Link Aggregation Group

Information About Link Aggregation Group

A link aggregation group (LAG) bundles all of the controller's distribution system ports into a single 802.3ad port channel. This reduces the number of IP addresses required to configure the ports on your controller. When LAG is enabled, the system dynamically manages port redundancy and load balances access points transparently to the corresponding user.

LAG simplifies controller configuration because you no longer have to configure ports for each interface. If any of the controller ports fail, traffic is automatically migrated to one of the other ports. As long as at least one controller port is functioning, the system continues to operate, access points remain connected to the network, and wireless clients continue to send and receive data.

Note The wireless management VLAN can only be part of one port channel.

Note LACP is supported on a standalone controller from Cisco IOS XE Gibraltar 16.12.x release. LACP is supported on an SSO pair from Cisco IOS XE Amsterdam 17.1.1s onwards.

Note When you use the ISE licensing enforcement, if there is a dual MAC entry generated in the switchport MAC table, it burns two licenses for a single AP. Therefore, if a single port is used in these conditions, use wired0 to avoid this behaviour.

Link Aggregation Control Protocol

Link Aggregation Control Protocol (LACP) is a part of an IEEE specification (802.3ad) that allows you to bundle several physical ports together to form a single logical channel. LACP allows a switch to negotiate an automatic bundle by sending LACP packets to a peer. By using the LACP, the wireless controller learns the identity of peers that are capable of supporting LACP, and the capabilities of each port. The LACP then

dynamically groups similarly configured ports into a single logical link (channel or aggregate port). Similarly, configured ports are grouped based on hardware, administrative, and port parameter constraints. If any of the controller ports fail, traffic is automatically migrated to one of the other ports. As long as at least one controller port is functioning, the system continues to operate, access points remain connected to the network, and wireless clients continue to send and receive data.

Configuring LAG Using LACP

To configure LAG using LACP, multiple port-channel interfaces must be created, and these interfaces should be added to the corresponding port bundle. LACP should also be configured on the uplink switch for the LACP bundle to come up.

- Create a port-channel interface
- Add interface to the port-channel
- Add VLAN to LAG
- Add interface to the port-channel

Port Aggregation Protocol

Port Aggregation Protocol (PAgP) is a Cisco-proprietary protocol that you can run on controllers. PAgP facilitates the automatic creation of EtherChannels by exchanging PAgP packets between Ethernet ports. PAgP packets are sent between Fast EtherChannel-capable ports in order to form a channel. When any of the active ports fail, a standby port becomes active.

By using PAgP, the controller learns the identity of partners that are capable of supporting PAgP and the capabilities of each port. PAgP then dynamically groups similarly configured ports (on a single device in a stack) into a single logical link (channel or aggregate port). Similarly, configured ports are grouped based on hardware, administrative, and port parameter constraints.

Configuring LAG Using PAgP

To configure LAG using PAgP, multiple port-channel interfaces must be created, and these interfaces should be added to the corresponding port bundle. PAgP should also be configured on the uplink switch for the PAgP bundle to come up.

- Create a port-channel interface
- Add interface to the port-channel

Information About Port Channel Interface Number

From Cisco IOS XE Bengaluru 17.5.1 onwards, the flexibility to number the port channel interface numbers between 1 and 64 is supported on the following Cisco Catalyst 9800 Series Wireless Controllers:

- Cisco Catalyst 9800-CL Wireless Controller for Cloud: The available range on the CLI is 1 to 64. The maximum supported port channel interfaces are 64.
- Cisco Catalyst 9800-L Wireless Controller: The available range on the CLI is 1 to 64. The maximum supported port channel interfaces are 14.

- Cisco Catalyst 9800-40 Wireless Controller: The available range on the CLI is 1 to 64. The maximum supported port channel interfaces are 16.

- Cisco Catalyst 9800-80 Wireless Controller: The available range on the CLI is 1 to 64. The maximum supported port channel interfaces are 64.

For example on the Cisco Catalyst 9800-L Wireless Controller, port-channel interface numbers can be anywhere between 1 and 64, as long as the total number of port-channel interfaces are 14 or lesser.

Note If you have configured 16 port-channel interfaces on the Cisco Catalyst 9800-40 Wireless Controller, and if the configured port-channel interfaces have reached their limitation, the following error message is displayed when you try to configure the 17th port-channel interface:

```
Device(config)#
Dec 15 08:58:22.209 CST: %ETC-5-CANNOT_ALLOCATE_AGGREGATOR: Aggregator limit reached, cannot
 allocate aggregator for group 17
```

When you downgrade from Cisco IOS XE Bengaluru 17.5.1 to an earlier version, and if the port channels are configured with a higher range than the supported range in the earlier version, the following errors are displayed when the earlier version is started. The non supported port channels disappear after the downgrade is completed.

```
interface Port-channel29
^% Invalid input detected at '^' marker.
interface Port-channel35
^% Invalid input detected at '^' marker.
```

Note that the HA pairing remains intact after downgrade.

Information about Flow Control

Flow control enables connected Ethernet ports to control traffic rates during congestion by allowing congested nodes to pause link operation at the other end. If one port experiences congestion and cannot receive more traffic, it notifies the other port by sending a pause frame to stop sending until the condition clears. Upon receipt of a pause frame, the sending device stops sending any data packets, preventing any data packet loss during the congestion period.

Flow control is enabled by default for both bay0 and bay1 ports as a day-1 behavior. We suggest turning on flow control on uplink switch if overruns are seen on a Cisco Catalyst 9800-L Wireless Controller due to burst traffic. This will help uplink switch to honor flow control settings enabled on the controller.

Note Though the show command might show the status as flow control off or unsupported on the controller's CLI, the actual & default behavior is turned on. For more information, check https://bst.cloudapps.cisco.com/bugsearch/bug/CSCwk52366.

Configuring LAG in ON Mode

To configure LAG in ON mode, multiple port-channel interfaces must be created, and these interfaces should be added to the corresponding port bundle. LACP should also be configured on the uplink switch for the LACP bundle to come up.

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Multichassis Link Aggregation Group

From Cisco IOS XE Amsterdam 17.2.1, Multichassis Link Aggregation Group (multi-LAG), which provides flexibility in connecting the controller to a switch's infrastructure is supported. Using multi-LAG, you can connect the multiple uplinks from the controller to the separated uplink switches. The controller supports VLAN-based traffic splitting when connected to a multiswitch topology. This provides the ability to distribute traffic on different uplinks, based on VLANs, for example, supporting a use case where guest traffic can be completely isolated to a different switch or network from the enterprise network. Same VLAN cannot be configured on both the uplinks.

You can connect a LAG to a single switch. However, different VLANs must be connected to different LAGs. The redundancy port must be connected to the same distribution switch as the uplinks, or back to back.

Multi-LAG is supported in LAG ON mode, LACP, and PAgP modes.

Prerequisites for Multi-LAG

- Each LAG must be connected to a single switch.

- Different VLANs must be assigned to different LAGs.

Restrictions for Multi-LAG

- If the primary LAG fails, automatic failover to secondary LAG is not supported.

- The interface on the controller does not come up when you shut or unshut the port on the switch port.

Note This is specific to Cisco Catalyst 9800-CL Cloud Wireless Controller in KVM environment for SR-IOV.

Supported Topologies

The Cisco Catalyst 9800-80 Wireless Controller has eight ports, while the Cisco Catalyst 9800-40 and Cisco Catalyst 9800-L wireless controllers have four ports each. You can create multi-LAGs of ports with similar capabilities, for example, 2.5 G and 2.5 G, or 10 G and 10 G. You cannot have a 2.5 G and a 10 G port in a port channel group with a minimum of two ports in one LAG.

Figure 1: Single Controller with Multi-LAG

C9800-40, C9800-80,
C9800-L

Te0/0/0   Te0/0/1   Te0/0/2   Te0/0/3

VLAN 10,30,50   VLAN 20,40,60

Switch 1   Switch 2

Layer 2 Network   Gateway

AP1   AP2

Client 1   Client 2
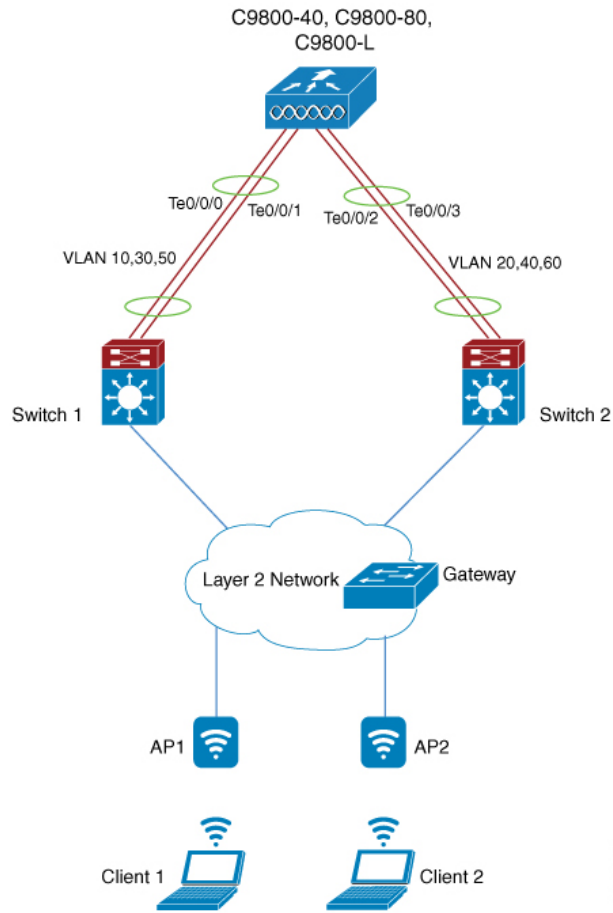
356504

Figure 2: SSO Pair with Multi-LAG
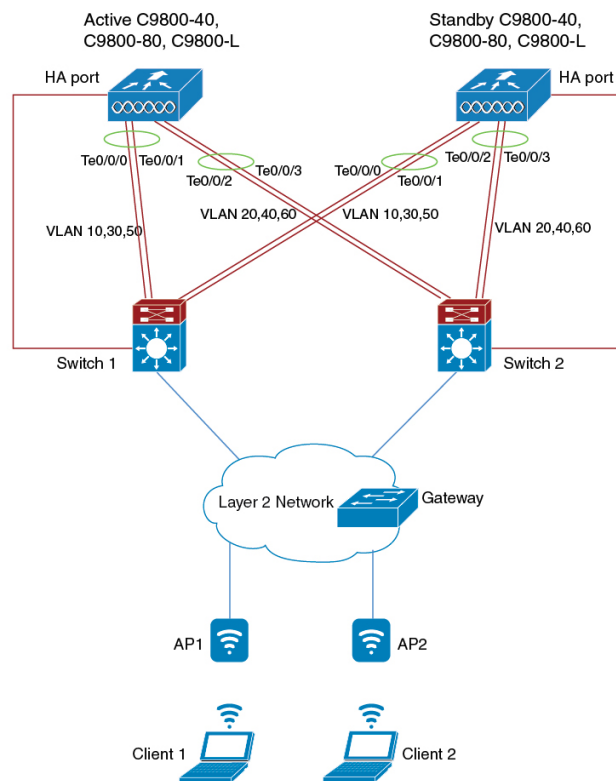
Configuring a Port Channel Interface (GUI)

Procedure

Step 1	Choose **Configuration** > **Interface** > **Logical**.
Step 2	Click the **Port Channel** tab to configure the Port Channel interface.

The **Port Channel** tab lists all the logical port-channel interfaces on the device.

Step 3 Click **Add** to add to a new logical port channel interface.

The **Add Port Channel Interface** window is displayed.

Step 4 In the **Add Port Channel Interface** complete the following procedure:

a) In the **Port Channel Number** field, enter the port channel number. The valid values are between 1 to 64.
b) In the **Description** field, enter the port channel description.
c) Click the **Admin Status** toggle button to set the admin status as *UP* or *DOWN*.
d) Click the **Enable Layer 3 Address** toggle button to enable the Layer 3 address.
e) In the Port Members section, select the port members from the list displayed in the **Available** list box, and add it to the **Associated** list.
f) From the **Switchport Mode** drop-down list, choose a switch mode for the interface.

- If you choose *access* as the switch mode, enter the access VLAN ID in the **Access VLAN** field.

- If you choose *trunk* as the switch mode, enter the VLAN IDs that you want to assign as trunk links. To allow all VLAN IDs as trunk links, set the **Allowed VLANs** to **All**. Specify a native VLAN.

- If you choose *dynamic auto* or *dynamic desirable* as the switch mode, enter the access VLAN ID. Enter the VLAN IDs you want to assign as trunk links. To allow all VLAN IDs as trunk links, set the **Allowed VLANs** to All. Specify a native VLAN.

g) Click **Update & Apply to Device**.

Create a Port-Channel Interface

Follow the procedure given below to create a port-channel interface.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** Device# configure terminal	Enters global configuration mode.
Step 2	**interface port-channel** *port-channel* **Example:** Device(config)# interface port-channel 2	Configures the port channel and enters interface configuration mode. The valid values for the port channel number ranges from 1 to 64.
Step 3	**switchport mode trunk** **Example:** Device(config-if)# switchport mode trunk	Configures the port as trunk.
Step 4	**no shutdown** **Example:** Device(config-if)# no shutdown	Enables the interface.

Configuring LAG in ON Mode

Follow the procedure given below to configure LAG in ON mode.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** Device# configure terminal	Enters global configuration mode.

	Command or Action	**Purpose**
Step 2	**interface TenGigabitEthernet** *port-slot* **Example:** `Device(config)# interface TenGigabitEthernet0/0/0`	Configures the port.
Step 3	**switchport mode trunk** **Example:** `Device(config-if)# switchport mode trunk`	Configures the port as trunk.
Step 4	**no shutdown** **Example:** `Device(config-if)# no shutdown`	Disables the interface.
Step 5	**channel-group** *group-number* **mode on** **Example:** `Device(config-if)# channel-group 3 mode on`	Assigns the port to a channel group, and specifies the ON mode. The valid values for the port channel number ranges from 1 to 64.
Step 6	**switchport trunk allowed vlan** *vlan-id* **Example:** `Device(config-if)# switchport trunk allowed vlan 16,17`	Assigns the allowed VLAN ID to the port when it is in trunking mode.

Add an Interface to a Port Channel (LACP)

Follow the procedure given below to add an interface to a port channel using the LACP.

Procedure

	Command or Action	**Purpose**
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**interface TenGigabitEthernet** *port-slot* **Example:** `Device(config)# interface TenGigabitEthernet0/0/0`	Configures the port.
Step 3	**channel-group** *group-number* {**active** | **passive**} **Example:** `Device(config-if)# channel-group 1 mode active`	Assigns the port to a channel group, and specifies the LACP mode. The valid values for the port channel number ranges from 1 to 64.

	Command or Action	Purpose
Step 4	**switchport mode trunk** **Example:** `Device(config-if)# switchport mode trunk`	Configures the port as trunk.

Add an Interface to a Port Channel (PAgP)

Follow the procedure given below to add an interface to a port channel using the PAgP.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

Step 2	**interface TenGigabitEthernet** *port-slot*
	
	Example:
	
	`Device(config)# interface`
	`TenGigabitEthernet0/0/0`
		Configures the TenGigabit Ethernet interface.

Step 3	**channel-group** *group-number* {**auto** | **desirable**}
	
	Example:
	
	`Device(config-if)# channel-group 1 mode`
	`auto`
		Assigns the port to a channel group, and specifies the PAgP mode.
		
		The valid values for the port channel number ranges from 1 to 64.

Step 4	**switchport mode trunk** **Example:** `Device(config-if)# switchport mode trunk`	Configures the port as trunk.

Add a VLAN to a Port Channel

Follow the procedure given below to add different VLANs under a port channel.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**interface port-channel** *port-channel* **Example:**	Configures the port channel.

	Command or Action	Purpose
	```Device(config)# interface port-channel 1```	Valid values for the port channel number range from 1 to 64.
Step 3	**switchport trunk allowed vlan** *vlan-id* **Example:** ```Device(config-if)# switchport trunk allowed vlan 10,30,50```	Adds VLANs to the list of allowed VLANs.

Remove a Port Channel Group from a Physical Interface

Perform this task to remove a port channel group from a physical port.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** ```Device# configure terminal```	Enters global configuration mode.
Step 2	**interface TenGigabitEthernet** *port-slot* **Example:** ```Device(config)# interface TenGigabitEthernet0/0/0```	Enters the TenGigabit Ethernet interface.
Step 3	**no channel-group** **Example:** ```Device(config-if)# no channel-group```	Removes the port channel group from the physical port.
Step 4	**end** **Example:** ```Device(config-if)# end```	Exits interface configuration mode.

Verify the LAG Configuration

To view a port channel's state, use the following command:

```
Device# show etherchannel summary

Flags:  D - down         P - bundled in port-channel
        I - stand-alone s - 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
```

```
        A - formed by Auto LAG
Number of channel-groups in use: 1
Number of aggregators:          1
Group  Port-channel  Protocol    Ports
------+------------+-----------+-----------------------------------------------
3      Po3(SU)         LACP        Tw0/0/0(P)       Tw0/0/1(P)
4      Po4(SU)         LACP        Tw0/0/2(P)       Tw0/0/3(P)
```

To verify an LACP or PAgP configuration, use the following commands:

```
Device# show running-config interface tenGigabitEthernet 0/0/0

Building configuration...

Current configuration : 114 bytes
!
interface TwoGigabitEthernet0/0/0
 switchport trunk allowed vlan 16,17
 switchport mode trunk
 speed 1000
 no negotiation auto
 no snmp trap link-status
 channel-group 3 mode on


Device# show running-config interface port-channel 1

Building configuration...

Current configuration : 54 bytes
!
interface Port-channel1
 switchport mode trunk
 switchport trunk allowed vlan 10,30,50
end
```

Verify the LAG Configuration