



Uplink Interface Connectivity

This workflow describes how to configure the Ethernet interfaces that connect a switch or switch stack to distribution switches or routers. These interfaces are uplink interfaces. They are different from access interfaces that connect to non-networking end devices such as IP phones, personal computers, wireless access points, printers, and IP cameras.

The switch interface configuration recommendations are based on a switch stack deployed in the campus or branch of the access layer.

When stacking two or more physical switches into one logical switch, we recommend that the uplink interfaces are configured across the physical members to ensure that an active uplink interface always available for switch-stack members.

Prerequisites for Uplink Interface Connectivity

Ensure that the best-practice configurations are set, as described in the [Global System Configuration](#) workflow.

Restrictions for Uplink Interface Connectivity

- A maximum of only eight physical links can be active in a single EtherChannel group.
- All the ports in an EtherChannel must be assigned to the same VLAN, or must be configured as trunk ports.
- All the interfaces in an EtherChannel must be of the same type, for example, Gigabit Ethernet interfaces cannot be mixed with 10-Gbps interfaces.

Identify Configuration Values

We recommend that you identify certain switch configuration values in advance so that you can proceed with this workflow without interruption. We recommend that you take a print out of Table 5, and, as you follow the configuration sequence, replace the values in column B with your values in column C.



**Note**

Replace the blue italicized example values with your own values.

Table 5 **Uplink Connectivity Values**

A. Value Name	B. Example Value Name	C. Your Value
Uplink interfaces	<i>GigabitEthernet 1/1/1</i> <i>GigabitEthernet 1/1/2</i> <i>GigabitEthernet 2/1/1</i> <i>GigabitEthernet 2/1/2</i>	
Data VLAN	<i>10</i>	
Voice VLAN	<i>11</i>	
Access points VLAN	<i>12</i>	
Wireless clients VLAN	<i>200</i>	
Management VLAN ID	<i>100</i>	
Dummy VLAN	<i>999</i>	
IPv6 Router Advertisement Guard policy name	<i>switch_ipv6_raguard</i> <i>router_ipv6_raguard</i>	
IPv6 Router Advertisement Guard policy name	<i>uplink_ipv6__guard</i>	
QoS service policy input name	<i>AutoQos-4.0-Trust-Dscp-Input-Policy</i>	
QoS service policy output name	<i>AutoQos-4.0-Output-Policy</i>	

**Note**

Configuration examples begin in global configuration mode, unless noted otherwise.

LAN Access Switch Topology with Uplinks to a Distribution Switch or Distribution Router

The following illustration displays the LAN Access Switch Topology with Uplinks to a distribution switch or distribution router:

Figure 6 LAN Access Switch Topology with Uplinks to a Distribution Switch

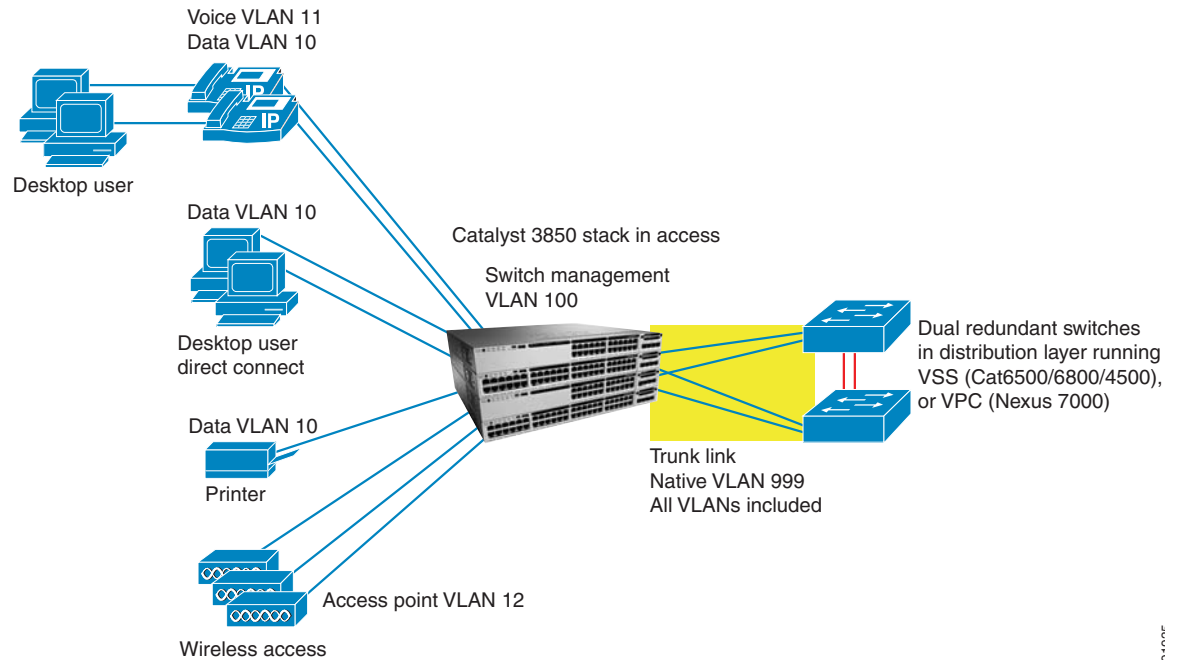
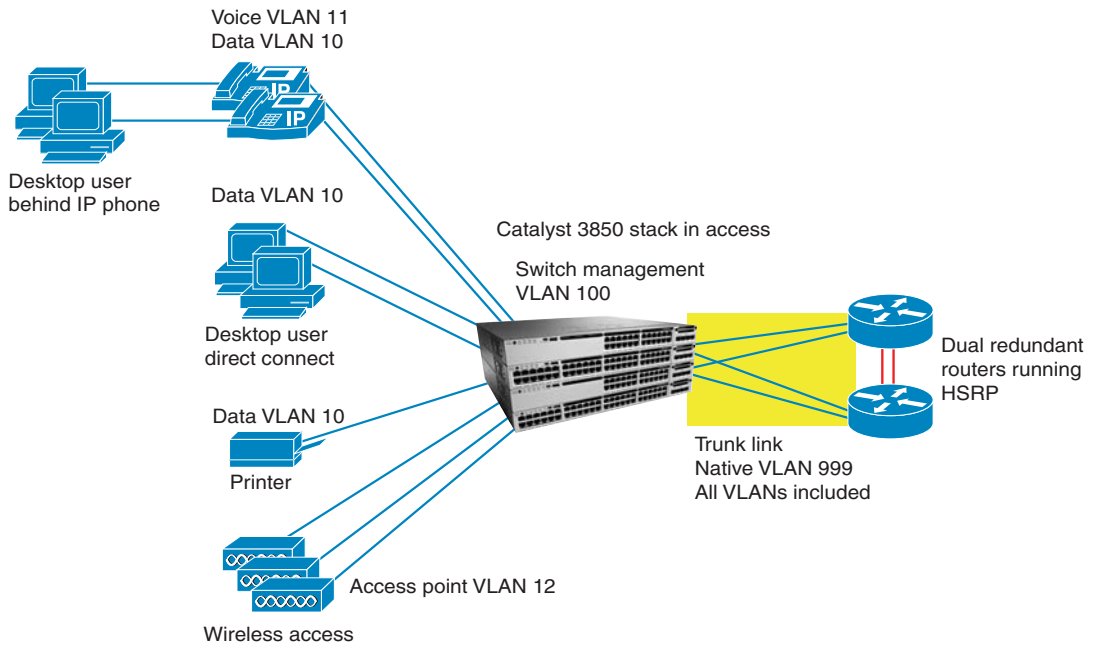


Figure 7 Uplinks for a Distribution Router



991996

Configure Uplink Interface Connectivity

- [Recommendations for Configuring an Uplink Interface to a Router or Switch](#)
- [Configure QoS on an Uplink EtherChannel Interfaces](#)
- [Configure an Uplink Interface as an EtherChannel and as a Trunk](#)
- [Configure Security Features on an Uplink EtherChannel Interface](#)
- [Spanning-Tree Recommendations for an Uplink Interface Connecting to a Distribution Switch](#)
- [Verify Uplink Interface Configurations](#)

Recommendations for Configuring an Uplink Interface to a Router or Switch

When configuring your uplink interface, follow the below recommendations to guide you through the configuration from interface to upstream router or switch:

- Make sure that the uplink connections from the switch stack to the distribution switches have enough bandwidth to carry the traffic associated with all of the access interfaces on the switch stack.
- Use EtherChannels to increase resilience of in case an uplink interface fails.
- For EtherChannels, use Link Aggregation Control Protocol (LACP) active-active mode, which adheres to the IEEE 802.3ad standard. The active-active mode implies that both the switch stack as well as the distribution switch side of the EtherChannel must be configured in LACP active mode.
- Use uplink ports on the different switches in the switch stack to connect back to the distribution switches. This configuration ensures that there is no single source of failure for the switch stack. If a switch in the stack owning one of the uplink connections fails, there will still be an uplink port connection from a remaining member of the switch stack connecting back to the distribution switches.
- All the interfaces are assigned to VLAN 1 by default. Do not configure VLAN 1 on the trunk; this is to prevent traffic associated with potential user connection errors from propagating across the trunk.

Configure QoS on an Uplink EtherChannel Interfaces

**Note**

This configuration should be applied to the physical uplink interfaces before adding them to an EtherChannel.

Step 1

Apply the Trust Differentiated Services Code Point (DSCP) service policy on an interface in the ingress direction, and then apply the 2P6Q3T policy in order to ensure proper congestion management and egress bandwidth distribution on the interface in the egress direction.

Ethernet traffic that is received from the upstream switch or router contains trusted QoS markings and is classified to guarantee a type of service.

Additional service policies should be applied after traffic is transmitted in order to ease congestion. For more information see, [“Configure QoS on an Access Interface” on page 56](#)

```

interface GigabitEthernet 1/1/1
  auto qos trust dscp
  service-policy input AutoQos-4.0-Trust-Dscp-input-Policy
  service-policy output 2P6Q3T
  exit

interface GigabitEthernet 1/1/2
  auto qos trust dscp
  service-policy input AutoQos-4.0-Trust-Dscp-input-Policy
  service-policy output 2P6Q3T
  exit

interface GigabitEthernet 2/1/1
  auto qos trust dscp
  service-policy input AutoQos-4.0-Trust-Dscp-input-Policy
  service-policy output 2P6Q3T
  exit

interface GigabitEthernet 2/1/2
  auto qos trust dscp
  service-policy input AutoQos-4.0-Trust-Dscp-input-Policy
  service-policy output 2P6Q3T

```

Configure an Uplink Interface as an EtherChannel and as a Trunk

- Step 1** Choose one of the following configurations based on your network topology:
- [“Configure an Uplink Interface to Connect to a Distribution VSS or VPC Switch”](#)
 - [“Configure an Uplink Interface to Connect to a Distribution Router \(or Standalone Distribution Switch\)”](#)

Configure an Uplink Interface to Connect to a Distribution VSS or VPC Switch

1. Ensure that the distribution Virtual Switch System (VSS) or Virtual Port Channel (VPC) switch connections are configured the same way and that the EtherChannel is configured in LACP active mode.
2. For additional resilience, ensure that the uplink interfaces are located on different switches in the switch stack.

[Figure 6](#), shows the switch stack that has a single EtherChannel connection to a distribution VSS or VPC switch pair.

The VSS and VPC systems have an explicit configuration between the Cisco distribution switch pair. That allows them to act as a single logical switch when connected to the EtherChannel. The EtherChannel is configured as a trunk with VLANs 10, 11, 12, and 100, with the native VLAN set to 999.



Note

Use this switch-stack uplink interface configuration only when connecting the switch stack to a VSS or VPC distribution switch pair, and not when the distribution switch pair is configured as two standalone switches.

```
interface GigabitEthernet 1/1/1
  description connection to Distribution VSS or VPC switch 1
  switchport mode trunk
  switchport trunk native vlan 999
  switchport trunk allowed vlan 10,11,12,100,200
  channel-protocol lacp
  channel-group 1 mode active
!
interface GigabitEthernet 2/1/1
  description connection to Distribution VSS or VPC switch 1
  switchport mode trunk
  switchport trunk native vlan 999
  switchport trunk allowed vlan 10,11,12,100,200
  channel-protocol lacp
  channel-group 1 mode active
!
interface GigabitEthernet 1/1/2
  description connection to Distribution VSS or VPC switch 2
  switchport mode trunk
  switchport trunk native vlan 999
  switchport trunk allowed vlan 10,11,12,100,200
  channel-protocol lacp
  channel-group 1 mode active
!
interface GigabitEthernet 2/1/2
  description connection to Distribution VSS or VPC switch 2
  switchport mode trunk
  switchport trunk native vlan 999
  switchport trunk allowed vlan 10,11,12,100,200
  channel-protocol lacp
  channel-group 1 mode active
```

Configure an Uplink Interface to Connect to a Distribution Router (or Standalone Distribution Switch)



Note

Use this configuration when connecting the switch stack to two standalone distribution switches (not configured as a VSS or VPC pair). However, do not use the **spanning-tree portfast trunk** command for switch configuration.

- Ensure that the distribution VSS or VPC router side of the connections are configured the same and that the EtherChannel is configured with the LACP active mode.
- For additional resilience, the configured uplink interfaces should be located on different switches in the switch stack.
- Use the **spanning-tree portfast trunk** command to allow the switch side of the uplink to immediately transition to a spanning-tree forwarding state when the link becomes available, because routers do not participate in a spanning tree.

Figure 7 shows a switch stack having a separate EtherChannel to each distribution router. Each EtherChannel is configured as a trunk with VLANs 10, 11, 12, 100, 200, and 999, with the native VLAN set to 999.

EtherChannel Connection to Router 1

```

interface GigabitEthernet 1/1/1
  description connection to Distribution router 1
  switchport mode trunk
  switchport trunk native vlan 999
  switchport trunk allowed vlan 10,11,12,100,200
  spanning-tree portfast trunk
  channel-protocol lacp
  channel-group 1 mode active
interface GigabitEthernet 2/1/1
  description connection to Distribution router 1
  switchport mode trunk
  switchport trunk native vlan 999
  switchport trunk allowed vlan 10,11,12,100,200
  spanning-tree portfast trunk
  channel-protocol lacp
  channel-group 1 mode active

```

EtherChannel Connection to Router 2

```

interface GigabitEthernet 1/1/2
  description connection to Distribution router 2
  switchport mode trunk
  switchport trunk native vlan 999
  switchport trunk allowed vlan 10,11,12,100,200
  spanning-tree portfast trunk
  channel-protocol lacp
  channel-group 2 mode active
interface GigabitEthernet 2/1/2
  description connection to Distribution router 2
  switchport mode trunk
  switchport trunk native vlan 999
  switchport trunk allowed vlan 10,11,12,100,200
  spanning-tree portfast trunk
  channel-protocol lacp
  channel-group 2 mode active

```

Configure Security Features on an Uplink EtherChannel Interface

Step 2 Configure IPv4 and IPv6 security features on uplink EtherChannel interfaces.

The uplink EtherChannel interfaces to distribution routers and switches should be configured to trust router advertisements and IP response, because Layer 3 routing and server functionality resides on the distribution switches and routers. This step is different from the access interface-to-end device configuration, which should not be trusted, as specified in the [“Access Interface Connectivity”](#) workflow.

The policies that should be applied are defined in the [“Global System Configuration”](#) workflow.

In the following example, security is applied to the uplink interfaces connecting to VPC, VSS, or standalone switch.


```
interface Port-channel 1
  ip arp inspection trust
  ip snooping trust
  ipv6 nd raguard attach-policy switch_ipv6_raguard
  ipv6 guard attach-policy uplink_ipv6_guard
```

In the following example, security is applied to the uplink interfaces connecting to routers:

```
interface Port-channel 1
  ip arp inspection trust
  ip snooping trust
  ipv6 nd raguard attach-policy router_ipv6_raguard
  ipv6 guard attach-policy uplink_ipv6_guard
  exit
!
interface Port-channel 2
  ip arp inspection trust
  ip snooping trust
  ipv6 nd raguard attach-policy router_ipv6_raguard
  ipv6 guard attach-policy uplink_ipv6_guard
```

Spanning-Tree Recommendations for an Uplink Interface Connecting to a Distribution Switch



Note

Complete this configuration on the distribution switches and not on the switch. The recommendations listed below are not applicable when routers are used at the distribution layer.

Step 3

On uplink interfaces to distribution switches (Figure 6), ensure that the spanning-tree root for the switch-stack VLANs is configured on the distribution switch pair.

Follow the below recommendations when the standalone distribution switches are used instead of a VSS or VPC system:

- Make sure that the spanning-tree roots for the VLANs are distributed evenly between two standalone distribution switches. For example, configure one switch as the spanning-tree root for all the even VLANs, and configure the other switch as the spanning-tree root for all the odd VLANs. This distribution configuration ensures that the spanning tree does not block all the VLANs on a single uplink interface, and results in an even traffic flow on the uplink interfaces.
- If Hot Standby Router Protocol (HSRP) or Virtual Router Redundancy Protocol (VRRP) is configured for the VLANs located on the standalone distribution switches, make sure that the VLAN configuration on the active switch is the same on the switch that is the spanning-tree root for that VLAN.
- Avoid flooding of traffic caused by asymmetric routing of traffic flows, by configuring the **arp timeout** interface configuration command. This command adjusts the ARP aging timer to less than the MAC address table aging timer on the Layer 3 VLAN interfaces of the distribution switches. By default, the MAC address table aging timer is set to 5 minutes (300 seconds) on the switch.

For more information about spanning tree root configuration on the VSS, see the “Spanning Tree Configuration Best Practice with VSS” section of the *VSS Enabled Campus Design Guide*.

For more information about spanning-tree root on distribution switches, see the “Spanning VLANs across Access Layer Switches” section of the *Campus Network for High Availability Design Guide*.

For more information about spanning-tree root configuration and asymmetric routing, see the “Spanning VLANs Across Access Layer Switches” and “Asymmetric Routing and Unicast Flooding” sections of the *Campus Network for High Availability Design Guide*.

Verify Uplink Interface Configurations

Use the following commands to verify if configurations in this workflow are correctly applied to your uplink interfaces:

- **show etherchannel summary**
- **show interface**
- **show interface trunk**
- **show cdp neighbors**
- **show auto qos interface**
- **show policy-map interface**

Display Uplink Interface Connectivity for the Switch

Step 1 Enter the **show running-configuration** command to display uplink interface connectivity for the switch.

```
Switch#sh int te2/1/3
TenGigabitEthernet2/1/3 is up, line protocol is up (connected)
  Hardware is Ten Gigabit Ethernet, address is 381c.1a24.d537 (bia
381c.1a24.d537)
  MTU 1500 bytes, BW 10000000 Kbit/sec, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not set
  Full-duplex, 10Gb/s, link type is auto, media type is SFP-10GBase-SR
  input flow-control is off, output flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 00:00:19, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/2000/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 1000 bits/sec, 1 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    2596461 packets input, 426179392 bytes, 0 no buffer
    Received 2596461 broadcasts (2596461 multicasts)
    0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    0 watchdog, 2596461 multicast, 0 pause input
    0 input packets with dribble condition detected
  303459 packets output, 45794121 bytes, 0 underruns
    0 output errors, 0 collisions, 2 interface resets
    0 unknown protocol drops
    0 babbles, 0 late collision, 0 deferred
    0 lost carrier, 0 no carrier, 0 pause output
    0 output buffer failures, 0 output buffers swapped out
```


■ Display Uplink Interface Connectivity for the Switch