配置 Catalyst 交换机之间的 802.1Q 中继

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简介

本文档介绍运行Cisco IOS®软件的Cisco Catalyst交换机之间的IEEE 802.1Q (dot1q)中继的区别。

先决条件

要求

尝试进行此配置之前，请确保满足以下要求：

- 了解 IEEE 802.1Q 中继
- 使用命令行界面(CLI)配置Catalyst 3560和Catalyst 6500系列交换机的知识

使用的组件

本文档中的信息基于以下软件和硬件版本：

- 运行 Cisco IOS 软件版本 12.2(25)SEA 的 Catalyst 3560 交换机
- 运行 Cisco IOS 软件版本 12.1(26)E1 的 Catalyst 6509 交换机

本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您的网络处于活动状态，请确保您了解所有命令的潜在影响。

背景信息

本文档提供了运行Cisco IOS®软件的Cisco Catalyst 3560交换机与Catalyst 6500系列交换机之间的IEEE 802.1Q (dot1q)中继的示例配置。中继是一种在两个设备之间点到点链路上传输来自若干VLAN 的流量的方式。

在传统平台上，有两种实施以太网中继的方法：

1. 交换机间链路协议 (ISL) - Cisco 专有协议
2. 802.1Q - IEEE标准

Catalyst组件

本文档中的Catalyst 3560和6500配置也适用于运行Cisco IOS软件的其他Catalyst交换机。

注意：请参阅以下文档以了解各种Catalyst交换机所支持的中继方法：

- 在Catalyst交换机上实施中继的系统要求

注意：本文档仅包含交换机的配置文件和相关示例 show 命令的输出。有关如何在Catalyst交换机之间配置802.1Q TRUNK的详细信息，请参阅以下文档：

- 配置 VLAN 的配置 VLAN 中继部分 - Catalyst 3560 系列交换机
- 配置第2层以太网接口的了解VLAN中继部分-运行Cisco IOS软件的Catalyst 4500系列交换机

背景理论

IEEE 802.1Q 使用内部标记机制。中继设备先插入 4 字节标记来识别帧所属的 VLAN，再重新计算帧校验序列 (FCS)。有关详细信息，请参阅以下文档：

- 交换机间链路和 IEEE 802.1Q 帧格式

注意：下面是此配置要记住的重要说明：

- Catalyst 3560/3750系列交换机上的任何以太网接口都可以支持802.1Q和ISL封装。默认情况下，Catalyst 3550 交换机上的以太网接口是第 2 层 (L2) 端口。

- Catalyst 6500/6000 系列交换机上的所有以太网端口均可支持 802.1Q 和 ISL 封装。

- 默认情况下，运行 Cisco IOS 软件的 Catalyst 4500 系列交换机支持 ISL 和 802.1Q 中继模式。这在 WS-X4418-GB 和 WS-X4412-2GB-T 模块上阻塞千兆端口以外的所有接口上均受到支持。这些端口不支持 ISL 而只支持 802.1Q 中继。端口 3 至 18 是 WS-X4418-GB 模块上的阻塞千兆端口。端口 1 至 12 是 WS-X4412-2GB-T 模块上的阻塞千兆端口。

注意：如果端口与背板的连接超订用，则该端口为阻塞端口。

- Catalyst 6500和Catalyst 4500平台之间的主要区别在于默认接口配置。默认情况下，运行Cisco IOS软件的Catalyst 6500交换机的接口处于关闭模式，即第3层(L3)路由端口。运行Cisco IOS软件的Catalyst 4500交换机启用了所有的接口。默认情况下，接口是 L2 交换机端口。

- 当802.1Q封装用于Catalyst 3750交换机上的中继接口时，可在 show interface 输出中看到残帧，因为61-64字节的有效802.1Q封装数据包（包括q标记）被Catalyst 3750交换机算作是过小帧，即使这些数据包被正确地转发。

注意：请注意，运行Cisco IOS XE的最新Catalyst交换机（例如3650/3850和更高版本）不再支持ISL协议。

配置

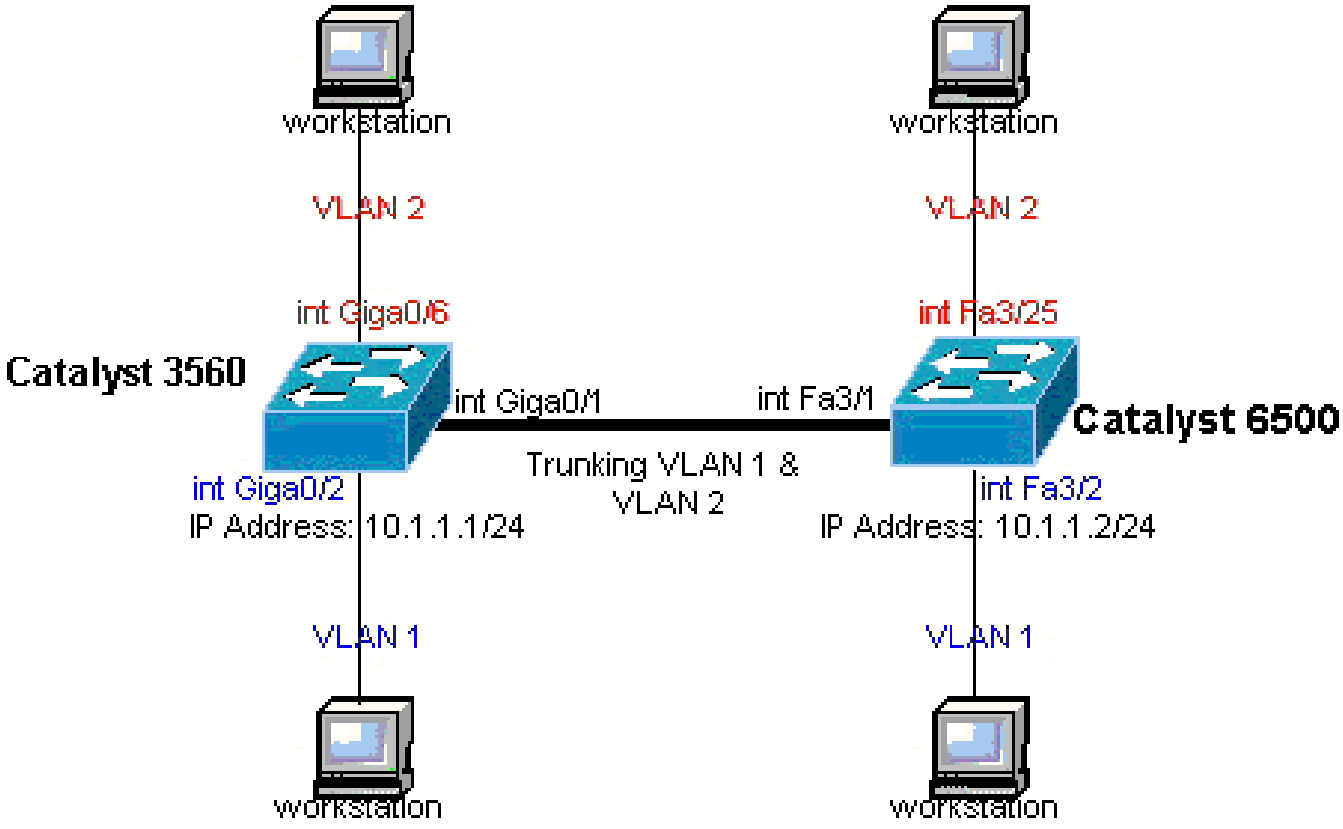
本部分提供有关如何配置本文档所述功能的信息。

网络图

本文档使用以下网络设置：

注意：Catalyst 3560上的千兆以太网接口是10/100/1000 Mbps协商以太网接口。因此，在此网络图中，Catalyst 3560 上的千

兆端口连接到 Catalyst 6500 上的快速以太网 (100 Mbps) 端口。



网络图

配置

本文档使用以下配置：

- Catalyst 3560 交换机
- Catalyst 6500 交换机

Catalyst 3560 交换机
<#root> *!--- 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 2 is 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

!--- Configure 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 server
!
```

```
!
line con 0
transport input none
line vty 0 4

!--- This is the privileged mode password for the example.

password mysecret
login
line vty 5 15
login
!
end
```

Catalyst 6500 交换机

<#root>

```
!--- 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-encryption
!
hostname Cat6500
!
vtp mode transparent
ip subnet-zero
!
!
mls flow ip destination
mls flow ipx destination
!

!--- This is the privileged mode password for the example.

enable password mysecret
!
redundancy
mode rpr-plus
main-cpu
auto-sync running-config
auto-sync standard
!
!

!--- This enables VLAN 2.

vlan 2
!
interface GigabitEthernet1/1
 no ip address
 shutdown
```

```
 !
 interface GigabitEthernet1/2
  no ip address
  shutdown
 !

!--- 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.

 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.



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 encapsulation 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.

 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.


 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 http 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
```

注意：如果将接口分配给不存在的VLAN，该接口将关闭，直到您在VLAN数据库中创建VLAN。有关详细信息，请参阅配置 VLAN 的创建或修改以太网 VLAN 部分。

验证

使用本部分可确认配置能否正常运行。在 Catalyst 3560/3750/6500/4500 交换机上，请使用以下命令：

- **show interfaces <interface_type module/port> trunk**
- **show interfaces <interface_type module/port> switchport**
- **show vlan**
- **show vtp status**

show

命令输出示例

Catalyst 3560 交换机

- **show interfaces <interface_type module/por> trunk** —此命令显示接口的中继配置以及能够通过中继为其传输流量的VLAN编号。

<#root>

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 —此命令显示接口的交换机端口配置。

在显示器中，选中 Operational Mode 和 Operational Trunking Encapsulation 字段。

```
    <#root>

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 - 此命令提供有关 VLAN 及属于特定 VLAN 的端口的信息。**

```
<#root>

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.
```

注意：输出中显示的端口仅为接入端口。但是，配置为中继以及未连接状态的端口也显示在**show vlan**输出中。

•

show vtp status - 此命令显示有关 VTP 管理域、状态和计数器的一般信息。

<#root>

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 交换机

- **show interfaces <interface_type module/port> trunk**- 此命令显示接口的中继配置以及能够通过中继为其传输流量的VLAN编号。

<#root>

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** —此命令显示接口的交换机端口配置。 在显示器中，选中 Operational Mode 和 Operational Trunking Encapsulation 字段。

<#root>

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 - 此命令提供有关 VLAN 及属于特定 VLAN 的端口的信息。**

<#root>

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
```

注意：显示的端口仅限于那些已配置为第2层非中继（接入）端口的端口。配置为中继以及未连接状态的端口也显示在**show vlan**输出中。有关详细信息，请参阅配置用于第2层交换的LAN端口的“配置用于第2层交换的LAN接口”部分。

- **show vtp status - 此命令显示有关 VTP 管理域、状态和计数器的一般信息。**

<#root>

```
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**

```
<#root>

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
```

相关信息

- Catalyst 3560 系列交换机配置指南
- Catalyst 4500 系列交换机配置指南

- Catalyst 6500 系列交换机配置指南
- 思科技术支持和下载

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