Configure 802.1Q Trunking Between Catalyst Switches

Contents

Introduction

This document describes the difference of IEEE 802.1Q (dot1q) trunking between Cisco Catalyst switches that run Cisco IOS® Software.

Prerequisites

Requirements

Ensure that you meet these requirements before you attempt this configuration:

- Knowledge of IEEE 802.1Q trunking
- Knowledge of the configuration of Catalyst 3560 and Catalyst 6500/6000 series switches with use of command-line interface (CLI)

Components Used

The information in this document is based on these software and hardware versions:

- Catalyst 3560 switch that runs Cisco IOS Software Release 12.2(25)SEA
- Catalyst 6509 switch that runs Cisco IOS Software Release 12.1(26)E1

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Background Information

This document provides a sample configuration of IEEE 802.1Q (dot1q) trunking between a Cisco Catalyst 3550/3560/3750 switch that runs Cisco IOS® Software and a Catalyst 6500/6000 series switch or Catalyst 4500/4000 series switch that runs Cisco IOS Software. Trunking is a way to carry traffic from several VLANs over a point-to-point link between the two devices.

Two ways in which you can implement Ethernet trunking are:

- Inter-Switch Link Protocol (ISL)—A Cisco proprietary protocol
- 802.1Q—An IEEE standard

Catalyst Components

The Catalyst 3560 configuration in this document is also applicable to Catalyst 3550/3750 switches that run Cisco IOS Software. The Catalyst 6500/6000 configuration in this document is also applicable to Catalyst 4500/4000 series switches that run Cisco IOS Software.

   Note: Refer to this next document to learn about the trunking methods that are supported by various Catalyst switches:

- [System Requirements to Implement Trunking](#)on Catalyst switches

   Note: This document includes only the configuration files from the switches and the output from the related sample **show** commands. For details on how to configure an 802.1Q trunk between Catalyst switches, refer to these next documents:

- *[Configuring VLAN Trunks](#)* section of *[Configuring VLANs](#)*—Catalyst 3560 series switches
- *[Understanding VLAN Trunks](#)* section of *[Configuring Layer 2 Ethernet Interfaces](#)* —Catalyst 4500 series switches that run Cisco IOS Software

Background Theory

IEEE 802.1Q uses an internal tagging mechanism. The trunking device inserts a 4-byte tag in order to identify the VLAN to which a frame belongs and then recomputes the frame check sequence (FCS). For more information, refer to these documents:

- [InterSwitch Link and IEEE 802.1Q Frame Format](#)
- *[Basic Characteristics of 802.1Q Trunking](#)* section of *[Trunking Between Catalyst 4500/4000, 5500/5000, and 6500/6000 Series Switches Using 802.1Q Encapsulation with Cisco CatOS System Software](#)*

   Note: Next are important notes to remember for this configuration:

- Any Ethernet interface on a Catalyst 3550/3560/3750 series switch can support 802.1Q and ISL encapsulation. The Ethernet interface on a Catalyst 3550 switch is a Layer 2 (L2) port, by default.
- Any Ethernet port on a Catalyst 6500/6000 series switch can support 802.1Q and ISL encapsulation.
- By default, the Catalyst 4500 series switch that runs Cisco IOS Software supports both ISL and 802.1Q trunking modes. The support is on all interfaces except blocking Gigabit ports on the WS-X4418-GB and WS-X4412-2GB-T modules. These ports do not support ISL and only support 802.1Q trunking. Ports 3 through 18 are blocking Gigabit ports on the WS-X4418-GB module. Ports 1 through 12 are blocking Gigabit ports on the WS-X4412-2GB-T module.

  Note: A port is a blocking port if its connection to the backplane is oversubscribed.

- The main difference between the Catalyst 6500/6000 and the Catalyst 4500 platforms is the default interface configuration. The Catalyst 6500/6000 switch that runs Cisco IOS Software has interfaces in shutdown mode that are Layer 3 (L3) routed ports by default. The Catalyst 4500/4000 switch that runs Cisco IOS Software has all the interfaces enabled. The interfaces are L2 switch ports by default.
- When 802.1Q encapsulation is used on a trunk interface on the Catalyst 3750 Switches, runts can be seen on **show interface** output because valid 802.1Q encapsulated packets which are 61-64 bytes that include the q-tag are counted by the Catalyst 3750 Switch as undersized frames, even though these packets are forwarded correctly. For more details, refer to Cisco bug ID CSCec14238 .

  Note: Only registered Cisco users have access to internal Cisco tools and information.

Configure

In this section, you are presented with the information to configure the features described in this document.
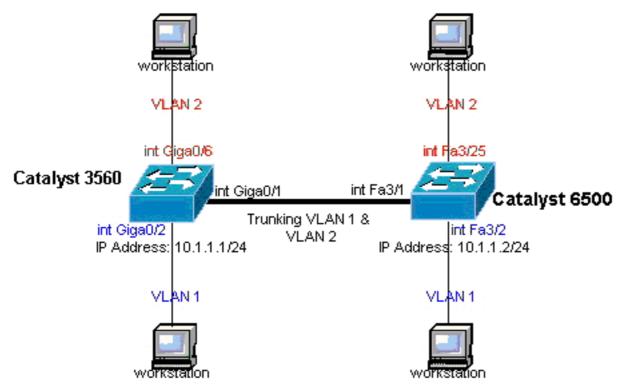
  Note: Use the Command Lookup Tool to obtain more information on the commands used in this section.

  Note: Only registered Cisco users have access to internal Cisco tools and information.

Network Diagram

This document uses this network setup:

  Note: The Gigabit Ethernet interface on the Catalyst 3560 is a 10/100/1000 Mbps negotiated Ethernet interface. Therefore, the Gigabit port on the Catalyst 3560 is connected to a Fast Ethernet (100 Mbps) port on the Catalyst 6500 in this network diagram.

Network Diagram

Configurations

This document uses these configurations:

- [Catalyst 3560 Switch](#)
- [Catalyst 6500 Switch](#)

Catalyst 3560 Switch

```
!--- Notice: This example creates VLAN 1 and VLAN 2
!--- and sets the VLAN Trunk Protocol (VTP) mode to transparent. Use your
!--- network as a basis and set the VTP mode accordingly. For more details,
!--- refer to Configuring VLANs. version 12.2 no service pad service timestamps debug uptime service
timestamps log uptime no service password-encryption ! hostname 3560 ! !--- This is the privileged mode
password for the example. enable password mysecret ! ip subnet-zero ! vtp mode transparent ! !--- VLAN
created. This is visible only when you set VTP mode
!--- to transparent.
vlan 2 ! ! !--- The Gigabit Ethernet interface on the Catalyst 3560 is a 10/100/1000 Mbps
!--- negotiated Ethernet interface. Therefore, the Gigabit port on the
!--- Catalyst 3560 is connected to a Fast Ethernet port on the Catalyst 6500.
!--- Configure the trunk on the Gigabit Ethernet 0/1 interface. interface GigabitEthernet0/1 !--- Confi
trunk encapsulation as dot1q.
!--- For details on trunking, refer to Configuring VLANs. switchport trunk encapsulation dot1q

!--- Enable trunking on the interface. switchport mode trunk
 no ip address
 snmp trap link-status
 !
 !

!--- Interfaces Gigabit Ethernet 0/2 through 0/5 are placed in VLAN 1.
!--- In order to configure the interface as an L2 port,
!--- refer to the Configuring Ethernet Interfaces section
!--- of Configuring Interface Characteristics. All L2 ports are placed
!--- in VLAN 1, by default. interface GigabitEthernet0/2 switchport mode access
 no ip address
```

```
 snmp trap link-status
 !
 interface GigabitEthernet0/3
 switchport mode access
 no ip address
 snmp trap link-status
 !
 !
 interface GigabitEthernet0/4
 switchport mode access
 no ip address
 snmp trap link-status
 !
 interface GigabitEthernet0/5
 switchport mode access
 no ip address
 snmp trap link-status
 !
 !
```

!--- Interfaces Gigabit Ethernet 0/6 through 0/12 are placed in VLAN 2. interface GigabitEthernet0/6
switchport access vlan 2
```
 switchport mode access
 no ip address
 snmp trap link-status
 !
```

!--- Output suppressed. ! interface GigabitEthernet0/12 **switchport access vlan 2**
```
 switchport mode access
 no ip address
 snmp trap link-status
 !
 interface Vlan1
```

!--- This is the IP address for management. ip address 10.1.1.1 255.255.255.0 ! ip classless ip http se
! line con 0 transport input none line vty 0 4 *!--- This is the privileged mode password for the exampl*
password mysecret login line vty 5 15 login ! end

Catalyst 6500 Switch

!--- Notice: This example creates VLAN 1 and VLAN 2 and sets
!--- the VTP mode to transparent. Use your network as a basis and set the VTP
!--- mode accordingly. For more details, refer to [Configuring VLANs](#). Current configuration : 4812 bytes
version 12.1 service timestamps debug uptime service timestamps log uptime no service password-encryptic
hostname Cat6500 ! vtp mode transparent ip subnet-zero ! ! mls flow ip destination mls flow ipx destina
!--- This is the privileged mode password for the example. enable password mysecret ! redundancy mode r
plus main-cpu auto-sync running-config auto-sync standard ! ! *!--- This enables VLAN 2.* vlan 2 ! ! inte
GigabitEthernet1/1 no ip address shutdown ! interface GigabitEthernet1/2 no ip address shutdown ! *!---*
Gigabit Ethernet interface on the Catalyst 3560 is a 10/100/1000 Mbps
!--- negotiated Ethernet interface. Therefore, the Gigabit port on the Catalyst 3560
!--- is connected to a Fast Ethernet port on the Catalyst 6500. interface FastEthernet3/1 no ip address
You must issue the switchport command once,
!--- without any keywords, in order to configure the interface as an L2 port for the
!--- Catalyst 6500 series switch that runs Cisco IOS Software.
!--- On a Catalyst 4500 series switch that runs Cisco IOS Software, all ports are L2
!--- ports by default. Therefore, if you do not change the default configuration,
!--- you do not need to issue the switchport command.
!--- For more details, refer to [Configuring Layer 2 Ethernet Interfaces](#)
!--- for the Catalyst 4500 series switch that runs Cisco IOS Software. **switchport**

!--- Configure trunk encapsulation as dot1q.
!--- For more details on trunking, refer to
!--- Configuring LAN Ports for Layer 2 Switching for the Catalyst 6500 series switch

```
!--- that runs Cisco IOS Software, or Configuring Layer 2 Ethernet Interfaces
!--- for the Catalyst 4500/4000 series switch that runs Cisco IOS Software. switchport trunk encapsulat
dot1q


!--- Enable trunking on the interface. switchport mode trunk
 !

!--- Configure interfaces Fast Ethernet 3/2 through 3/24 to be in access mode.
!--- By default, all access ports are configured in VLAN 1.
!--- For more details, refer to Configuring LAN Ports for Layer 2 Switching
!--- for the Catalyst 6500 series switch that runs Cisco IOS Software, or
!--- Configuring Layer 2 Ethernet Interfaces for the Catalyst 4500/4000 series
!--- switch that runs Cisco IOS Software. interface FastEthernet3/2 no ip address switchport
 switchport mode access
 !


!--- Output suppressed. ! interface FastEthernet3/24 no ip address  switchport
 switchport mode access
 !

!--- Fast Ethernet 3/25 through 3/48 are placed in VLAN 2.
!--- For more details, refer to Configuring LAN Ports for Layer 2 Switching
!--- for the Catalyst 6500 series switch that runs Cisco IOS Software,
!--- or Configuring Layer 2 Ethernet Interfaces for the Catalyst 4500/4000
!--- series switch that runs Cisco IOS Software. interface FastEthernet3/25 no ip address switchport
 switchport access vlan 2
 switchport mode access
 !


!--- Output suppressed. ! interface FastEthernet3/48 no ip address  switchport
 switchport access vlan 2
 switchport mode access
 !
 !
 interface Vlan1

!--- This is the IP address for management. ip address 10.1.1.2 255.255.255.0 ! ! ip classless no ip ht
server ! ! ip classless ip http server ! line con 0 exec-timeout 0 0 transport input none line vty 0 4
This is the Telnet password for the example. password mysecret login ! end
```

> **Note**: If you assign an interface to a VLAN that does not exist, the interface shuts down until you create the VLAN in the VLAN database. For details, refer to the *Creating or Modifying an Ethernet VLAN* section of *Configuring VLANs*.

Verify

Use this section to confirm that your configuration works properly.

The Output Interpreter Tool (OIT) supports certain **show** commands. Use the OIT to view an analysis of show command output.

> **Note**: Only registered Cisco users have access to internal Cisco tools and information.

On Catalyst 3550/3560/3750/6500/4500 switches, use these commands:

- **show interfacesinterface_typemodule/porttrunk**
- **show interfacesinterface_typemodule/portswitchport**
- **show vlan**
- **show vtp status**

Sample show Command Output

Catalyst 3560 Switch

- **show interfaces interface_type module/por trunk** —This command displays the trunk configuration of the interface along with the VLAN numbers for which traffic is able to be carried over the trunk.

```
3560# show interface gigabitethernet 0/1 trunk

Port        Mode            Encapsulation  Status        Native vlan
Gi0/1       on              802.1q         trunking      1

Port        Vlans allowed on trunk
Gi0/1       1 4094

Port        Vlans allowed and active in management domain
Gi0/1       1-2

Port        Vlans in spanning tree forwarding state and not pruned
Gi0/1       1-2
```

- **show interfaces interface_type module/port switchport** —This command displays the switch port configuration of the interface.In the display, check the `Operational Mode` and the `Operational Trunking Encapsulation` fields.

```
3560# show interface gigabitethernet 0/1 switchport
Name: Gi0/1
Switchport: Enabled
Administrative Mode: trunk
Operational Mode: trunk
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL
Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust : none
```

- **show vlan**—This command gives information about the VLANs and the ports that belong to a particular VLAN.

```
3560# show vlan
```

```
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gi0/2, Gi0/3, Gi0/4, Gi0/5
2    VLAN0002                         active    Gi0/6, Gi0/7, Gi0/8, Gi0/9
                                                        Gi0/10, Gi0/11, Gi0/12

1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
```

!--- Output suppressed.

Note: The ports that are displayed in the output are only access ports. But the ports that are configured to be trunk and that are in the 'notconnected' status also show up in the **show vlan** output.

- **show vtp status**—This command displays general information about the VTP management domain, status, and counters.

```
3560# show vtp status
VTP Version : 2
Configuration Revision : 0
Maximum VLANs supported locally : 1005
Number of existing VLANs : 6
VTP Operating Mode : Transparent
VTP Domain Name :
VTP Pruning Mode : Disabled
VTP V2 Mode : Disabled
VTP Traps Generation : Disabled
MD5 digest : 0x4A 0x55 0x17 0x84 0xDB 0x99 0x3F 0xD1
Configuration last modified by 10.1.1.1 at 0-0-00 00:00:00

3560# ping 10.1.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
3560#
```

Catalyst 6500 Switch

- **show interfacesinterface_type module/porttrunk**—This command displays the trunk configuration of the interface along with the VLAN numbers for which traffic is able to be carried over the trunk.

```
Cat6500# show interfaces fastethernet 3/1 trunk

Port        Mode             Encapsulation  Status         Native vlan
Fa3/1       on               802.1q         trunking       1

Port        Vlans allowed on trunk
Fa3/1       1 4094

Port        Vlans allowed and active in management domain
Fa3/1       1-2

Port        Vlans in spanning tree forwarding state and not pruned
Fa3/1       1-2
```

- **show interfaces**_interface_type_**module/port**_switchport —This command displays the switch port configuration of the interface. In the display, check the `Operational Mode` and the `Operational Trunking Encapsulation` fields.

```
cat6500# show interface fastethernet 3/1 switchport
Name: Fa3/1
Switchport: Enabled
Administrative Mode: trunk
Operational Mode: trunk
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL
```

- **show vlan**—This command gives information about the VLANs and the ports that belong to a particular VLAN.

```
Cat6500# show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa3/2, Fa3/3, Fa3/4, Fa3/5
                                                Fa3/6, Fa3/7, Fa3/8, Fa3/9
                                                Fa3/10, Fa3/11, Fa3/12, Fa3/13
                                                Fa3/14, Fa3/15, Fa3/16, Fa3/17
                                                Fa3/18, Fa3/19, Fa3/20, Fa3/21
                                                Fa3/22, Fa3/23, Fa3/24
2    VLAN0002                         active    Fa3/25, Fa3/26, Fa3/27, Fa3/28
                                                Fa3/29, Fa3/30, Fa3/31, Fa3/32
                                                Fa3/33, Fa3/34, Fa3/35, Fa3/36
                                                Fa3/37, Fa3/38, Fa3/39, Fa3/40
                                                Fa3/41, Fa3/42, Fa3/43, Fa3/44
                                                Fa3/45, Fa3/46, Fa3/47, Fa3/48
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup


!--- Output suppressed.
```

Note: The ports that display are only those ports that you have configured as Layer 2 nontrunk (access) ports. The ports that are configured to be trunk and that are in the 'notconnected' status also show up in the **show vlan** output. For details, refer to the

Configuring LAN Interfaces for Layer 2 Switching section of [*Configuring LAN Ports for Layer 2 Switching*](#).

- **show vtp status**—This command displays general information about the VTP management domain, status, and counters.

```
Cat6500# show vtp status
VTP Version                    : 2
Configuration Revision         : 0
Maximum VLANs supported locally : 1005
Number of existing VLANs       : 6
VTP Operating Mode             : Transparent
VTP Domain Name                :
VTP Pruning Mode               : Disabled
VTP V2 Mode                    : Disabled
VTP Traps Generation           : Disabled
MD5 digest                     : 0xBF 0x86 0x94 0x45 0xFC 0xDF 0xB5 0x70
Configuration last modified by 10.1.1.2 at 0-0-00 00:00:00
```

- **ping**

```
Cat6500# ping 10.1.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
```

Troubleshoot

There is currently no specific troubleshoot information available for this configuration. For common problems that relate to trunking and 802.1Q configuration, refer to the [*Common Errors*](#)section of the document[Trunking Between Catalyst 4500/4000, 5500/5000, and 6500/6000 Series Switches Using 802.1Q Encapsulation with Cisco CatOS System Software](#).

Related Information

- [**Using PortFast and Other Commands to Fix Workstation Startup Connectivity Delays**](#)
- [**Catalyst 3560 Series Switches Configuration Guides**](#)
- [**Catalyst 4500 Series Switches Configuration Guides**](#)
- [**Catalyst 6500 Series Switches Configuration Guides**](#)
- [**Cisco Technical Support & Downloads**](#)