Chapter 3 Lab 3-2– EtherChannel

Topology

All switch-to-switch connections are 802.1Q trunks

Objectives

- Create EtherChannel Links.
- Configure and test load balancing options

Background

Four switches have just been installed. The distribution layer switches are Catalyst 3560 switches, and the access layer switches are Catalyst 2960 switches. There are redundant uplinks between the access layer and distribution layer. Usually, only one of these links could be used; otherwise, a bridging loop might occur. However, using only one link utilizes only half of the available bandwidth. EtherChannel allows up to eight redundant links to be bundled together into one logical link. In this lab, you configure Port Aggregation Protocol (PAgP), a Cisco EtherChannel protocol, and Link Aggregation Control Protocol (LACP), an IEEE 802.3X (formerly IEEE 802.1ad) open standard version of EtherChannel. LACP and PAgP are signaling protocols allowing two switches to negotiate the use of selected physical ports as members of a single EtherChannel bundle. Throughout this lab, we will be using the term EtherChannel to refer to a logical bundling of multiple physical links, and the term Port-channel to refer to a virtual interface that represents an EtherChannel bundle in the Cisco IOS configuration.

Note: This lab uses Cisco Catalyst 3560 and 2960 switches running Cisco IOS 15.0(2)SE6 IP Services and LAN Base images, respectively. The 3560 and 2960 switches are configured with the SDM templates “dual-ipv4-and-ipv6-routing” and “lanbase-routing”, respectively. Depending on the switch model and Cisco IOS Software version,
the commands available and output produced might vary from what is shown in this lab. Catalyst 3650 switches (running any Cisco IOS XE release) and Catalyst 2960-Plus switches (running any comparable Cisco IOS image) can be used in place of the Catalyst 3560 switches and the Catalyst 2960 switches.

Required Resources

- 2 Cisco 2960 with the Cisco IOS Release 15.0(2)SE6 C2960-LANBASEK9-M or comparable
- 2 Cisco 3560v2 with the Cisco IOS Release 15.0(2)SE6 C3560-IPSERVICESK9-M or comparable
- Computer with terminal emulation software
- Ethernet and console cables

Part 1: Configure EtherChannel Links

Step 1: Prepare the switches for the lab

The instructions in this lab assume that the switches are running using the final configuration from Lab 3-1 "Static VLANs, Trunking, and VTP".

Step 2: Configure an EtherChannel with Cisco PAgP.

The first EtherChannel created for this lab aggregates interfaces Fa0/11 and Fa0/12 between ALS1 and ALS2. Make sure that you have a trunk link active for those two links with the `show interfaces trunk` command.

ALS1# show interfaces trunk

<table>
<thead>
<tr>
<th>Port</th>
<th>Mode</th>
<th>Encapsulation</th>
<th>Status</th>
<th>Native vlan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fa0/7</td>
<td>on</td>
<td>802.1q</td>
<td>trunking</td>
<td>666</td>
</tr>
<tr>
<td>Fa0/8</td>
<td>on</td>
<td>802.1q</td>
<td>trunking</td>
<td>666</td>
</tr>
<tr>
<td>Fa0/9</td>
<td>on</td>
<td>802.1q</td>
<td>trunking</td>
<td>666</td>
</tr>
<tr>
<td>Fa0/10</td>
<td>on</td>
<td>802.1q</td>
<td>trunking</td>
<td>666</td>
</tr>
<tr>
<td>Fa0/11</td>
<td>on</td>
<td>802.1q</td>
<td>trunking</td>
<td>666</td>
</tr>
<tr>
<td>Fa0/12</td>
<td>on</td>
<td>802.1q</td>
<td>trunking</td>
<td>666</td>
</tr>
</tbody>
</table>

Note: When configuring EtherChannels, it can be helpful to shut down the physical interfaces being grouped on both devices before configuring them into channel groups. Otherwise, the EtherChannel Misconfig Guard may place these interfaces into error disabled state. The interfaces and port channel can be re-enabled after the EtherChannel is configured.

On ALS1, bundle interfaces Fa0/11 and Fa0/12 under the Port-Channel 1 interface with the `channel-group 1 mode desirable` command. The `mode desirable` option indicates that you want the switch to actively negotiate to form a PAgP link. The Port-Channel interface numbers are locally-significant only. On the 2960, the number can be anything between 1 and 6, and they do not have to match end to end. If it is possible, use the same number on both sides of a port-channel so that coordinating troubleshooting is less complicated. At the very least, clearly document the configuration.

ALS1(config)# interface range f0/11-12
ALS1(config-if-range)# shutdown
<output omitted - interfaces logged as shutting down>
ALS1(config-if-range)# channel-group 1 mode desirable
Creating a port-channel interface Port-channel 1

ALS1(config-if-range)# no shutdown
<output omitted - interfaces logged as coming up>
ALS1(config-if-range)# exit
ALS1(config)#

<the following output is seen after ALS2 configuration is complete>
*Mar 1 00:14:01.570: %LINK-3-UPDOWN: Interface Port-channel1, changed state to up
*Mar 1 00:14:02.576: %LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel1, changed state to up

After you configure an EtherChannel, a virtual port channel interface is created automatically that represents a logical link consisting of the bundled physical interfaces. The port channel interface will automatically inherit the configuration of the first physical interface that was added to the EtherChannel. All configuration changes applied to the port channel interface will then apply to all the physical ports bundled under this interface.

The configuration of the physical interfaces that are bundled into an EtherChannel must be consistent. Otherwise, the bundle may never form or individual links in the bundle may be suspended. Once physical interfaces are added to the EtherChannel bundle, the administrator should not make any configuration changes directly to the physical interfaces. Any necessary adjustments should be made to the appropriate port-channel interface.

Therefore, unless explicitly asked to do so in these labs, after physical ports have been bundled in an EtherChannel, apply all further commands to the corresponding port channel interface only.

Before configuring the EtherChannel bundle on ALS2, issue the command show etherchannel summary on ALS1 and notice the status of both the bundle and the individual interfaces:

ALS1# show etherchannel summary
Flags:  D - down        P - bundled in port-channel
          I - stand-alone    s - suspended
          H - Hot-standby    c - Layer2
          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(S,D)      PAgP     Fa0/11(I)  Fa0/12(I)

ALS1#

PAgP is preventing the bundle from forming because the other end is not speaking the PAgP protocol.
Using the same commands as above, configure interfaces F0/11 and F0/12 on ALS2 to be in an EtherChannel, and then verify that it is working by issuing the `show etherchannel summary` command on both switches. This command displays the type of EtherChannel, the ports utilized, and port states.

ALS1# 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)     PAgP      Fa0/11(P) Fa0/12(P)

ALS1#

ALS2# 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)     PAgP      Fa0/11(P) Fa0/12(P)

ALS2#
At this point, the system does not consider interfaces FastEthernet 0/11 and 0/12 as individual trunks, but as a components of interface Port-Channel 1. The output of `show interface trunk` illustrates this; F0/11 and F0/12 are not shown while the Port-channel is operational.

```
ALS1# show interfaces trunk

<table>
<thead>
<tr>
<th>Port</th>
<th>Mode</th>
<th>Encapsulation</th>
<th>Status</th>
<th>Native vlan</th>
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<td>on</td>
<td>802.1q</td>
<td>trunking</td>
<td>666</td>
</tr>
<tr>
<td>Fa0/10</td>
<td>on</td>
<td>802.1q</td>
<td>trunking</td>
<td>666</td>
</tr>
<tr>
<td>Po1</td>
<td>on</td>
<td>802.1q</td>
<td>trunking</td>
<td>666</td>
</tr>
</tbody>
</table>
```

Step 3: Configure an EtherChannel with IEEE 802.1X LACP

In 2000, the IEEE passed an open standard version of EtherChannel numbered 802.3ad and referred to as "Link Aggregation". The current version of the standard is numbered 802.1AX. LACP-based EtherChannels are supported by most major network equipment vendors and provide interoperability in multi-vendor environments.

Using the previous commands, configure the link between DLS1 and ALS1 on ports Fa0/7 and Fa0/8 as an 802.1X LACP EtherChannel.

You must use a different port channel number on ALS1 than 1, because you already used that in the previous step. The port channel number you use on DLS1 is locally-significant and can be anything between 1 and 48. If it is possible, use the same number on both sides of a port-channel so that coordinating troubleshooting is less complicated. At the very least, clearly document the configuration.

To configure a port channel as LACP, use the interface-level command `channel-group number mode active`. Active mode indicates that the switch actively tries to negotiate that link as LACP, as opposed to PAgP.

```
DLS1(config)# interface range f0/7-8
DLS1(config-if-range)# shutdown
DLS1(config-if-range)# channel-group 2 mode active
Creating a port-channel interface Port-channel 2

DLS1(config-if-range)# no shutdown
DLS1(config-if-range)# end
```

```
<the following output is seen after ALS1 configuration is complete>
*Mar 1 00:31:29.752: %LINK-3-UPDOWN: Interface Port-channel2, changed state to up
*Mar 1 00:31:30.758: %LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel2, changed state to up
```

Verify that EtherChannel is working by issuing the `show etherchannel summary` command on both switches. This command displays the type of EtherChannel, the ports utilized, and port states.
DLS1# 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
------ ----------------- --------- -----------------------------------------------
2      Po2(SU)        LACP      Fa0/7(P)    Fa0/8(P)

DLS1#

ALS1# 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: 2
Number of aggregators: 2

Group  Port-channel  Protocol  Ports
------ ----------------- --------- -----------------------------------------------
1      Po1(SU)        PAgP      Fa0/11(P)   Fa0/12(P)
2      Po2(SU)        LACP      Fa0/7(P)    Fa0/8(P)

ALS1#

Step 4: Explore Misconfiguration

In this step, you will intentionally misconfigure an EtherChannel bundle on DLS2 with parameters that do not match the distant end switches to observe the results.
To do this, you will configure the interfaces on DLS1 and ALS1 as they should be configured for our final desired configuration. Then you will misconfigure DLS2 by bundling an interface that is connected to DLS1 and an interface that is connected to ALS1 into a single EtherChannel. Because different protocols are being used on the two distant ends, misconfiguration guard will force the interfaces into an error disabled state.

To begin, configure an EtherChannel using LACP on ALS1 interfaces F0/9 and F0/10. Assign this EtherChannel to Port-channel number 3.

```
ALS1(config)# interface range f0/9-10
ALS1(config-if-range)# shutdown
ALS1(config-if-range)# channel-group 3 mode active
Creating a port-channel interface Port-channel 3

ALS1(config-if-range)# no shut
ALS1(config-if-range)# exit
ALS1(config)#
```

Next configure an EtherChannel in "on" mode on DLS1 interfaces F0/11 and F0/12. Assign this EtherChannel to Port-channel number 12.

```
DLS1(config)# interface range f0/11-12
DLS1(config-if-range)# shutdown
DLS1(config-if-range)# channel-group 12 mode on
Creating a port-channel interface Port-channel 12

DLS1(config-if-range)# no shut
DLS1(config-if-range)# exit
DLS1(config)#
```

Now go to DLS2 and configure an EtherChannel using PAgP on interfaces F0/10 and F0/11. Assign this EtherChannel to Port-channel number 40.

```
DLS2(config)# interface range f0/10-11
DLS2(config-if-range)# shutdown
DLS2(config-if-range)# channel-group 40 mode desirable
Creating a port-channel interface Port-channel 40

DLS2(config-if-range)# no shut
DLS2(config-if-range)# exit
DLS2(config)#
```

Wait about three minutes, then issue the command `show etherchannel summary` on DLS2. Notice the difference in the individual interface status'.
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

<table>
<thead>
<tr>
<th>Group</th>
<th>Port-channel</th>
<th>Protocol</th>
<th>Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Po40(S)</td>
<td>PAgP</td>
<td>Fa0/10(I)   Fa0/11(D)</td>
</tr>
</tbody>
</table>

DLS2#

Interface F0/10 is attempting to communicate with a distant interface that is configured for LACP. This results in the interface being in a stand-alone state. Interface F0/11 is attempting to communicate with a distant interface that is configured not to use a signaling protocol, so the interface is in a down state.

On DLS1, the configuration mismatch caused Etherchannel Misconfig Guard to put F0/11, F0/12, and Port-channel 12 into an error-disabled state. The messages that displayed at DLS1’s console when this happened:

*Mar 1 05:43:12.639: %PM-4-ERR_DISABLE: channel-misconfig (STP) error detected on Fa0/11, putting Fa0/11 in err-disable state
*Mar 1 05:43:12.664: %PM-4-ERR_DISABLE: channel-misconfig (STP) error detected on Fa0/12, putting Fa0/12 in err-disable state
*Mar 1 05:43:12.698: %PM-4-ERR_DISABLE: channel-misconfig (STP) error detected on Po12, putting Fa0/11 in err-disable state
*Mar 1 05:43:12.698: %PM-4-ERR_DISABLE: channel-misconfig (STP) error detected on Po12, putting Fa0/12 in err-disable state
*Mar 1 05:43:12.698: %PM-4-ERR_DISABLE: channel-misconfig (STP) error detected on Po12, putting Po12 in err-disable state
*Mar 1 05:43:13.654: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/11, changed state to down
*Mar 1 05:43:13.679: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/12, changed state to down
*Mar 1 05:43:13.688: %LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel112, changed state to down

To fix all of this, remove Port-channel 40 on DLS2 and create EtherChannels with the proper configurations to match the distant ends.

DLS2(config)# interface range f0/10-11
DLS2(config-if-range)# shut
DLS2(config-if-range)# no channel-group 40 mode desirable
DLS2(config-if-range)# exit
DLS2(config)# interface range f0/9-10
DLS2(config-if-range)# channel-group 3 mode active
Creating a port-channel interface Port-channel 3

DLS2(config-if-range)# no shut
DLS2(config-if-range)# exit
DLS2(config)# interface range f0/11-12
DLS2(config-if-range)# channel-group 12 mode on
Creating a port-channel interface Port-channel 12

DLS2(config-if-range)# no shut
DLS2(config-if-range)# exit
DLS2(config)# no interface port-channel 40
DLS2(config)# exit

Then reset Port-channel 12 on DSL1:
DLS1(config)# interface port-channel 12
DLS1(config-if)# shut
DLS1(config-if)# no shut
DLS1(config-if)# end

And all of the EtherChannels on DLS2 should be up and operational.

DLS2# 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: 2
Number of aggregators: 2

<table>
<thead>
<tr>
<th>Group</th>
<th>Port-channel</th>
<th>Protocol</th>
<th>Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Po3(SU)</td>
<td>LACP</td>
<td>Fa0/9(P)</td>
</tr>
<tr>
<td>12</td>
<td>Po12(SU)</td>
<td>-</td>
<td>Fa0/11(P)</td>
</tr>
</tbody>
</table>

DLS2#

Challenge

The topology still has redundant links that you can combine. Experiment with the other port channel modes using the question mark on the physical interface command `channel-group number mode` ?. Look at the descriptions and implement the remaining EtherChannels in different ways.

You may find the desirable, auto, active, and passive keywords cumbersome and unintuitive to associate with the particular signaling protocol. Try using the `channel-protocol` physical interface
command, which limits the keywords in the `channel-group number mode` command so that only the keywords appropriate to the selected signaling protocol will be accepted.

Using `channel-protocol pagp` will make sure that in subsequent `channel-group number mode` command, only `desirable` and `auto` keywords are accepted. Conversely, using `channel-protocol lacp` will make sure that in subsequent `channel-group number mode` command, only `active` and `passive` keywords are accepted.

The end state from this part of the lab is that there are NO single interface trunks; all connections between switches will be port-channel interfaces consisting of two members.

**Part 2: Configure and Test EtherChannel Load Balancing**

**Step 1: Configure the load-balancing method**

The load balancing method used to send traffic through an EtherChannel is a global setting on the switch. All EtherChannels on a given switch will use the method selected for that switch. The load balancing method used at either end of an EtherChannel bundle do not have to match.

The available methods as well as the default method used varies by hardware platform. By default, Cisco Catalyst 3560 and Catalyst 2960 switches load-balance using the source MAC address.

```
DLS1# show etherchannel load-balance
EtherChannel Load-Balancing Configuration:
   src-mac

EtherChannel Load-Balancing Addresses Used Per-Protocol:
Non-IP: Source MAC address
   IPv4: Source MAC address
   IPv6: Source MAC address

DLS1#

ALS1# show etherchannel load-balance
EtherChannel Load-Balancing Configuration:
   src-mac

EtherChannel Load-Balancing Addresses Used Per-Protocol:
Non-IP: Source MAC address
   IPv4: Source MAC address
   IPv6: Source MAC address

ALS1#
```

Change the load balancing configuration on ALS1 and ALS2 to `src-dst-ip`, which is ideal for most environments. Example from ALS2:

```
ALS2(config)# port-channel load-balance ?
   dst-ip       Dst IP Addr
   dst-mac      Dst Mac Addr
   src-dst-ip   Src XOR Dst IP Addr
```
 src-dst-mac  Src XOR Dst Mac Addr  
 src-ip       Src IP Addr  
 src-mac      Src Mac Addr

ALS2(config)#port-channel load-balance src-dst-ip
ALS2(config)#end
ALS2#

**Step 2: Verify EtherChannel Load Balancing**

Once this is configured on the switches, you can use the `test etherchannel load-balance` command. Using this command, you input a source and destination value and the switch will respond with what member interface of the EtherChannel would be used.

ALS1#  test etherchannel load-balance interface po 1 ?
   ip    IP address
   ipv6  IPv6 address
   mac   Mac address

ALS1#  test etherchannel load-balance interface po 1 ip ?
   A.B.C.D  Source IP address

ALS1#  test etherchannel load-balance interface po 1 ip 10.1.99.103 ?
   A.B.C.D  Destination IP address

ALS1#  test etherchannel load-balance interface po 1 ip 10.1.99.103 10.1.99.104
Would select Fa0/12 of Po1

ALS1#  test etherchannel load-balance interface po 1 ip 10.1.99.103 209.165.200.103
Would select Fa0/11 of Po1

ALS1#

**Step 3: End of Lab**

Do not save your configurations. The equipment will be reset for the next lab.

---

**Device Configurations:**

Below are the final configurations for each switch.
DLS1

DLS1# show run | exclude !
Building configuration...

Current configuration : 4616 bytes
version 15.0
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
hostname DLS1
boot-start-marker
boot-end-marker
no aaa new-model
system mtu routing 1500
no ip domain-lookup
ip domain-name CCNP.NET
spanning-tree mode pvst
spanning-tree extend system-id
vlan internal allocation policy ascending
interface Port-channel12
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface Port-channel12
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface FastEthernet0/1
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/2
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/3
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/4
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/5
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
switchport nonegotiate
shutdown
interface FastEthernet0/6
shutdown
interface FastEthernet0/7
switchport trunk encapsulation dot1q
switchport trunk native vlan 666
switchport trunk allowed vlan 2-998,1000-4094
switchport mode trunk
switchport nonegotiate
channel-group 2 mode active
interface FastEthernet0/8
switchport trunk encapsulation dot1q
switchport trunk native vlan 666
switchport trunk allowed vlan 2-998,1000-4094
switchport mode trunk
switchport nonegotiate
channel-group 2 mode active
interface FastEthernet0/9
switchport trunk encapsulation dot1q
switchport trunk native vlan 666
switchport trunk allowed vlan 2-998,1000-4094
switchport mode trunk
switchport nonegotiate
interface FastEthernet0/10
switchport trunk encapsulation dot1q
switchport trunk native vlan 666
switchport trunk allowed vlan 2-998,1000-4094
switchport mode trunk
switchport nonegotiate
interface FastEthernet0/11
switchport trunk encapsulation dot1q
switchport trunk native vlan 666
switchport trunk allowed vlan 2-998,1000-4094
switchport mode trunk
switchport nonegotiate
channel-group 12 mode on
interface FastEthernet0/12
switchport trunk encapsulation dot1q
switchport trunk native vlan 666
switchport trunk allowed vlan 2-998,1000-4094
switchport mode trunk
switchport nonegotiate
channel-group 12 mode on
interface FastEthernet0/13
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/14
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/15
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/16
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/17
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/18
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/19
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/20
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/21
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/22
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/23
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/24
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface GigabitEthernet0/1
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface GigabitEthernet0/2
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface Vlan1
    no ip address
interface Vlan99
    ip address 10.1.99.101 255.255.255.0
    ip http server
    ip http secure-server
    line con 0
        exec-timeout 0 0
        logging synchronous
    line vty 0 4
        login
    line vty 5 15
        login
end

DLS2
DLS2# show run | exclude !
Building configuration...

Current configuration : 4474 bytes
version 15.0
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
hostname DLS2
boot-start-marker
boot-end-marker
no aaa new-model
system mtu routing 1500
no ip domain-lookup
ip domain-name CCNP.NET
spanning-tree mode pvst
spanning-tree extend system-id
vlan internal allocation policy ascending
interface Port-channel3
    switchport trunk encapsulation dot1q
    switchport trunk native vlan 666
    switchport trunk allowed vlan 2-998,1000-4094
    switchport mode trunk
    switchport nonegotiate
interface Port-channel12
    switchport trunk encapsulation dot1q
    switchport trunk native vlan 666
    switchport trunk allowed vlan 2-998,1000-4094
    switchport mode trunk
    switchport nonegotiate
interface FastEthernet0/1
    switchport access vlan 999
    switchport mode access
    switchport nonegotiate
    shutdown
interface FastEthernet0/2
    switchport access vlan 999
    switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/3
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/4
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/5
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/6
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/7
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface FastEthernet0/8
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface FastEthernet0/9
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
  channel-group 3 mode active
interface FastEthernet0/10
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
  channel-group 3 mode active
interface FastEthernet0/11
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
  channel-group 12 mode on
interface FastEthernet0/12
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
switchport nonegotiate
channel-group 12 mode on
interface FastEthernet0/13
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/14
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/15
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/16
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/17
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/18
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/19
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/20
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/21
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/22
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/23
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/24
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface GigabitEthernet0/1
  shutdown
interface GigabitEthernet0/2
  shutdown
interface Vlan1
  no ip address
  shutdown
interface Vlan99
  ip address 10.1.99.102 255.255.255.0
  ip http server
  ip http secure-server
  line con 0
    exec-timeout 0 0
    logging synchronous
  line vty 0 4
    login
  line vty 5 15
    login
end

ALS1
ALS1# show run | exclude !
Building configuration...

ALS1# show run | exclude !
Building configuration...

Current configuration : 4514 bytes
version 15.0
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
hostname ALS1
boot-start-marker
boot-end-marker
no aaa new-model
system mtu routing 1500
no ip domain-lookup
ip domain-name CCNP.NET
spanning-tree mode pvst
spanning-tree extend system-id
vlan internal allocation policy ascending
interface Port-channel1
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface Port-channel2
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface Port-channel3
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface FastEthernet0/1
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/2
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/3
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/4
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/5
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/6
  shutdown
interface FastEthernet0/7
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
  channel-group 2 mode active
interface FastEthernet0/8
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
  channel-group 2 mode active
interface FastEthernet0/9
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
  channel-group 3 mode active
interface FastEthernet0/10
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
  channel-group 3 mode active
interface FastEthernet0/11
switchport trunk native vlan 666
switchport trunk allowed vlan 2-998,1000-4094
switchport mode trunk
switchport nonegotiate
channel-group 1 mode desirable
interface FastEthernet0/12
switchport trunk native vlan 666
switchport trunk allowed vlan 2-998,1000-4094
switchport mode trunk
switchport nonegotiate
channel-group 1 mode desirable
interface FastEthernet0/13
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/14
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/15
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/16
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/17
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/18
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/19
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/20
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/21
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/22
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/23
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface FastEthernet0/24
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface GigabitEthernet0/1
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface GigabitEthernet0/2
switchport access vlan 999
switchport mode access
switchport nonegotiate
shutdown
interface Vlan1
no ip address
shutdown
interface Vlan99
ip address 10.1.99.103 255.255.255.0
ip http server
ip http secure-server
line con 0
exec-timeout 0 0
logging synchronous
line vty 0 4
login
line vty 5 15
login
end

ALS2

ALS2# show run | exclude !
Building configuration...

Current configuration : 4127 bytes
version 15.0
no service pad
service timestamps debug datatime msec
service timestamps log datatime msec
no service password-encryption
hostname ALS2
boot-start-marker
boot-end-marker
no aaa new-model
system mtu routing 1500
no ip domain-lookup
ip domain-name CCNP.NET
port-channel load-balance src-dst-ip
spanning-tree mode pvst
spanning-tree extend system-id
vlan internal allocation policy ascending
interface Port-channel1
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface FastEthernet0/1
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/2
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/3
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/4
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/5
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/6
  shutdown
interface FastEthernet0/7
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface FastEthernet0/8
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface FastEthernet0/9
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
interface FastEthernet0/10
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
switchport nonegotiate
interface FastEthernet0/11
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
  channel-group 1 mode desirable
interface FastEthernet0/12
  switchport trunk native vlan 666
  switchport trunk allowed vlan 2-998,1000-4094
  switchport mode trunk
  switchport nonegotiate
  channel-group 1 mode desirable
interface FastEthernet0/13
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/14
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/15
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/16
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/17
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/18
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/19
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/20
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/21
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
shutdown
interface FastEthernet0/22
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/23
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface FastEthernet0/24
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface GigabitEthernet0/1
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface GigabitEthernet0/2
  switchport access vlan 999
  switchport mode access
  switchport nonegotiate
  shutdown
interface Vlan1
  no ip address
  shutdown
interface Vlan99
  ip address 10.1.99.104 255.255.255.0
  ip http server
  ip http secure-server
  line con 0
    exec-timeout 0 0
    logging synchronous
  line vty 0 4
  login
  line vty 5 15
  login
end