EtherChannel Interfaces

This chapter tells how to configure EtherChannels interfaces.

Note For multiple context mode, complete all tasks in this section in the system execution space. To change from the context to the system execution space, enter the **changeto system** command.

For ASA cluster interfaces, which have special requirements, see ASA Cluster for the Secure Firewall 3100/4200.

Note For Firepower 4100/9300 chassis, EtherChannel interfaces are configured in the FXOS operating system. See the configuration or getting started guide for your chassis for more information.

About EtherChannels

This section describes EtherChannels.

About EtherChannels

An 802.3ad EtherChannel is a logical interface (called a port-channel interface) consisting of a bundle of individual Ethernet links (a channel group) so that you increase the bandwidth for a single network. A port channel interface is used in the same way as a physical interface when you configure interface-related features.

You can configure up to 48 EtherChannels, depending on how many interfaces your model supports.

Channel Group Interfaces

Each channel group can have up to 8 active interfaces, except for the ISA 3000, which supports 16 active interfaces. For switches that support only 8 active interfaces, you can assign up to 16 interfaces to a channel group: while only 8 interfaces can be active, the remaining interfaces can act as standby links in case of interface failure.

All interfaces in the channel group must be the same type and speed. The first interface added to the channel group determines the correct type and speed.

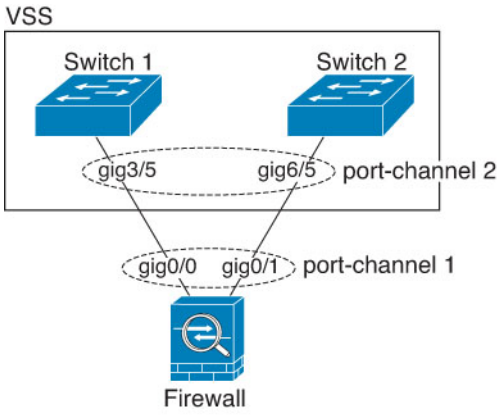
The EtherChannel aggregates the traffic across all the available active interfaces in the channel. The interface is selected using a proprietary hash algorithm, based on source or destination MAC addresses, IP addresses, TCP and UDP port numbers and VLAN numbers.

Connecting to an EtherChannel on Another Device

The device to which you connect the ASA EtherChannel must also support 802.3ad EtherChannels; for example, you can connect to the Catalyst 6500 switch or the Cisco Nexus 7000.

When the switch is part of a Virtual Switching System (VSS) or Virtual Port Channel (vPC), then you can connect ASA interfaces within the same EtherChannel to separate switches in the VSS/vPC. The switch interfaces are members of the same EtherChannel port-channel interface, because the separate switches act like a single switch.

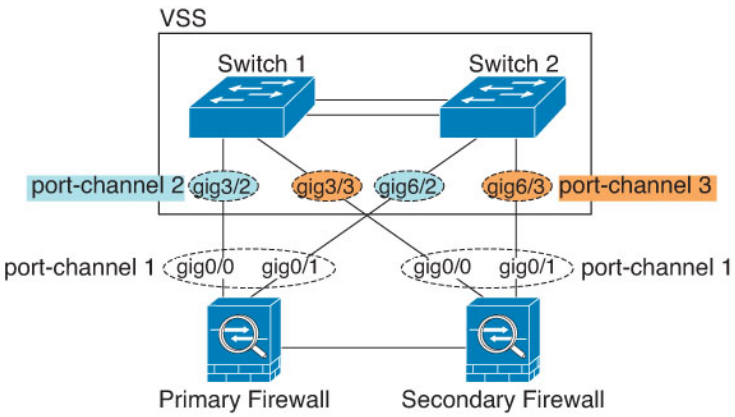
Figure 1: Connecting to a VSS/vPC



Note If the ASA device is in transparent firewall mode, and you place the ASA device between two sets of VSS/vPC switches, then be sure to disable Unidirectional Link Detection (UDLD) on any switch ports connected to the ASA device with an EtherChannel. If you enable UDLD, then a switch port may receive UDLD packets sourced from both switches in the other VSS/vPC pair. The receiving switch will place the receiving interface in a down state with the reason "UDLD Neighbor mismatch".

If you use the ASA device in an Active/Standby failover deployment, then you need to create separate EtherChannels on the switches in the VSS/vPC, one for each ASA device. On each ASA device, a single EtherChannel connects to both switches. Even if you could group all switch interfaces into a single EtherChannel connecting to both ASA devices (in this case, the EtherChannel will not be established because of the separate ASA system IDs), a single EtherChannel would not be desirable because you do not want traffic sent to the standby ASA device.

Figure 2: Active/Standby Failover and VSS/vPC



Link Aggregation Control Protocol

The Link Aggregation Control Protocol (LACP) aggregates interfaces by exchanging the Link Aggregation Control Protocol Data Units (LACPDUs) between two network devices.

You can configure each physical interface in an EtherChannel to be:

- Active—Sends and receives LACP updates. An active EtherChannel can establish connectivity with either an active or a passive EtherChannel. You should use the active mode unless you need to minimize the amount of LACP traffic.
- Passive—Receives LACP updates. A passive EtherChannel can only establish connectivity with an active EtherChannel. Not supported on hardware models.
- On—The EtherChannel is always on, and LACP is not used. An "on" EtherChannel can only establish a connection with another "on" EtherChannel.

LACP coordinates the automatic addition and deletion of links to the EtherChannel without user intervention. It also handles misconfigurations and checks that both ends of member interfaces are connected to the correct channel group. "On" mode cannot use standby interfaces in the channel group when an interface goes down, and the connectivity and configurations are not checked.

Load Balancing

The ASA device distributes packets to the interfaces in the EtherChannel by hashing the source and destination IP address of the packet (this criteria is configurable). The resulting hash is divided by the number of active links in a modulo operation where the resulting remainder determines which interface owns the flow. All packets with a *hash_value* **mod** *active_links* result of 0 go to the first interface in the EtherChannel, packets with a result of 1 go to the second interface, packets with a result of 2 go to the third interface, and so on. For example, if you have 15 active links, then the modulo operation provides values from 0 to 14. For 6 active links, the values are 0 to 5, and so on.

For a spanned EtherChannel in clustering, load balancing occurs on a per ASA basis. For example, if you have 32 active interfaces in the spanned EtherChannel across 8 ASAs, with 4 interfaces per ASA in the EtherChannel, then load balancing only occurs across the 4 interfaces on the ASA.

If an active interface goes down and is not replaced by a standby interface, then traffic is rebalanced between the remaining links. The failure is masked from both Spanning Tree at Layer 2 and the routing table at Layer 3, so the switchover is transparent to other network devices.

Related Topics

Customize the EtherChannel (ISA 3000), on page 9

EtherChannel MAC Address

All interfaces that are part of the channel group share the same MAC address. This feature makes the EtherChannel transparent to network applications and users, because they only see the one logical connection; they have no knowledge of the individual links.

Firepower and Secure Firewall Hardware

The port-channel interface uses the MAC address of the internal interface Internal-Data 0/1. Alternatively you can manually configure a MAC address for the port-channel interface. In multiple context mode, you can automatically assign unique MAC addresses to *shared* interfaces, including an EtherChannel port interface. All EtherChannel interfaces on a chassis use the same MAC address, so be aware that if you use SNMP polling, for example, multiple interfaces will have the same MAC address.

Note Member interfaces only use the Internal-Data 0/1 MAC address after a reboot. Prior to rebooting, the member interface uses its own MAC address. If you add a new member interface after a reboot, you will have to perform another reboot to update its MAC address.

Guidelines for EtherChannels

Bridge Group

In routed mode, ASA-defined EtherChannels are not supported as bridge group members. EtherChannels on the Firepower 4100/9300 can be bridge group members.

Failover

- When you use an EtherChannel interface as a Failover link, it must be pre-configured on both units in the Failover pair; you cannot configure it on the primary unit and expect it to replicate to the secondary unit because *the Failover link itself is required for replication*.
- If you use an EtherChannel interface for the state link, no special configuration is required; the configuration can replicate from the primary unit as normal. For the Firepower 4100/9300 chassis, all interfaces, including EtherChannels, need to be pre-configured on both units.
- You can monitor EtherChannel interfaces for Failover using the **monitor-interface** command. When an active member interface fails over to a standby interface, this activity does not cause the EtherChannel interface to appear to be failed when being monitored for device-level Failover. Only when all physical interfaces fail does the EtherChannel interface appear to be failed (for an EtherChannel interface, the number of member interfaces allowed to fail is configurable).

- If you use an EtherChannel interface for a Failover or state link, then to prevent out-of-order packets, only one interface in the EtherChannel is used. If that interface fails, then the next interface in the EtherChannel is used. You cannot alter the EtherChannel configuration while it is in use as a Failover link. To alter the configuration, you need to temporarily disable Failover, which prevents Failover from occurring for the duration.

Model Support

- You cannot add EtherChannels in ASA for the Firepower 4100/9300, or the ASA Virtual. The Firepower 4100/9300 supports EtherChannels, but you must perform all hardware configuration of EtherChannels in FXOS on the chassis.
- You cannot use Firepower 1010 or Secure Firewall 1210/1220 switch ports or VLAN interfaces in EtherChannels.

Clustering

- When you use the EtherChannel interface as the Cluster Control Link, it must be pre-configured on all units in the cluster; you cannot configure it on the primary unit and expect it to replicate to member units because *the Cluster Control Link itself is required for replication*.
- To configure a spanned EtherChannel or an individual cluster interface, see the clustering chapter.

General EtherChannel Guidelines

- You can configure up to 48 EtherChannels, depending on how many interfaces are available on your model.
- Each channel group can have up to 8 active interfaces, except for the ISA 3000, which supports 16 active interfaces. For switches that support only 8 active interfaces, you can assign up to 16 interfaces to a channel group: while only 8 interfaces can be active, the remaining interfaces can act as standby links in case of interface failure.
- All interfaces in the channel group must be the same media type and speed capacity, and must be set to the same speed and duplex. The media type can be either RJ-45 or SFP; SFPs of different types (copper and fiber) can be mixed. You cannot mix interface capacities (for example 1GB and 10GB interfaces) by setting the speed to be lower on the larger-capacity interface, except for the Secure Firewall 1200/3100/4200, which supports different interface capacities as long as the speed is set to Detect SFP; in this case the lowest common speed is used.
- The device to which you connect the ASA EtherChannel must also support 802.3ad EtherChannels.
- The ASA device does not support LACPDUs that are VLAN-tagged. If you enable native VLAN tagging on the neighboring switch using the Cisco IOS **vlan dot1Q tag native** command, then the ASA device will drop the tagged LACPDUs. Be sure to disable native VLAN tagging on the neighboring switch. In multiple context mode, these messages are not included in a packet capture, so that you cannot diagnose the issue easily.
- The LACP rate depends on the model. When you set the rate (normal or fast), the device requests that rate from the connecting switch. In return, the device will send at the rate requested by the connecting switch. We recommend that you set the same rate on both sides.
    - Firepower 4100/9300—The LACP rate is set to fast by default in FXOS, but you can configure it as normal (also known as slow).

  - Secure Firewall 3100/4200—The LACP rate is set to normal (slow) by default, but you can configure it as fast on the device.
  - All other models—The LACP rate set to normal (also known as slow), and it is not configurable, which means the device will always request a slow rate from the connecting switch. We recommend setting the rate on the switch to slow, so both sides send LACP messages at the same rate.

- In Cisco IOS software versions earlier than 15.1(1)S2, ASA did not support connecting an EtherChannel to a switch stack. With default switch settings, if the ASA EtherChannel is connected cross stack, and if the primary switch is powered down, then the EtherChannel connected to the remaining switch will not come up. To improve compatibility, set the **stack-mac persistent timer** command to a large enough value to account for reload time; for example, 8 minutes or 0 for indefinite. Or, you can upgrade to more a more stable switch software version, such as 15.1(1)S2.
- All the ASA configuration refers to the logical EtherChannel interface instead of the member physical interfaces.
- You must first remove the breakout ports from the port channel membership before you can delete an port channel with breakout ports. Otherwise, the breakout ports will show as unassociated when joining them back after deleting the port channel. This is not applicable if a port channel has only fixed ports and no breakout ports.

Default Settings for EtherChannels Interfaces

This section lists default settings for interfaces if you do not have a factory default configuration.

Default State of Interfaces

The default state of an interface depends on the type and the context mode.

In multiple context mode, all allocated interfaces are enabled by default, no matter what the state of the interface is in the system execution space. However, for traffic to pass through the interface, the interface also has to be enabled in the system execution space. If you shut down an interface in the system execution space, then that interface is down in all contexts that share it.

In single mode or in the system execution space, interfaces have the following default states:

- Physical interfaces—Disabled.
- EtherChannel port-channel interfaces—Enabled. However, for traffic to pass through the EtherChannel, the channel group physical interfaces must also be enabled.

Configure an EtherChannel

This section describes how to create an EtherChannel port-channel interface, assign interfaces to the EtherChannel, and customize the EtherChannel.

Add Interfaces to the EtherChannel

This section describes how to create an EtherChannel port-channel interface and assign interfaces to the EtherChannel. By default, port-channel interfaces are enabled.

Before you begin

- You can configure up to 48 EtherChannels, depending on how many interfaces your model has.
- Each channel group can have up to 8 active interfaces, except for the ISA 3000, which supports 16 active interfaces. For switches that support only 8 active interfaces, you can assign up to 16 interfaces to a channel group: while only 8 interfaces can be active, the remaining interfaces can act as standby links in case of interface failure.
- To configure a spanned EtherChannel for clustering, see the clustering chapter instead of this procedure.
- All interfaces in the channel group must be the same media type and capacity, and must be set to the same speed and duplex. The media type can be either RJ-45 or SFP; SFPs of different types (copper and fiber) can be mixed. You cannot mix interface capacities (for example 1GB and 10GB interfaces) by setting the speed to be lower on the larger-capacity interface, except for the Secure Firewall 3100/4200, which supports different interface capacities as long as the speed is set to Detect SFP; in this case, the lowest common speed is used..
- You cannot add a physical interface to the channel group if you configured a name for it. You must first remove the name using the **no nameif** command.
- For multiple context mode, complete this procedure in the system execution space. To change from the context to the system execution space, enter the **changeto system** command.

Caution If you are using a physical interface already in your configuration, removing the name will clear any configuration that refers to the interface.

Procedure

Step 1 Specify the interface you want to add to the channel group:

interface *physical_interface*

Example:

```
ciscoasa(config)# interface gigabitethernet 0/0
```

The *physical_interface* ID includes the type, slot, and port number as type[slot/]port. This first interface in the channel group determines the type and speed for all other interfaces in the group.

In transparent mode, if you create a channel group with multiple Management interfaces, then you can use this EtherChannel as the management-only interface.

Step 2 Assign this physical interface to an EtherChannel:

channel-group *channel_id* **mode** {**active** | **passive** | **on**}

Example:

```
ciscoasa(config-if)# channel-group 1 mode active
```

The *channel_id* is an integer between 1 and 48 (1 and 8 for the Firepower 1010 and 1210, and between 1 and 10 for the 1220). If the port-channel interface for this channel ID does not yet exist in the configuration, one will be added:

interface port-channel *channel_id*

We recommend using **active** mode. **passive** mode is only available for the ISA 3000 only.

Step 3 (Optional) (Secure Firewall 3100/4200 only) Set the LACP data unit receive rate for a physical interface in the channel group.

lacp rate {**normal** | **fast**}

The default is **normal** (slow, every 30 seconds). The **fast** option receives LACP data units every second. You should match the setting on the connected switch.

Step 4 (Optional) (ISA 3000 models only) Set the priority for a physical interface in the channel group.

lacp port-priority *number*

Example:

```
ciscoasa(config-if)# lacp port-priority 12345
```

The priority *number* is an integer between 1 and 65535. The default is 32768. The higher the number, the lower the priority. The ASA uses this setting to decide which interfaces are active and which are standby if you assign more interfaces than can be used. If the port priority setting is the same for all interfaces, then the priority is determined by the interface ID (slot/port). The lowest interface ID is the highest priority. For example, GigabitEthernet 0/0 is a higher priority than GigabitEthernet 0/1.

If you want to prioritize an interface to be active even though it has a higher interface ID, then set this command to have a lower value. For example, to make GigabitEthernet 1/3 active before GigabitEthernet 0/7, then make the **lacp port-priority** value be 12345 on the 1/3 interface vs. the default 32768 on the 0/7 interface.

If the device at the other end of the EtherChannel has conflicting port priorities, the system priority is used to determine which port priorities to use. See the **lacp system-priority** command.

Step 5 (Optional) Set the Ethernet properties for the port-channel interface to override the properties set on the individual interfaces.

interface port-channel *channel_id*

See Enable the Physical Interface and Configure Ethernet Parameters for Ethernet commands. This method provides a shortcut to set these parameters because these parameters must match for all interfaces in the channel group.

Step 6 Repeat Steps 1 through 3 for each interface you want to add to the channel group.

Each interface in the channel group must be the same type and speed. Half duplex is not supported. If you add an interface that does not match, it will be placed in a suspended state.

Step 7 (Optional) (Secure Firewall 3100/4200 only) Set the LACP data unit receive rate for a physical interface in the channel group.

a) Click the physical interface in the **Interfaces** table, and click **Edit**.

The **Edit Interface** dialog box appears.

b) Click the **Advanced** tab.

c) In the **EtherChannel** area, from the **Rate** drop down list, choose **Normal** or **Fast**.

The default is **Normal** (slow, every 30 seconds). The **Fast** option received LACP updates every second. You should match the setting on the connected switch.

Related Topics

Link Aggregation Control Protocol, on page 3
Customize the EtherChannel (ISA 3000), on page 9

Customize the EtherChannel (ISA 3000)

This section describes how to set the maximum number of interfaces in the EtherChannel, the minimum number of operating interfaces for the EtherChannel to be active, the load balancing algorithm, and other optional parameters. These parameters only apply to the ISA 3000.

Procedure

Step 1 Specify the port-channel interface:

interface port-channel *channel_id*

Example:

```
ciscoasa(config)# interface port-channel 1
```

This interface was created automatically when you added an interface to the channel group. If you have not yet added an interface, then this command creates the port-channel interface.

You need to add at least one member interface to the port-channel interface before you can configure logical parameters for it such as a name.

Step 2 Specify the maximum number of active interfaces allowed in the channel group:

lacp max-bundle *number*

Example:

```
ciscoasa(config-if)# lacp max-bundle 6
```

The *number* is between 1 and 16. The default is 16. If your switch does not support 16 active interfaces, be sure to set this command to 8 or fewer.

Step 3 Specify the minimum number of active interfaces required for the port-channel interface to become active:

port-channel min-bundle *number*

Example:

```
ciscoasa(config-if)# port-channel min-bundle 2
```

The *number* is between 1 and 16. The default is 1. If the active interfaces in the channel group falls below this value, then the port-channel interface goes down, and could trigger a device-level failover.

Step 4 Configure the load-balancing algorithm:

port-channel load-balance {**dst-ip** | **dst-ip-port** | **dst-mac** | **dst-port** | **src-dst-ip** | **src-dst-ip-port** | **src-dst-mac** | **src-dst-port** | **src-ip** | **src-ip-port** | **src-mac** | **src-port** | **vlan-dst-ip** | **vlan-dst-ip-port** | **vlan-only** | **vlan-src-dst-ip** | **vlan-src-dst-ip-port** | **vlan-src-ip** | **vlan-src-ip-port**}

Example:

```
ciscoasa(config-if)# port-channel load-balance src-dst-mac
```

By default, the ASA balances the packet load on interfaces according to the source and destination IP address (**src-dst-ip**) of the packet. If you want to change the properties on which the packet is categorized, use this command. For example, if your traffic is biased heavily towards the same source and destination IP addresses, then the traffic assignment to interfaces in the EtherChannel will be unbalanced. Changing to a different algorithm can result in more evenly distributed traffic.

Step 5 Set the LACP system priority:

lacp system-priority *number*

Example:

```
ciscoasa(config)# lacp system-priority 12345
```

The *number* is between 1 and 65535. The default is 32768. The higher the number, the lower the priority. This command is global for the ASA.

If the device at the other end of the EtherChannel has conflicting port priorities, the system priority is used to determine which port priorities to use. For interface priorities within an EtherChannel, see the **lacp port-priority** command.

Related Topics

Load Balancing, on page 3
Add Interfaces to the EtherChannel, on page 7

Monitoring EtherChannels

See the following commands:

Note For Firepower and Secure Firewall models, some statistics are not shown using the ASA commands. You must view more detailed interface statistics using FXOS commands.

- /eth-uplink/fabric# **show interface**
- /eth-uplink/fabric# **show port-channel**
- /eth-uplink/fabric/interface# **show stats**

See the FXOS troubleshooting guide for more information.

- **show interface**

  Displays interface statistics.

- **show interface ip brief**

  Displays interface IP addresses and status.

- (ISA 3000 only) **show lacp** {[*channel_group_number*] {**counters** | **internal** | **neighbor**} | **sys-id**}

  For EtherChannel, displays LACP information such as traffic statistics, system identifier and neighbor details.

- (ISA 3000 only) **show port-channel** [*channel_group_number*] [**brief** | **detail** | **port** | **protocol** | **summary**]

  For EtherChannel, displays EtherChannel information in a detailed and one-line summary form. This command also displays the port and port-channel information.

- (ISA 3000 only) **show port-channel** *channel_group_number* **load-balance** [**hash-result** {**ip** | **ipv6** | **l4port** | **mac** | **mixed** | **vlan-only**} *parameters*]

  For EtherChannel, displays port-channel load-balance information along with the hash result and member interface selected for a given set of parameters.

Examples for EtherChannels

The following example configures three interfaces as part of an EtherChannel. It also sets the system priority to be a higher priority, and GigabitEthernet 0/2 to be a higher priority than the other interfaces in case more than eight interfaces are assigned to the EtherChannel.

```
lacp system-priority 1234
interface GigabitEthernet0/0
  channel-group 1 mode active
interface GigabitEthernet0/1
  channel-group 1 mode active
interface GigabitEthernet0/2
  lacp port-priority 1234
  channel-group 1 mode passive
interface Port-channel1
  lacp max-bundle 4
  port-channel min-bundle 2
  port-channel load-balance dst-ip
```

History for EtherChannels

Table 1: History for EtherChannels

Feature Name	Releases	Feature Information
EtherChannel support	8.4(1)	You can configure up to 48 802.3ad EtherChannels of eight active interfaces each. We introduced the following commands: **channel-group**, **lacp port-priority**, **interface port-channel**, **lacp max-bundle**, **port-channel min-bundle**, **port-channel load-balance**, **lacp system-priority**, **clear lacp counters**, **show lacp**, **show port-channel**. **Note** EtherChannel is not supported on the ASA 5505.
Support for 16 active links in an EtherChannel	9.2(1)	You can now configure up to 16 active links in an EtherChannel. Previously, you could have 8 active links and 8 standby links. Be sure that your switch can support 16 active links (for example the Cisco Nexus 7000 with F2-Series 10 Gigabit Ethernet Module). **Note** If you upgrade from an earlier ASA version, the maximum active interfaces is set to 8 for compatibility purposes (the **lacp max-bundle** command). We modified the following commands: **lacp max-bundle** and **port-channel min-bundle**.