

# Configuring InterVLAN Routing and ISL/802.1Q Trunking on Catalyst 2900XL/3500XL/2940/2950/2970 Series Switches Using an External Router

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## Introduction

### Before You Begin

- Conventions
- Prerequisites
- Components Used
- Important Notes

### Configure

- Network Diagram
- Configurations

### debug and show Commands

### Sample show Command Output

- Catalyst 3500XL Switch
- Cisco 2600 Router

### Related Information

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## Introduction

This document provides sample configurations on InterSwitch Link (ISL) and 802.1Q trunking between a Catalyst 3512–XL switch and a Cisco 2600 router; the results of each command are displayed as they are executed. Cisco 3600 and 4500/4700 series routers, or other members of the Cisco 2600 series routers, with FastEthernet interfaces, and any Catalyst 2900XL, 3500XL, 2940, 2950 or 2970 can be used in the scenarios presented in this document to obtain the same results.

Trunking is a way to carry traffic from several VLANs over a point–to–point link between the two devices. Two ways in which Ethernet trunking can be implemented are:

- ISL (Cisco proprietary protocol, and not supported by the 2940 or 2950 series switches)
- 802.1Q (Institute of Electrical and Electronics Engineers (IEEE) standard)

We will create a trunk that will carry traffic from two VLANs (VLAN1 and VLAN2) across a single link between a Catalyst 3500 and a Cisco 2600 router.

We are using the Cisco 2600 router to do the Inter–VLAN routing between VLAN1 and VLAN2. Catalyst 2900XL/3500XL/2940/2950/2970 series switches are Layer 2 (L2) switches, and are not capable of routing or communicating between the VLANs. For further details on Inter–VLAN routing, refer to the Routing Between Virtual LANs Overview chapter of the Cisco IOS® Switching Services Configuration Guide, Release 12.1.

To create the examples in this document, we used the following switches in a lab environment with cleared configurations:

- Catalyst 3512XL switch running Cisco IOS 12.0(5.x)XU
- Cisco 2621 router running Cisco IOS 12.1(3)T

- Cisco 2621 router running Cisco IOS 12.1(1)T

The configurations in this document were implemented in an isolated lab environment. Ensure that you understand the potential impact of any configuration or command on your network before using it. The configurations on all devices were cleared with the write erase command to ensure that they have a default configuration.

## Before You Begin

### Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.

### Prerequisites

There are no specific prerequisites for this document.

### Components Used

This document is not restricted to specific software and hardware versions.

### Important Notes

#### For Catalyst 2900XL/3500XL/2940/2950/2970 Switches:

Catalyst 2940 and 2950 series switches only support 802.1q trunking, and do not support ISL trunking.

On a 4 MB DRAM Catalyst 2900XL switch, trunking is only supported with the following trunking-capable modules:

- WS-X2914-XL-V: 4-port 10/100 ISL/802.1Q switch module
- WS-X2922-XL-V: 2-port 100BaseFX ISL/802.1Q switch module
- WS-X2924-XL-V: 4-port 100BaseFX ISL/802.1Q switch module
- WS-X2931-XL: 1000BaseX uplink for Catalyst 2900 XL
- WS-X2932-XL: 1000BaseT uplink for Catalyst 2900 XL

Refer to Table 1 below for a current list of switch models that support trunking:

**Table 1**

| Switch Models                  | Minimum Release Required for ISL Trunking | Minimum Release Required for IEEE 802.1Q Trunking | Current Release Required for Trunking              |
|--------------------------------|---|---|--|
| WS-C2916M-XL<br>(4-Meg Switch) | 11.2(8)SA4<br>(Enterprise Edition)        | 11.2(8)SA5<br>(Enterprise Edition)                | (ISL/802.1Q)<br>11.2(8.6)SA6<br>(Original Edition) |
| C2912-XL                       | 11.2(8)SA4<br>(Enterprise Edition)        | 11.2(8)SA5<br>(Enterprise Edition)                | 12.0(5)WC(1)<br>or later                           |

|                 |                                       |                                       |   |
|-----------------|---------------------------------------|---------------------------------------|---|
| C2924-XL        | 11.2(8)SA4<br>(Enterprise<br>Edition) | 11.2(8)SA5<br>(Enterprise<br>Edition) | 12.0(5)WC(1)<br>or later  |
| WS-C2924C-XL    | 11.2(8)SA4<br>(Enterprise<br>Edition) | 11.2(8)SA5<br>(Enterprise<br>Edition) | 12.0(5)WC(1)<br>or later  |
| WS-C2924M-XL    | 11.2(8)SA4<br>(Enterprise<br>Edition) | 11.2(8)SA5<br>(Enterprise<br>Edition) | 12.0(5)WC(1)<br>or later  |
| WS-C2912MF-XL   | 11.2(8)SA4<br>(Enterprise<br>Edition) | 11.2(8)SA5<br>(Enterprise<br>Edition) | 12.0(5)WC(1)<br>or later  |
| WS-C2924M-XL-DC | 12.0(5)XU                             | 12.0(5)XU                             | 12.0(5)WC(1)<br>or later  |
| WS-C3508G-XL    | 11.2(8)SA4<br>(Enterprise<br>Edition) | 11.2(8)SA5<br>(Enterprise<br>Edition) | 12.0(5)WC(1)<br>or later  |
| WS-C3512-XL     | 11.2(8)SA4<br>(Enterprise<br>Edition) | 11.2(8)SA5<br>(Original<br>Edition)   | 12.0(5)WC(1)<br>or later  |
| WS-C3524-XL     | 11.2(8)SA4<br>(Enterprise<br>Edition) | 11.2(8)SA5<br>(Enterprise<br>Edition) | 12.0(5)WC(1)<br>or later  |
| WS-C3548-XL     | 12.0(5)XP<br>(Enterprise<br>Edition)  | 12.0(5)XP<br>(Enterprise<br>Edition)  | 12.0(5)WC(1)<br>or later  |
| WS-C3524-PWR-XL | 12.0(5)XU                             | 12.0(5)XU                             | 12.0(5)WC(1)<br>or later  |
| WS-C2940-8TF    | ISL Not<br>Supported                  | 12.1(13)AY                            | 12.1(13)AY<br>or later for<br>802.1Q. ISL<br>is not<br>supported.   |
| WS-C2940-8TT    | ISL Not<br>Supported                  | 12.1(13)AY                            | 12.1(13)AY<br>or later for<br>802.1Q. ISL<br>is not<br>supported.   |
| WS-C2950-12     | ISL Not<br>Supported                  | 12.0(5)WC(1)                          | 12.0(5)WC(1)<br>or later for<br>802.1Q. ISL<br>is not<br>supported. |
| WS-C2950-24     | ISL Not<br>Supported                  | 12.0(5)WC(1)                          | 12.0(5)WC(1)<br>or later for<br>802.1Q. ISL<br>is not               |

|                   |                   |              |   |
|-------------------|-------------------|--------------|---|
|                   |                   |              | supported.  |
| WS-C2950C-24      | ISL Not Supported | 12.0(5)WC(1) | 12.0(5)WC(1) or later for 802.1Q. ISL is not supported. |
| WS-C2950T-24      | ISL Not Supported | 12.0(5)WC(1) | 12.0(5)WC(1) or later for 802.1Q. ISL is not supported. |
| WS-C2950G-12-EI   | ISL Not Supported | 12.0(5)WC(1) | 12.0(5)WC(1) or later for 802.1Q. ISL is not supported. |
| WS-C2950G-24-EI   | ISL Not Supported | 12.0(5)WC(1) | 12.0(5)WC(1) or later for 802.1Q. ISL is not supported. |
| WS-C2950G-48-EI   | ISL Not Supported | 12.0(5)WC(1) | 12.0(5)WC(1) or later for 802.1Q. ISL is not supported. |
| WS-C2950SX-24     | ISL Not Supported | 12.0(5)WC(1) | 12.0(5)WC(1) or later for 802.1Q. ISL is not supported. |
| WS-C2950-24-EI-DC | ISL Not Supported | 12.0(5)WC(1) | 12.0(5)WC(1) or later for 802.1Q. ISL is not supported. |
| WS-C2955T-12      | ISL Not Supported | 12.1(13)EA1  | 12.1(13)EA1 or later for 802.1Q. ISL is not supported.  |
| WS-C2955S-12      | ISL Not Supported | 12.1(13)EA1  | 12.1(13)EA1 or later for 802.1Q. ISL is not supported.  |
| WS-C2955C-12      | ISL Not Supported | 12.1(13)EA1  | 12.1(13)EA1 or later for 802.1Q. ISL                    |

|                |             |             |                      |
|----------------|-------------|-------------|----------------------|
|                |             |             | is not supported.    |
| WS-C2970G-24T  | 12.1(11)AX  | 12.1(11)AX  | 12.1(11)AX or later  |
| WS-C2970G-24TS | 12.1(14)EA1 | 12.1(14)EA1 | 12.1(14)EA1 or later |

**Note:** In the above table, only WS-C2916M-XL is a 4 MB DRAM switch. All the other switches listed are 8 MB DRAM switches. To determine whether your switch has 4 MB or 8 MB of DRAM, enter the user-level show version command. For more information, see the How to Determine the Amount of Switch Memory Using the Command Line Interface section of Upgrading Software in Catalyst 2900-XL/3500-XL Switches Using the Command Line Interface.

**Note:** In Catalyst 2900XL/3500XL/2940/2950/2970 switches, a VLAN interface, for example, int vlan 1, int vlan 2, int vlan x, can be created for each and every VLAN that is configured on the switch. However, only one VLAN can be used at a time as a management VLAN. The IP address is assigned to the VLAN interface of the management VLAN only. If the IP address is assigned to another VLAN interface whose VLAN is not used as management VLAN, that interface will not come up. It is preferred to create the VLAN interface only for the management VLAN.

#### For Cisco 2600 Routers:

For 802.1Q trunking, one VLAN is not tagged. This VLAN is called native VLAN. The native VLAN is used for untagged traffic when the port is in 802.1Q trunking mode. While configuring 802.1Q trunking, it is very important to keep in mind that the native VLAN must be configured the same on each side of the trunk link. It is a common mistake not to match the native VLANs while configuring 802.1Q trunking between the router and the switch. For details on native VLANs, refer to the IEEE 802.1Q section of Bridging Between IEEE 802.1Q VLANs, in New Features in Release 12.1(3)T.

In this sample configuration, the native VLAN is VLAN1, by default, on both the Cisco 2621 router and the Catalyst 3512XL switch. Depending on your network needs, you may have to use a native VLAN other than the default VLAN, VLAN1. Commands have been mentioned in the Configurations section of this document on how to change the native VLAN on the Cisco 2600 router and Catalyst 3500XL switch.

Sample configurations presented in this document can be used on Cisco 2600/3600/4500/4700 series routers with Fast Ethernet interfaces or Fast Ethernet network modules. Also, make sure that you are using the Cisco IOS version that supports ISL/802.1Q VLAN trunking. For a complete list of Cisco 2600/3600/4500/4700 routers that support ISL/802.1Q VLAN trunking and the supported Cisco IOS versions, refer to Table 2 below.

**Table 2**

| Router Models | Minimum Release Required for ISL Trunking | Minimum Release Required for IEEE 802.1Q Trunking | Minimum Required Feature Set (ISL/802.1Q) |
|---------------|---|---|---|
| Cisco 2620    | 11.3(3a)T                                 | 12.0(1)T  | IP PLUS / IP PLUS                         |
| Cisco 2621    | 11.3(3a)T                                 | 12.0(1)T  | IP PLUS / IP PLUS                         |

|              |           |           |                   |
|--------------|-----------|-----------|-------------------|
| Cisco 2620   | 12.1(3a)T | 12.1(3a)T | IP PLUS / IP PLUS |
| Cisco 2650   | 12.1(3a)T | 12.1(3a)T | IP PLUS / IP PLUS |
| Cisco 3620   | 11.3(1)T  | 12.0(1)T  | IP PLUS / IP PLUS |
| Cisco 3640   | 11.3(1)T  | 12.0(1)T  | IP PLUS / IP PLUS |
| Cisco 3661   | 12.0(5)T  | 12.0(5)T  | IP PLUS / IP PLUS |
| Cisco 3662   | 12.0(5)T  | 12.0(5)T  | IP PLUS / IP PLUS |
| Cisco 4500-M | 11.3(1)T  | 12.0(1)T  | IP PLUS / IP PLUS |
| Cisco 4700-M | 11.3(1)T  | 12.0(1)T  | IP PLUS / IP PLUS |

**Note:** Table 2 only lists the minimum or current maintenance/main releases that support this sample configuration. Router models with certain network modules may have different minimum Cisco IOS versions. For a complete list of minimum supported software for any router family, use the Software Advisor ( registered customers only) .

**Note:** The minimum supported release may not necessarily be the recommended release. To determine the best maintenance release for your Cisco product, search for bugs listed by product component in the Bug Toolkit ( registered customers only) .

**Note:** Table 2 lists the minimum feature set required to do IP Inter-VLAN routing and trunking to support this sample configuration. For a complete list of other feature sets supported in different Cisco IOS versions and on different platforms, use the Download Software area.

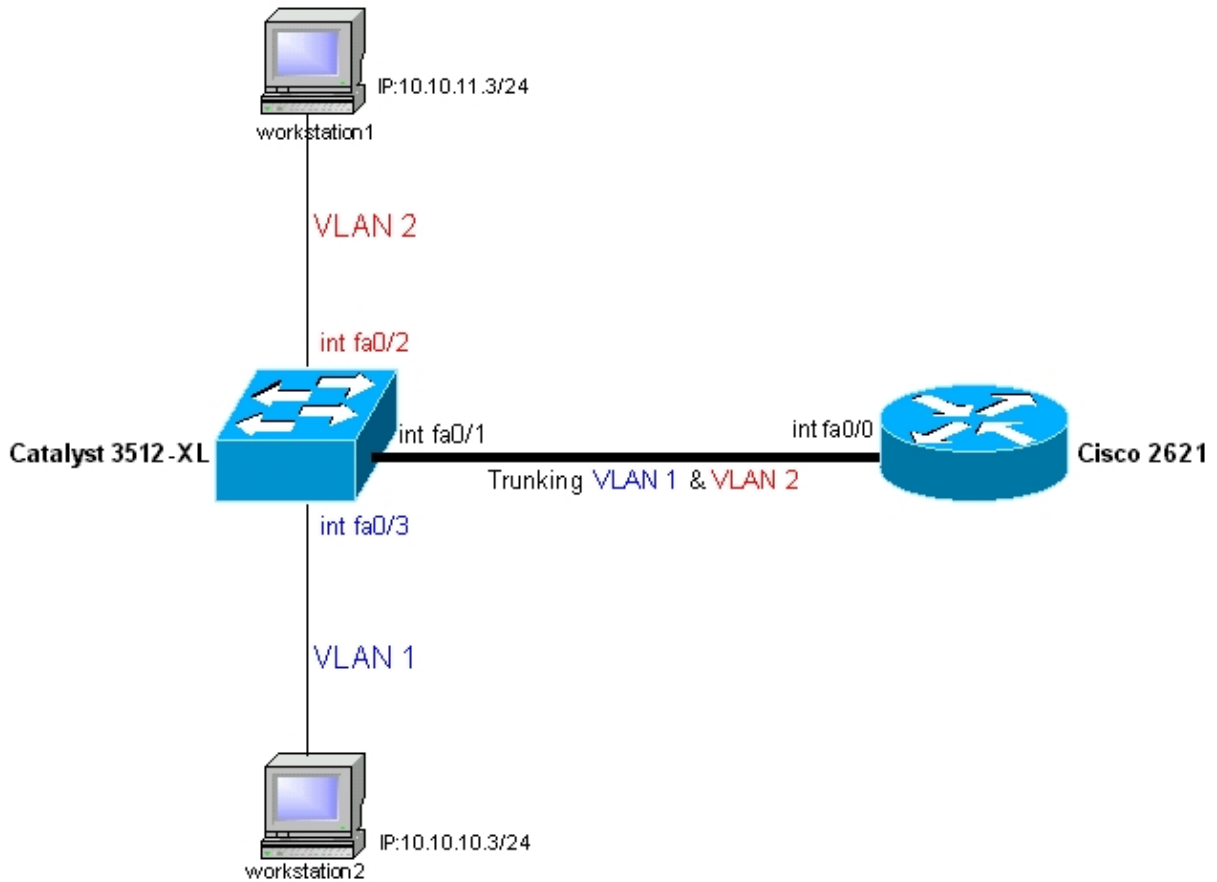
## Configure

In this section, you are presented with the information to configure the features described in this document.

**Note:** To find additional information on the commands used in this document, use the Command Lookup Tool ( registered customers only) .

## Network Diagram

This document uses the network setup shown in the diagram below.



## Configurations

This document uses the configurations shown below.

**Note:** Router models with certain network modules may have different minimum Cisco IOS versions that support ISL trunking.

- Catalyst 3512–XL
- Cisco 2600 Router
- 802.1Q Configuration on the Router for Cisco IOS Versions Earlier than 12.1(3)T

### Catalyst 3512–XL

**Note:** The following screen captures show the commands that were entered on the 3512XL switch. Comments between the commands are added in blue italics to explain certain commands and steps.

```
!-- Set the privileged mode
```

```
!-- and Telnet password on the switch.
```

```
switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
switch(config)#hostname 3512x1
3512x1(config)#enable password mysecret
3512x1(config)#line vty 0 4
3512x1(config-line)#login
3512x1(config-line)#password mysecret
3512x1(config-line)#exit
```

```
3512xl(config)#no logging console
3512xl(config)#^Z
```

```
!-- Set the IP address and default gateway for VLAN1 for management purposes.
```

```
3512xl#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
3512xl(config)#int vlan 1
3512xl(config-if)#ip address 10.10.10.2 255.255.255.0
3512xl(config-if)#exit
3512xl(config)#ip default-gateway 10.10.10.1
3512xl(config)#end
```

```
!-- Set the VTP Mode.
!-- In our example, we have set the mode to be transparent.
!-- Depending on your network, set the VTP Mode accordingly.
!-- For details on VTP,
!-- refer to
!-- Creating and Maintaining VLANs on Catalyst 2900XL and 3500XL Switches.
```

```
3512xl#vlan database
3512xl(vlan)#vtp transparent
Setting device to VTP TRANSPARENT mode.
```

```
!-- Adding VLAN2. VLAN1 already exists by default.
```

```
3512xl(vlan)#vlan 2
VLAN 2 added:
Name: VLAN0002
3512xl(vlan)#exit
APPLY completed.
Exiting....
```

```
!-- Enable trunking on the interface fastEthernet 0/1.
```

```
3512xl#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
3512xl(config)#int fastEthernet 0/1
3512xl(config-if)#switchport mode trunk
```

```
!-- Enter the trunking encapsulation as either isl
```

```
3512xl(config-if)#switchport trunk encapsulation isl
```

```
!-- or as dot1q:
```

```
3512xl(config-if)#switchport trunk encapsulation dot1q
```

```
!-- In case of 2940/2950 series switches, none of the above two commands are used,
!-- 2940/2950 series switches only support 802.1q encapsulation which is configured automatically
!-- when trunking is enabled on the interface by using switchport mode trunk command.
```

```
!-- In case of dot1q, you need to make sure that
!-- the native VLAN matches across the link.
!-- On 3512XL, by default, the native VLAN is 1.
!-- Depending on your network needs, you may change
!-- the native VLAN to be other than VLAN1,
!-- but it is very important that you change the native VLAN
!-- on the router accordingly.
!-- You may change the native VLAN, if needed, by using the following command:
!-- 3512xl(config-if)#switchport trunk native vlan <vlan ID>
```

```
!-- Allow all VLANs on the trunk.

3512xl(config-if)#switchport trunk allowed vlan all
3512xl(config-if)#exit

!-- The following set of commands will place FastEthernet 0/2
!-- into VLAN2 and enable portfast on the interface.

3512xl(config)#int fastEthernet 0/2
3512xl(config-if)#switchport access vlan 2
3512xl(config-if)#spanning-tree portfast
3512xl(config-if)#exit

!-- FastEthernet 0/3 is already in VLAN1 by default.
!-- Enable portfast on the interface.

3512xl(config)#int fastEthernet 0/3
3512xl(config-if)#spanning-tree portfast
3512xl(config-if)^Z

!-- For details on why to enable portfast,
!-- refer to:
!-- Using PortFast and Other Commands to Fix Workstation Startup Connectivity Delays.
!-- Remember to save the configuration.

3512xl#write memory
Building configuration...

3512xl#

-----

3512xl#show running-config
Building configuration...

Current configuration:

!
version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname 3512xl
!
no logging console
enable password mysecret
!
!
!
!
!
ip subnet-zero
!
!
!
interface FastEthernet0/1
    switchport mode trunk
!

!-- If 802.1Q is configured,
!-- you will instead see the following output
```

```

!-- under interface FastEthernet0/1:
!-- interface FastEthernet0/1
!-- switchport trunk encapsulation dot1q
!-- switchport mode trunk

!
interface FastEthernet0/2
  switchport access vlan 2
  spanning-tree portfast
!
interface FastEthernet0/3
  spanning-tree portfast
!
interface FastEthernet0/4
!
interface FastEthernet0/5
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
interface FastEthernet0/8
!
interface FastEthernet0/9
!
interface FastEthernet0/10
!
interface FastEthernet0/11
!
interface FastEthernet0/12
!
interface GigabitEthernet0/1
!
interface GigabitEthernet0/2
!
interface VLAN1
  ip address 10.10.10.2 255.255.255.0
  no ip directed-broadcast
  no ip route-cache
!
ip default-gateway 10.10.10.1
!
line con 0
  transport input none
  stopbits 1
line vty 0 4
  password mysecret
  login
line vty 5 15
  login
!
end

```

## 2600 Router

**Note:** The following screen captures show the commands that were entered on the Cisco 2600 router. Comments between the commands are added in blue italics to explain certain commands and steps.

```

!-- Set the privileged mode
!-- and Telnet password on the router.

```

```
Router#configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

```
Router(config)#hostname c2600
```

```
c2600(config)#enable password mysecret
```

```
c2600(config)#line vty 0 4
```

```
c2600(config-line)#login
```

```
c2600(config-line)#password mysecret
```

```
c2600(config-line)#exit
```

```
c2600(config)#no logging console
```

```
c2600(config)#^Z
```

```
c2600#configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

```
!-- Select FastEthernet 0/0 for the trunk configuration.
```

```
!-- No L2 or Layer 3 (L3) configuration is done here.
```

```
c2600(config)#int fastEthernet 0/0
```

```
c2600(config-if)#no shut
```

```
c2600(config-if)#exit
```

```
!-- Enable trunking on the sub-interface FastEthernet 0/0.1.
```

```
!-- Note that actual trunks are configured on the sub-interfaces.
```

```
c2600(config)#int fastEthernet 0/0.1
```

```
!-- Enter the trunking encapsulation as either isl
```

```
c2600(config-subif)#encapsulation isl 1
```

```
!-- or as dot1q:
```

```
!-- In case of dot1q, you need to make sure that
```

```
!-- the native VLAN matches across the link.
```

```
!-- On 3512XL, by default, the native VLAN is 1.
```

```
!-- On the router, configure VLAN1 as the native VLAN.
```

```
c2600(config-subif)#encapsulation dot1Q 1 ?
```

```
native Make this is native vlan
```

```
<cr>
```

```
c2600(config-subif)#encapsulation dot1Q 1 native
```

```
!-- On the switch, if you have a native VLAN other than VLAN1,
```

```
!-- on the router, configure the same VLAN to be the native VLAN,
```

```
!-- by using the above command.
```

**Note:** The **encapsulation dot1Q 1 native** command was added in Cisco IOS version 12.1(3)T. If you are using an earlier version of Cisco IOS, refer to the 802.1Q configuration for Cisco IOS Versions Earlier than 12.1(3)T section of this document to configure 802.1Q trunking on the router.

```
!-- Configure L3 information on the sub-interface 0/0.1.
```

```
c2600(config-subif)#ip address 10.10.10.1 255.255.255.0
```

```
c2600(config-subif)#exit
```

```
!-- Enable trunking on the sub-interface FastEthernet 0/0.2.
```

```
!-- Note that actual trunks are configured on the sub-interfaces.
```

```
c2600(config)#int fastEthernet 0/0.2

!-- Enter the trunking encapsulation as either isl
c2600(config-subif)#encapsulation isl 2

!-- or as dot1q:
c2600(config-subif)#encapsulation dot1Q 2

!-- Configure L3 information on the sub-interface 0/0.2.
c2600(config-subif)#ip address 10.10.11.1 255.255.255.0
c2600(config-subif)#exit
c2600(config)#^Z

!-- Remember to save the configuration.

c2600#write memory
Building configuration...
[OK]
c2600#
```

**Note:** In order to make this setup work, and to successfully ping between workstation1 and workstation2, you need to make sure that the default gateways on the workstations are setup properly. For workstation1, the default gateway should be 10.10.11.1 and for workstation2, the default gateway should be 10.10.10.1. For details on how to set the default gateways on the workstations, refer to their respective sections in this document.

**Note:** The following paragraph is only applicable, if you have configured 802.1Q trunking between the router and the switch.

**Note:** If you have followed the configuration steps listed in the above sections, and are still not able to ping across the VLANs (between workstation1 and workstation2), then there is a possibility that you have come across Caveat CSCds42715, in which the 802.1Q native VLAN keyword does not function properly when fast switching is enabled. The bug fix was integrated in the following code versions: 12.2(0.5), 12.2(0.5)T, 12.1(5)DC, 12.1(5)YB, 12.2(0.18)S, 12.1(5)YD02, 12.2(2)B, 12.2(15)ZN. You can check the status and a brief description of the bug by using the Bug Toolkit ( registered customers only) and entering the bug ID CSCds42715.

---

```
c2600#show running-config
Building configuration...

Current configuration:
!
version 12.1
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname c2600
!
no logging console
enable password mysecret
```

```
!  
!  
!  
!  
!  
ip subnet-zero  
!  
!  
!  
!  
!  
!  
!  
!  
!  
interface FastEthernet0/0  
no ip address  
duplex auto  
speed auto  
!  
interface FastEthernet0/0.1  
encapsulation isl 1  
ip address 10.10.10.1 255.255.255.0  
no ip redirects  
!  
  
!-- If 802.1Q is configured,  
!-- you will instead see the following output  
!-- under interface FastEthernet0/0.1:  
!-- interface FastEthernet0/0.1  
!-- encapsulation dot1Q 1 native  
!-- ip address 10.10.10.1 255.255.255.0  
  
!  
!  
interface FastEthernet0/0.2  
encapsulation isl 2  
ip address 10.10.11.1 255.255.255.0  
no ip redirects  
!  
  
!-- If 802.1Q is configured,  
!-- you will instead see the following output  
!-- under interface FastEthernet0/0.2:  
!-- interface FastEthernet0/0.2  
!-- encapsulation dot1Q 2  
!-- ip address 10.10.11.1 255.255.255.0  
  
!  
interface FastEthernet0/1  
no ip address  
shutdown  
duplex auto  
speed auto  
!  
ip classless  
no ip http server  
!  
!  
!  
line con 0  
transport input none  
line aux 0  
line vty 0 4  
password mysecret
```

```
login
!  
no scheduler allocate  
end
```

### 802.1Q Configuration on the Router for Cisco IOS Versions Earlier than 12.1(3)T

As described earlier in this document, while configuring 802.1Q trunking it is very important to match the native VLAN across the link. In the Cisco IOS software versions earlier than 12.1(3)T, you cannot define the native VLAN explicitly, as the encapsulation dot1q 1 native command under the sub-interface is not available. In the earlier Cisco IOS versions, it is important to configure the native VLAN-Interface not as a sub-interface, which is in our example VLAN1. If configured wrong, the router would expect a tag dot1q frame on VLAN1 and the switch is not expecting a tag on VLAN1. As a result, no traffic will pass between VLAN1 on the switch and the router. In these situations always put the configuration for the native VLAN under the main interface and on the trunk create subinterface for all other VLANs.

In the current lab setup, use the following steps to configure the Cisco 2600 router:

```
!-- Set the privileged mode  
!-- and Telnet password on the router.  
  
Router#configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#hostname c2600  
c2600(config)#enable password mysecret  
c2600(config)#line vty 0 4  
c2600(config-line)#login;  
c2600(config-line)#password mysecret  
c2600(config-line)#exit  
c2600(config)#no logging console  
c2600(config)#^Z  
  
c2600#configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
  
!-- Select FastEthernet 0/0 for the trunk configuration.  
  
c2600(config)#int fastEthernet 0/0  
c2600(config-if)#no shut  
  
!-- Note that the IP address for VLAN1 is configured on the main interface,  
!-- and no encapsulation for VLAN1 will be done under the sub-interface.  
  
c2600(config-if)#ip address 10.10.10.1 255.255.255.0  
c2600(config-if)#exit  
  
!-- Configure dot1q encapsulation for VLAN 2  
!-- on sub-interface fastEthernet 0/0.2.  
  
c2600(config)#int fastEthernet 0/0.2  
c2600(config-subif)#encapsulation dot1q 2  
c2600(config-subif)#  
  
!-- Configuring L3 information on the sub-interface 0/0.2.
```

```
c2600(config-subif)#ip address 10.10.11.1 255.255.255.0
c2600(config-subif)#exit
c2600(config)#^Z
```

*!-- Remember to save the configuration.*

```
c2600#write memory
Building configuration...
[OK]
c2600#
```

**Note:** In order to make this setup work and to successfully ping between workstation1 and workstation2, you need to make sure that the default gateways on the workstations are setup properly. For workstation1, the default gateway should be 10.10.11.1, and for workstation2, the default gateway should be 10.10.10.1. For details on how to set the default gateways on the workstations, refer to their respective sections in this document.

```
c2600#show running-config
Building configuration...

Current configuration:
!
version 12.1
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname c2600
!
no logging console
enable password mysecret
!
!
!
!
memory-size iomem 7
ip subnet-zero
!
!
!
!
!
!
interface FastEthernet0/0
 ip address 10.10.10.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/0.2
 encapsulation dot1Q 2
 ip address 10.10.11.1 255.255.255.0
!
interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
!
ip classless
no ip http server
```

```
!  
!  
line con 0  
  transport input none  
line aux 0  
line vty 0 4  
  password mysecret  
  login  
!  
no scheduler allocate  
end  
  
c2600#
```

## debug and show Commands

This section provides information you can use to confirm your configuration is working properly.

Certain **show** commands are supported by the Output Interpreter Tool ( registered customers only) , which allows you to view an analysis of **show** command output.

On the Catalyst 2900XL/3500XL/2940/2950/2970 switch, use the following commands:

- **show int {FastEthernet | GigabitEthernet} <module/port> switchport**
- **show vlan**
- **show vtp status**

On the Cisco 2600 router, use the following commands:

- **show vlan**
- **show interface**

## Sample show Command Output

### Catalyst 3500XL Switch

**show int {FastEthernet | GigabitEthernet} <module/port> switchport**

This command is used to check the administrative and operational status of the port. It is also used to make sure that the native VLAN matches on both sides of the trunk. The native VLAN is used for untagged traffic when the port is in 802.1Q trunking mode. Refer to Creating and Maintaining VLANs on Catalyst 2900XL and 3500XL Switches for details on native VLANs.

```
3512xl#show int fastEthernet 0/1 switchport  
Name: Fa0/1  
Switchport: Enabled  
Administrative mode: trunk  
Operational Mode: trunk  
Administrative Trunking Encapsulation: isl  
Operational Trunking Encapsulation: isl  
Negotiation of Trunking: Disabled  
Access Mode VLAN: 0 ((Inactive))  
Trunking Native Mode VLAN: 1 (default)  
Trunking VLANs Enabled: ALL  
Trunking VLANs Active: 1,2  
Pruning VLANs Enabled: 2-1001
```

```
Priority for untagged frames: 0
Override vlan tag priority: FALSE
Voice VLAN: none
Appliance trust: none
```

**Note:** For 802.1Q trunking, the output of the above command changes as follows:

```
3512xl#show int fastEthernet 0/1 switchport
Name: Fa0/1
Switchport: Enabled
Administrative mode: trunk
Operational Mode: trunk
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: Disabled
Access Mode VLAN: 0 ((Inactive))
Trunking Native Mode VLAN: 1 (default)
Trunking VLANs Enabled: ALL
Trunking VLANs Active: 1,2
Pruning VLANs Enabled: 2-1001

Priority for untagged frames: 0
Override vlan tag priority: FALSE
Voice VLAN: none
```

## show vlan

This command is used to verify that the interfaces (ports) belong to the correct VLAN. In our example, only interface Fa0/2 belongs to VLAN2. The rest are members of VLAN1.

```
3512xl#show vlan
VLAN Name                Status    Ports
-----
1    default                active    Fa0/3, Fa0/4, Fa0/5, Fa0/6,
                                Fa0/7, Fa0/8, Fa0/9, Fa0/10,
                                Fa0/11, Fa0/12, Gi0/1, Gi0/2
2    VLAN0002              active    Fa0/2
1002 fddi-default          active
1003 token-ring-default   active
1004 fddinet-default      active
1005 trnet-default        active

...(output suppressed)
```

## show vtp status

This command is used to check the VLAN trunking protocol (VTP) configuration on the switch. In our example, we have used transparent mode. The correct VTP mode depends on the topology of your network. For details on VTP, refer to *Creating and Maintaining VLANs on Catalyst 2900XL and 3500XL Switches*.

```
3512xl#show vtp status
VTP Version                : 2
Configuration Revision     : 0
Maximum VLANs supported locally : 254
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                 : 0xC3 0x71 0xF9 0x77 0x2B 0xAC 0x5C 0x97
Configuration last modified by 0.0.0.0 at 0-0-00 00:00:00
```

# Cisco 2600 Router

## show vlan

This command tells you what L2 or L3 information is configured for each VLAN.

```
c2600#show vlan
```

```
Virtual LAN ID: 1 (Inter Switch Link Encapsulation)
```

```
vLAN Trunk Interface: FastEthernet0/0.1
```

|                       |            |           |              |
|-----------------------|------------|-----------|--------------|
| Protocols Configured: | Address:   | Received: | Transmitted: |
| IP                    | 10.10.10.1 | 40        | 38           |

```
Virtual LAN ID: 2 (Inter Switch Link Encapsulation)
```

```
vLAN Trunk Interface: FastEthernet0/0.2
```

|                       |            |           |              |
|-----------------------|------------|-----------|--------------|
| Protocols Configured: | Address:   | Received: | Transmitted: |
| IP                    | 10.10.11.1 | 9         | 9            |

**Note:** For 802.1Q trunking, the output of the above command changes as follows:

```
c2600#show vlan
```

```
Virtual LAN ID: 1 (IEEE 802.1Q Encapsulation)
```

```
vLAN Trunk Interface: FastEthernet0/0.1
```

```
This is configured as native Vlan for the following interface(s): FastEthernet0/0
```

|                       |            |           |              |
|-----------------------|------------|-----------|--------------|
| Protocols Configured: | Address:   | Received: | Transmitted: |
| IP                    | 10.10.10.1 | 0         | 2            |

```
Virtual LAN ID: 2 (IEEE 802.1Q Encapsulation)
```

```
vLAN Trunk Interface: FastEthernet0/0.2
```

|                       |            |           |              |
|-----------------------|------------|-----------|--------------|
| Protocols Configured: | Address:   | Received: | Transmitted: |
| IP                    | 10.10.11.1 | 42        | 19           |

**Note:** For 802.1Q trunking, with Cisco IOS versions earlier than 12.1(3)T, the output of the command changes as follows:

```
c2600#show vlan
```

```
Virtual LAN ID: 2 (IEEE 802.1Q Encapsulation)
```

```
vLAN Trunk Interface: FastEthernet0/0.2
```

|                       |            |           |              |
|-----------------------|------------|-----------|--------------|
| Protocols Configured: | Address:   | Received: | Transmitted: |
| IP                    | 10.10.11.1 | 6         | 4            |

**Note:** No IEEE 802.1Q encapsulation is displayed for VLAN1 on any of the sub-interfaces.

## show interface

This command is used to check the administrative and operational status of the interface.

```
c2600#show interfaces fastEthernet 0/0  
FastEthernet0/0 is up, line protocol is up
```

```
Hardware is AmdFE, address is 0003.e36f.41e0 (bia 0003.e36f.41e0)
MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
Full-duplex, 100Mb/s, 100BaseTX/FX
ARP type: ARPA, ARP Timeout 04:00:00
Last input 00:00:00, output 00:00:07, output hang never
Last clearing of "show interface" counters never
Queueing strategy: fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 1 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
    217 packets input, 12884 bytes
    Received 217 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    0 watchdog
    0 input packets with dribble condition detected
    45 packets output, 6211 bytes, 0 underruns(0/0/0)
    0 output errors, 0 collisions, 4 interface resets
    0 babbles, 0 late collision, 0 deferred
    0 lost carrier, 0 no carrier
    0 output buffer failures, 0 output buffers swapped out
```

```
c2600#show interfaces fastEthernet 0/0.1
FastEthernet0/0.1 is up, line protocol is up
Hardware is AmdFE, address is 0003.e36f.41e0 (bia 0003.e36f.41e0)
Internet address is 10.10.10.1/24
MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ISL Virtual LAN, Color 1.
ARP type: ARPA, ARP Timeout 04:00:00
```

```
c2600#show interfaces fastEthernet 0/0.2
FastEthernet0/0.2 is up, line protocol is up
Hardware is AmdFE, address is 0003.e36f.41e0 (bia 0003.e36f.41e0)
Internet address is 10.10.11.1/24
MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ISL Virtual LAN, Color 2.
ARP type: ARPA, ARP Timeout 04:00:00
```

**Note:** For 802.1Q trunking, the output of the above command changes as follows:

```
c2600#show interfaces fastEthernet 0/0.1
FastEthernet0/0.1 is up, line protocol is up
Hardware is AmdFE, address is 0003.e36f.41e0 (bia 0003.e36f.41e0)
Internet address is 10.10.10.1/24
MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation 802.1Q Virtual LAN, Vlan ID 1.
ARP type: ARPA, ARP Timeout 04:00:00
```

```
c2600#show interfaces fastEthernet 0/0.2
FastEthernet0/0.2 is up, line protocol is up
Hardware is AmdFE, address is 0003.e36f.41e0 (bia 0003.e36f.41e0)
Internet address is 10.10.11.1/24
MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation 802.1Q Virtual LAN, Vlan ID 2.
ARP type: ARPA, ARP Timeout 04:00:00
```

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## Related Information

- [Configuring 802.1q Trunking Between a Catalyst 3550/3750 and Catalyst Switches](#)
  - [Creating and Maintaining VLANs on Catalyst 2900XL and 3500XL Switches](#)
  - [Creating and Maintaining VLANs on Catalyst 2950 Switches](#)
  - [Using PortFast and Other Commands to Fix Workstation Startup Connectivity Delays](#)
  - [Catalyst 2900XL/3500XL, Cisco IOS Desktop Switching Command Reference](#)
  - [Catalyst 2940 Switch Command Reference](#)
  - [Catalyst 2950 and Catalyst 2955 Switch Command Reference](#)
  - [Catalyst 2970 Switch Command Reference](#)
  - [XC: Cisco IOS Switching Services Configuration Guide](#)
  - [XR: Cisco IOS Switching Services Command Reference](#)
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