FastEthernet0/7
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/8
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/9
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/10
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/11
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/12
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/13
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/14
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/15
switchport access vlan 999
switchport mode access
shutdown
!
interface FastEthernet0/16
switchport access vlan 999
switchport mode access
```

## Lab - Implement EtherChannel

---

```
shutdown
!
interface FastEthernet0/17
  switchport access vlan 999
  switchport mode access
  shutdown
!
interface FastEthernet0/18
  switchport access vlan 20
  switchport mode access
!
interface FastEthernet0/19
  switchport access vlan 999
  switchport mode access
  shutdown
!
interface FastEthernet0/20
  switchport access vlan 999
  switchport mode access
  shutdown
!
interface FastEthernet0/21
  switchport access vlan 999
  switchport mode access
  shutdown
!
interface FastEthernet0/22
  switchport access vlan 999
  switchport mode access
  shutdown
!
interface FastEthernet0/23
  switchport access vlan 999
  switchport mode access
  shutdown
!
interface FastEthernet0/24
  switchport access vlan 999
  switchport mode access
  shutdown
!
interface GigabitEthernet0/1
  switchport access vlan 999
  switchport mode access
  shutdown
!
interface GigabitEthernet0/2
  switchport access vlan 999
  switchport mode access
  shutdown
```

## Lab - Implement EtherChannel

---

```
!  
interface Vlan1  
  no ip address  
!  
interface Vlan10  
  ip address 192.168.10.12 255.255.255.0  
!  
ip http server  
ip http secure-server  
!  
banner motd ^C Authorized Users Only! ^C  
!  
line con 0  
  password 7 14141B180F0B  
  login  
line vty 0 4  
  password 7 14141B180F0B  
  login  
line vty 5 15  
  login  
vlan 10  
  name Management  
vlan 20  
  name Clients  
vlan 999  
  name Parking_Lot  
vlan 1000  
  name Native  
exit  
end
```