Cisco SD-WAN EtherChannel

Table 1: Feature History

Feature Name	Release Information	Description
Cisco SD-WAN EtherChannel	Cisco IOS XE Release 17.6.1a Cisco vManage Release 20.6.1	This feature allows you to configure EtherChannels on Cisco IOS XE SD-WAN devices in service-side VPN. An EtherChannel provides fault-tolerant high speed link, redundancy, and increased bandwidth between Cisco IOS XE SD-WAN devices and other devices such as routers, switches, or servers connected in a network. You can configure EtherChannels only using the CLI device templates and CLI add-on feature templates.

Supported Devices for Cisco SD-WAN EtherChannel

The following platforms support an EtherChannel on the service-side VPN:

- **Cisco 4000 Series Integrated Services Routers**

  - Cisco 4451-X Integrated Services Router
  - Cisco 4461 Integrated Services Router
  - Cisco 4431 Integrated Services Router
  - Cisco 4331 Integrated Services Router
  - Cisco 4351 Integrated Services Router
- **Cisco ASR 1000 Series Aggregation Services Routers**
  - Cisco ASR 1001-X Router
  - Cisco ASR 1006-X Router
  - Cisco ASR 1001-HX Router
  - Cisco ASR 1002-HX Router
  - Cisco ASR 1002-X Router
- Cisco Catalyst 8000V Edge Software
- Cisco Catalyst 8200 Router
- Cisco Catalyst 8300 Router
- Cisco Catalyst 8500 Series Edge Router

Note Network Interface Modules (NIMs) do not support EtherChannels on the service-side VPN.

Prerequisites for Cisco SD-WAN EtherChannel

- All the LAN ports in each EtherChannel must be of the same speed.
- All the LAN ports must be configured on Layer 3 service-side ports.

Restrictions for Cisco SD-WAN EtherChannel

- The EtherChannel feature is supported only on the service-side VPN.
- You can configure EtherChannels on a device by using the CLI, or using only the CLI templates or CLI add-on feature templates in Cisco vManage.
- NIMs do not support EtherChannels on the service-side VPN.
- The EtherChannel Quality of Service (QoS) feature on port channels is not supported on the service-side VPN.

- The Aggregate EtherChannel QoS EtherChannel Quality of Service feature on port channels are not supported on the service-side VPN.
- An EtherChannel does not support Digital Signal Processor (DSP) farm services and voice services.

Benefits of Cisco SD-WAN EtherChannel

- Provides fault-tolerance. If any one of the links in an EtherChannel fail, the EtherChannel automatically redistributes traffic across the remaining links.
- Helps increase bandwidth between Cisco IOS XE SD-WAN devices and other devices such as switches and servers that are connected in a network.

Information About Cisco SD-WAN EtherChannel

An EtherChannel provides fault-tolerant high-speed links between switches, routers, and servers. You can use the EtherChannel to increase bandwidth between the wiring closets and the data center, and also deploy it at any place in a network where bottlenecks are likely to occur. An EtherChannel provides automatic recovery for the loss of a link by redistributing the load across the remaining links. If a link fails, an EtherChannel redirects traffic from the failed link to the remaining links in the channel.

An EtherChannel comprises a channel group and a port-channel interface. The channel group binds physical ports to the port-channel interface. Configuration changes applied to the port-channel interface apply to all the physical ports bound together in the channel group.

EtherChannel on Service-Side VPN

To create an EtherChannel, begin by configuring a port channel. A port channel is a logical interface on a Cisco IOS XE SD-WAN device. After you create an EtherChannel, the configuration changes that are applied to the port-channel interface are also applied to all the physical ports assigned to the port-channel interface.

You can configure an EtherChannel using one these methods:

- Link Aggregation Control Protocol (LACP) mode
- Static mode

  Use the LACP mode to configure an EtherChannel if it is supported on both ends of a device. If either of the device does not support LACP mode, use a static mode to configure an EtherChannel.

LACP Mode

LACP facilitates the automatic creation of EtherChannels by exchanging LACP packets between the Ethernet ports.

This table shows the user-configurable EtherChannel LACP modes.

Table 2: EtherChannel LACP Modes

Mode	Description
active	Places a port in an active negotiating state in which the port starts negotiations with other ports by sending LACP packets.
passive	Places a port in a passive negotiating state in which the port responds to the packets that it receives, but does not start LACP packet negotiation. This setting minimizes the transmission of LACP packets.

Both the **active** and **passive** modes enable ports to negotiate with partner ports based on port speed.

Ports can form an EtherChannel when they are in different LACP modes as long as the modes are compatible. For example:

- A port in the **active** mode can form an EtherChannel with another port that is in the **active** or **passive** mode.
- A port in the **passive** mode cannot form an EtherChannel with another port that is also in the **passive** mode because neither port starts LACP negotiation.

Static Mode

You can manually create an EtherChannel by using the **interface port-channel** command in the global configuration mode. You then use the **channel-group interface** command in the global configuration mode to assign an interface to the EtherChannel. After you configure an EtherChannel, the configuration changes applied to the port-channel interface are applied to all the physical ports assigned to the port-channel interface. Unlike an LACP mode, in a static mode, no packets are sent for negotiations with the other ports. Instead, you must manually configure the ports as part of an EtherChannel.

EtherChannel Load Balancing

An EtherChannel balances traffic load across the links in a channel. You can specify one of several different load-balancing modes. EtherChannels can use either dynamic flow-based load balancing or virtual LAN (VLAN) manual load balancing.

You can configure the load-balancing method globally for all the port channels or directly on specific port channels. The global configuration applies only to those port channels for which you have not explicitly configured load balancing. The port-channel configuration overrides the global configuration.

The following load-balancing methods are supported on Cisco IOS XE SD-WAN devices:

- Flow-Based

  VLAN-Based

Flow-Based Load Balancing

Flow-based load balancing is the default load-balancing method, and is enabled by default at the global level. Flow-based load balancing identifies different flows of traffic based on the key fields in the data packet. For example, IPv4 source and destination IP addresses can be used to identify a flow. The various data traffic flows are then mapped to the different member links of a port channel. After the mapping is done, the data traffic for a flow is transmitted through the assigned member link. The flow mapping is dynamic and changes

when there is any change in the state of a member link to which a flow is assigned. The flow mapping is dynamic when member links are added or deleted.

VLAN-Based Load Balancing

VLAN-based load balancing allows you to configure static assignment of user traffic, as identified by a VLAN ID, to a given member link of an EtherChannel. You can manually assign VLAN subinterfaces to a primary and secondary link. This feature allows load balancing to downstream equipment regardless of vendor equipment capabilities, and provides failover protection by redirecting traffic to the secondary member link if the primary link fails. Member links are supported with up to 16 bundles per chassis.

Use Cases for Cisco SD-WAN EtherChannel

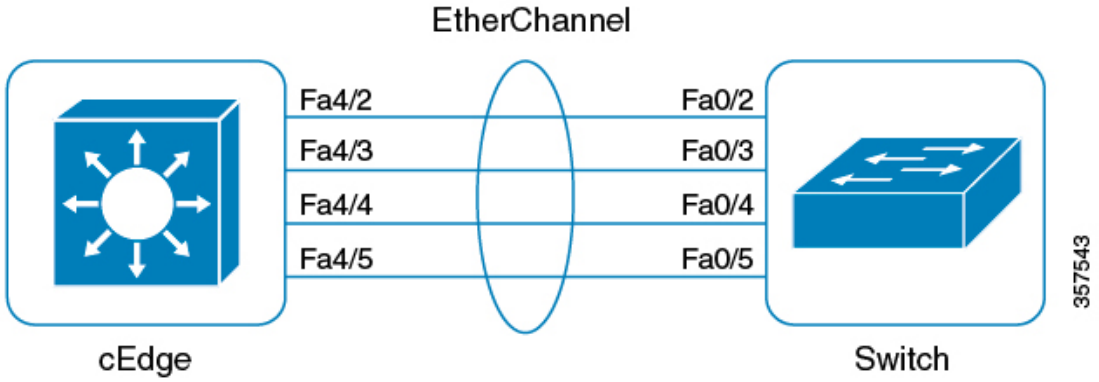
You can configure Etherchannels on the service-side VPN because they can provide increased bandwidth and resilience in a network.

Increased Bandwidth

An EtherChannel allows multiple links to be combined into one logical link. Because an EtherChannel offers redundancy of links, you can configure EtherChannels to increase the speed in a network.

Increased Resilience

An EtherChannel also provides network resiliency. Even if a link within an EtherChannel fails, traffic that is previously carried over the failed link switches to the remaining links within the EtherChannel. Thus, EtherChannel provides automatic recovery for the loss of a link by redistributing the load across the remaining



link.

Configure Cisco SD-WAN EtherChannel

1. From the Cisco vManage menu, choose **Configuration** > **Templates**.
2. Click **Create Template**, and then choose **CLI Template**.

Note You can also use the CLI Add-on template to configure an EtherChannel. For more information, see Create a CLI Add-On Feature Template.

3. From **Device Model**, choose a device model for which you are creating the template.
4. In the **Template Name** field, enter a name for the device template. This field is mandatory and can contain only uppercase and lowercase letters, the digits 0 to 9, hyphens (-), and underscores (_). It cannot contain spaces or any other characters.
5. In the **Description** field, enter a description for the device template. This field is mandatory, and it can contain any character and spaces.
6. In the **CLI Configuration** field, enter the EtherChannel configuration by typing it, cutting and pasting it, or uploading a file.
7. Click **Save**.

Configure Cisco SD-WAN EtherChannel Using CLI

This section provides sample CLI configurations to configure Cisco SD-WAN EtherChannel using CLI.

1. Configure a Layer 3 port channel:

```
Device# config-transaction
Device(config)# interface Port-channel channel-number
Device(config-if)# ip address ip-address mask
```

2. Assign Interfaces to Layer 3 port channel:

Configure LACP EtherChannel

```
Device# config-transaction
Device(config)# interface GigabitEthernet slot/subslot/port
Device(config-if)# no ip address
Device(config-if)# channel-group channel-group-number mode {active passive}
Device(config-if)# exit

Device# config-transaction
Device(config)# lacp system-priority priority
Device(config)# interface GigabitEthernet slot/subslot/port
Device(config-if)# lacp port-priority priority
```

Configure Static EtherChannel

```
Device# config-transaction
Device(config)# interface GigabitEthernet slot/subslot/port
Device(config-if)# no ip address
Device(config-if)# channel-group channel-group-number
```

Configure Load Balancing

Enable Flow Based Load Balancing Per Port Channel

```
Device(config)# interface Port-channel channel-number
Device(config-if)#load-balancing flow
```

Hash Algorithms For FLow-based Load Balancing

```
Device(config)# port-channel load-balance-hash-algo {dst-ip dst-mac src-dst-ip
 src-dst-mac  src-dst-mixed-ip-port src-ip src-mac}
```

Note The default hash algorithm for flow-based load balancing is **src-dst-ip**.

Manual Traffic Distribution Based on VLAN ID

```
Device(config)# port-channel load-balancing vlan-manual
```

Note This command is available for configuration in the global configuration mode, and applies to all the port-channel configured on the device.

Enable VLAN Load Balancing Per Port Channel

```
Device(config)# interface Port-channel channel-number
Device(config-if)#load-balancing vlan
```

Example of Configuring VLAN Load Balancing

```
Device# config-transaction
Device(config)# interface Port-channel channel-number
Device(config)# interface GigabitEthernet slot/subslot/port
Device(config-if)# channel-group channel-group-number
Device(config)# interface GigabitEthernet slot/subslot/port
Device(config-if)# channel-group channel-group-number
Device(config)# interface Port-channelchannel-number
Device(config-if)# load-balancing vlan
Device(config)# interface Port-channel channel-number.channel-number
Device(config-subif)# encapsulation dot1Q vlan_id primary interface1
secondaryinterface2
```

Note Interface 1 and interface 2 must be member ports of a port channel when **encapsulation dot1q** is configured.

The following is a complete configuration example for creating an EtherChannel in static mode:

```
interface Port-channel2
 ip address 10.0.0.1 255.255.255.0
 no negotiation auto
!

interface GigabitEthernet2/1/0
 no ip address
 negotiation auto
 cdp enable
 channel-group 2
!
interface GigabitEthernet2/1/1
```

```
 no ip address
 negotiation auto
 cdp enable
 channel-group 2
!
```

Configuration Example for Cisco SD-WAN EtherChannel

Example

This example shows how to configure EtherChannel 1 and add physical interfaces to the EtherChannel in static mode:

```
Device# config-transaction
Device(config)# interface port-channel 1
Device(config-if)# ip address 10.0.0.1 255.255.255.0
Device(config-if)# exit
Device(config)# interface GigabitEthernet 0/0/1
Device(config-if)# channel-group 1
Device(config-if)# end
```

Configuration Example to configure EtherChannnel Using LACP

Example

This example shows how to configure a Layer 3 EtherChannel, and how to asssign two ports to channel 5 with the LACP mode as active:

```
Device# config-transaction
Device(config)# interface Gigabitethernet 0/1/2
Device(config-if-range)# no ip address
Device(config-if-range)# channel-group 5 mode active
Device(config-if-range)# end
```

Configuration Example for Flow-Based Port-Channel Load Balancing

Example

This example shows a configuration where flow-based load balancing is configured on port channel 2 while the VLAN manual method is configured globally:

```
!
no aaa new-model
port-channel load-balancing vlan-manual
ip source-route
.
.
.
interface Port-channel2
 ip address 10.0.0.1 255.255.255.0
 no negotiation auto
 load-balancing flow
!

interface GigabitEthernet2/1/0
 no ip address
 negotiation auto
 cdp enable
```

```
 channel-group 2
!
interface GigabitEthernet2/1/1
 no ip address
 negotiation auto
 cdp enable
 channel-group 2
!
```

Configuration Example for VLAN Manual Load Balancing

Example

This example shows how the load-balancing configuration can be globally applied to define policies for handling traffic by using the **port-channel load-balancing** command.

```
port-channel load-balancing vlan-manual

!
interface Port-channel1
!
interface Port-channel1.100
 encapsulation dot1Q 100 primary GigabitEthernet 1/1/1
 secondary GigabitEthernet 1/2/1
 ip address 10.16.2.100 255.255.255.0
!
interface Port-channel1.200
 encapsulation dot1Q 200 primary GigabitEthernet 1/2/1
 ip address 10.16.3.200 255.255.255.0
!
interface Port-channel1.300
 encapsulation dot1Q 300
 ip address 10.16.4.300 255.255.255.0
 !
interface GigabitEthernet 1/1/1
 no ip address
 channel-group 1!
interface GigabitEthernet 1/2/1
 no ip address
 channel-group 1
```

Monitor Configured EtherChannel Using CLI

Example 1

The following is a sample output from the **show etherchannel summary** command . This example shows summary for each channel group.

```
Device# show etherchannel summary

Flags:  D - down        P/bndl - bundled in port-channel
        I - stand-alone s/susp - 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(RU)         LACP     Te0/3/0(bndl) Te0/3/1(hot-sby)

RU - L3 port-channel UP State
SU - L2 port-channel UP state
P/bndl -  Bundled
S/susp  - Suspended
```

Example 2

The following is a sample output from the **show etherchannel load-balancing** command . This example displays the load-balancing method that is applied to each port channel.

```
Device# show etherchannel load-balancing

EtherChannel Load-Balancing Method:
Global LB Method: vlan-manual
  Port-Channel:                       LB Method
    Port-channel1                   :  flow-based
```