Ports and Interfaces

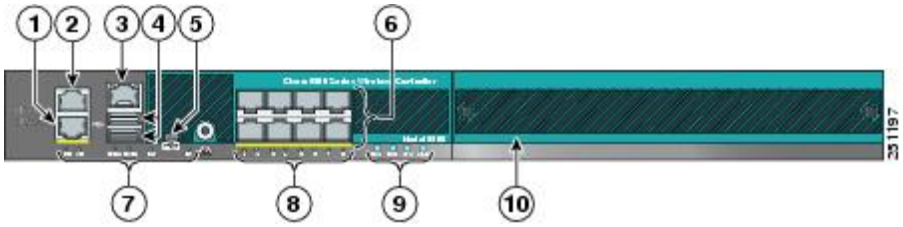
Overview of Ports and Interfaces

Three concepts are key to understanding how controllers connect to a wireless network: ports, interfaces, and WLANs.

Information About Ports

A port is a physical entity that is used for connections on the controller platform. Controllers have two types of ports: distribution system ports and a service port.

Figure 1: Ports on the Cisco 5500 Series Wireless LAN Controllers



1	Redundant port (RJ-45)	6	SFP distribution system ports 1–8
2	Service port (RJ-45)	7	Management port LEDs
3	Console port (RJ-45)	8	SFP distribution port Link and Activity LEDs
4	USB ports 0 and 1 (Type A)	9	Power supply (PS1 and PS2), System (SYS), and Alarm (ALM) LEDs
5	Console port (Mini USB Type B) **Note** You can use only one console port (either RJ-45 or mini USB). When you connect to one console port, the other is disabled.	10	Expansion module slot

Information About Distribution System Ports

A distribution system port connects the controller to a neighbor switch and serves as the data path between these two devices.

Restrictions for Configuring Distribution System Ports

- Cisco 5508 Controllers have eight Gigabit Ethernet distribution system ports, through which the Controller can manage multiple access points. The 5508-12, 5508-25, 5508-50, 5508-100, and 5508-250 models allow a total of 12, 25, 50, 100, or 250 access points to join the controller. Cisco 5508 controllers have no restrictions on the number of access points per port. However, we recommend using link aggregation (LAG) or configuring dynamic AP-manager interfaces on each Gigabit Ethernet port to automatically balance the load. If more than 100 access points are connected to the Cisco 5500 Series Controller, make sure that more than one Gigabit Ethernet interface is connected to the upstream switch.

Note The Gigabit Ethernet ports on the Cisco 5508 Controllers accept these SX/LC/T small form-factor plug-in (SFP) modules: -

- 1000BASE-SX SFP modules, which provide a 1000-Mbps wired connection to a network through an 850nM (SX) fiber-optic link using an LC physical connector
- 1000BASE-LX SFP modules, which provide a 1000-Mbps wired connection to a network through a 1300nM (LX/LH) fiber-optic link using an LC physical connector
- 1000BASE-T SFP modules, which provide a 1000-Mbps wired connection to a network through a copper link using an RJ-45 physical connector

- GLC-SX-MM, a 1000BASE-SX connector should be in auto-negotiation mode to function as desired because all SFP modules using LC physical connecters must ideally be in auto-negotiation mode on Cisco 5508 Series Controllers to function properly. However, when Cisco ASR is connected using the fiber port, GLC-SX-MM does not come up between Cisco ASR and Cisco 5508 as Cisco ASR requires the connector to be in fixed mode to function properly.
- Each distribution system port is, by default, an 802.1Q VLAN trunk port. The VLAN trunking characteristics of the port are not configurable.

Note Some controllers support link aggregation (LAG), which bundles all of the controller's distribution system ports into a single 802.3ad port channel. Cisco 5500 Series Controllers support LAG, and LAG is enabled automatically on the controllers within the Cisco WiSM2.

- Cisco WLC configuration in access mode is not supported. We recommend that you configure Cisco WLC in trunk mode when you configure Cisco WLC ports on a switch.
- In Cisco Flex 7500 and 8500 Series Controllers:
  - If a port is unresponsive after a soaking period of 5 seconds, all the interfaces for which the port is the primary and the active port, fail over to the backup port, if a backup is configured and is operational. Similarly, if the unresponsive port is the backup port, then all the interfaces fail over to the primary port if it is operational.
  - After the unresponsive port is restored, there is a soaking period of 60 seconds after which if the port is still operational, then all the interfaces fall back to this port, which was the primary port. If the port was the backup port, then no change is done.
  - You must ensure that you configure the port before you connect a switch or distribution system in the Cisco Wireless LAN Controller 2500 series.
- If an IPv6 packet is destined to controller management IPv6 address and the client VLAN is different from the controller management VLAN, then the IPv6 packet is switched out of the WLC box. If the same IPv6 packet comes as a network packet to the WLC, management access is not denied.

Information About Service Port

Cisco 5500 Series Controllers also have a 10/100/1000 copper Ethernet service port. The service port is controlled by the service-port interface and is reserved for out-of-band management of the controller and system recovery and maintenance in the event of a network failure. It is also the only port that is active when the controller is in boot mode. The service port is not capable of carrying 802.1Q tags, so it must be connected to an access port on the neighbor switch. Use of the service port is optional.

The service port of the Cisco Wireless Controller 7510 and 8510 models is a one Gigabit Ethernet port. To verify the speed of service port, you must connect the service port to a Gigabit Ethernet port on the switch.

Note The service port is not auto-sensing. You must use the correct straight-through or crossover Ethernet cable to communicate with the service port.

Caution Do not configure wired clients in the same VLAN or subnet of the service port of the controller on the network. If you configure wired clients on the same subnet or VLAN as the service port, it is not possible to access the management interface of the controller.

Information About Interfaces

An interface is a logical entity on the controller. An interface has multiple parameters associated with it, including an IP address, default gateway (for the IP subnet), primary physical port, secondary physical port, VLAN identifier, and DHCP server.

These five types of interfaces are available on the controller. Four of these are static and are configured at setup time:

- Management interface (static and configured at setup time; mandatory)
- AP-manager interface (static and configured at setup time; mandatory)

  Note You are not required to configure an AP-manager interface on Cisco 5500 Series Controllers.

- Virtual interface (static and configured at setup time; mandatory)
- Service-port interface (static and configured at setup time; optional)
- Dynamic interface (user-defined)

Note Typically, you define the management, AP-manager, virtual, and service-port interface parameters using the Startup Wizard. However, you can display and configure interface parameters through either the GUI or CLI after the controller is running.

When LAG is disabled, each interface is mapped to at least one primary port, and some interfaces (management and dynamic) can be mapped to an optional secondary (or backup) port. If the primary port for an interface fails, the interface automatically moves to the backup port. In addition, multiple interfaces can be mapped to a single controller port.

In Cisco Wireless LAN Controller 5508 Series, the controller marks packets greater than 1500 bytes as long. However, the packets are not dropped. The workaround to this is to configure the MTU on a switch to less than 1500 bytes.

Note Interfaces that are quarantined are not displayed on the Controller > Interfaces page. For example, if there are 6 interfaces and one of them is quarantined, the quarantined interface is not displayed and the details of the other 5 interfaces are displayed on the GUI. You can get the total number of interfaces that is inclusive of quarantined interfaces through the count displayed on the top-right corner of the GUI.

Restrictions for Configuring Interfaces

- Each physical port on the wireless controller can have only one AP-manager configured with it. For the Cisco 5500 Series Controllers, the management interface with AP-management enabled cannot fail over to the backup port, which is primary for the AP-manager on the management or dynamic VLAN interface.
- Cisco 5500 Series Controllers do not support fragmented pings on any interface.
- When the port comes up in VMware ESXi with configuration for NIC teaming, the vWLC may lose connectivity. However, the virtual wireless LAN controller (vWLC) resumes connectivity after a while.

Configuring the Management Interface

Information About the Management Interface

The management interface is the default interface for in-band management of the controller and connectivity to enterprise services such as AAA servers. It is also used for communications between the controller and access points. The management interface has the only consistently “pingable” in-band interface IP address on the controller. You can access the GUI of the controller by entering the management interface IP address of the controller in the address field of your browser.

For CAPWAP, the controller requires one management interface to control all inter-controller communications and one AP-manager interface to control all controller-to-access point communications, regardless of the number of ports.

If the service port is in use, the management interface must be on a different supernet from the service-port interface.

Note To prevent or block a wired or wireless client from accessing the management network on a controller (from the wireless client dynamic interface or VLAN), the network administrator must ensure that only authorized clients gain access to the management network through proper CPU ACLs, or use a firewall between the client dynamic interface and the management network.

Caution Do not map a guest WLAN to the management interface. If the EoIP tunnel breaks, the client could obtain an IP and be placed on the management subnet.

Caution Do not configure wired clients in the same VLAN or subnet of the service port of the controller on the network. If you configure wired clients on the same subnet or VLAN as the service port, it is not possible to access the management interface of the controller.

Authentication Type for Management Interfaces

For any type of management access to the controller, bet it SSH, Telnet, or HTTP, we recommend that you use any one authentication type, which can be TACACS+, RADIUS, or Local, and not a mix of these authentication types. Ensure that you take care of the following:

- Authentication type (TACACS+, RADIUS, or Local), must be the same for all management access and for all AAA authentication and authorization parameters.
- The method list must be explicitly specified in the HTTP authentication.

Example

Follow these steps to configure Telnet:

1. Configure TACACS+ server by entering these commands:
   a. **tacacs server** *server-name*
   b. **address ipv4** *ip-address*
   c. **key** *key-name*
2. Configure the server group name by entering these commands:
   a. **aaa group server tacacs+** *group-name*
   b. **server name** *name*
3. Configure authentication and authorization by entering these commands:
   a. **aaa authentication login** *method-list* **group** *server-group*
   b. **aaa authorization exec** *method-list* **group** *server-group*

Note These and all the other authentication and authorization parameters must be using the same database, be it RADIUS, TACACS+, or Local. For example, if command authorization has to be enabled, it also needs to be pointing to the same database.

4 Configure HTTP to use the above method lists:

1 **ip http authentication aaa login-auth** *method-list*
You must explicitly specify the method list, even if the method list is "default".

2 **ip http authentication aaa exec-auth** *method-list*

Note

- Do not configure any method-lists on the "line vty" configuration parameters. If the above steps and the line vty have different configurations, then line vty configurations take precedence.
- The database should be the same across all management configuration types such as SSH/Telnet and webui.
- You must explicitly define the method list for HTTP authentication.

Workaround

As a workaround, enter the following commands:

1 **aaa authentication login default group** *server-group* **local**
2 **aaa authorization exec default group** *server-group* **local**

Configuring the Management Interface (GUI)

Step 1 Choose **Controller > Interfaces** to open the Interfaces page.

Step 2 Click the management link.
The **Interfaces > Edit** page appears.

Step 3 Set the management interface parameters:

Note The management interface uses the controller's factory-set distribution system MAC address.

- Quarantine and quarantine VLAN ID, if applicable

  Note Select the **Quarantine** check box if you want to configure this VLAN as unhealthy or you want to configure network access control (NAC) out-of-band integration. Doing so causes the data traffic of any client that is assigned to this VLAN to pass through the controller.

- NAT address (only Cisco 2500 Series Controllers and Cisco 5500 Series Controllers are configured for dynamic AP management.)

  Note Select the **Enable NAT Address** check box and enter the external NAT IP address if you want to be able to deploy your Cisco 2500 Series Controllers or Cisco 5500 Series Controller behind a router or other gateway device that is using one-to-one mapping network address translation (NAT). NAT allows a device, such as a router, to act as an agent between the Internet (public) and a local network (private). In this case, it maps the controller's intranet IP addresses to a corresponding external address. The controller's dynamic AP-manager interface must be configured with the external NAT IP address so that the controller can send the correct IP address in the Discovery Response.

Note If a Cisco 2500 Series Controllers or Cisco 5500 Series Controller is configured with an external NAT IP address under the management interface, the APs in local mode cannot associate with the controller. The workaround is to either ensure that the management interface has a globally valid IP address or ensure that external NAT IP address is valid internally for the local APs.

Note The NAT parameters are supported for use only with one-to-one-mapping NAT, where each private client has a direct and fixed mapping to a global address. The NAT parameters do not support one-to-many NAT, which uses source port mapping to enable a group of clients to be represented by a single IP address.

- VLAN identifier

  Note Enter 0 for an untagged VLAN or a nonzero value for a tagged VLAN. We recommend using tagged VLANs for the management interface.

- Configuring Management Interface using IPv4— Fixed IP address, IP netmask, and default gateway.
  - Configuring Management Interface using IPv6— Fixed IPv6 address, prefix-length (interface subnet mask for IPv6) and the link local address of the IPv6 gateway router.

  Note
  - Once the Primary IPv6 Address, Prefix Length, and Primary IPv6 Gateway are configured on the management interface, they cannot be changed back to default values (:: /128).
  - A configuration backup must be carried out before configuring IPv6 in case the user wants to revert back to IPv4 only management interface.
  - When more than 1300 IPv6 APs are in use, on a single Catalyst 6000 Switch, then assign APs on multiple VLANs.
  - In 8500 controller running a ha-pair,IPv6 primary gateway(link local) configured though 3600 AP joined with the IPv6 address tears down the capwap. Using the command test capwap though the AP joined with ipv6 address, it is seen that when the Link local address is not reachable capwap should not be formed.

    If APs are joined on V6 tunnel and if IPv6 gateway is misconfigured then v6 tunnel will not be teared down. The APs will still be on v6 tunnel and will not fall back to v4 tunnel.

- Dynamic AP management (for Cisco 2500 Series Controllers or Cisco 5500 Series Controller only)

  Note For Cisco 5500 Series Controllers, the management interface acts like an AP-manager interface by default. If desired, you can disable the management interface as an AP-manager interface and create another dynamic interface as an AP manager.

- Physical port assignment (for all controllers except the Cisco 2500 Series Controllers or Cisco 5500 Series Controller)
- Primary and secondary DHCP servers
- Access control list (ACL) setting, if required

Step 4 Click **Save Configuration**.

Step 5 If you made any changes to the management or virtual interface, reboot the controller so that your changes take effect.

Configuring the Management Interface (CLI)

Step 1 Enter the **show interface detailed management** command to view the current management interface settings.
Note The management interface uses the controller's factory-set distribution system MAC address.

Step 2 Enter the **config wlan disable** *wlan-number* command to disable each WLAN that uses the management interface for distribution system communication.

Step 3 Enter these commands to define the management interface:

a) **Using IPv4 Address**

- **config interface address management** *ip-addr ip-netmask gateway*
- **config interface quarantine vlan management** *vlan_id*

  Note Use the **config interface quarantine vlan management** *vlan_id* command to configure a quarantine VLAN on the management interface.
- **config interface vlan management** {*vlan-id* | *0*}

  Note Enter 0 for an untagged VLAN or a nonzero value for a tagged VLAN. We recommend using tagged VLANs for the management interface.
- **config interface ap-manager management** {**enable** | **disable**} (for Cisco 5500 Series Controllers only)

  Note Use the **config interface ap-manager management** {**enable** | **disable**} command to enable or disable dynamic AP management for the management interface. For Cisco 5500 Series Controllers, the management interface acts like an AP-manager interface by default. If desired, you can disable the management interface as an AP-manager interface and create another dynamic interface as an AP manager.
- **config interface port management** *physical-ds-port-number* (for all controllers except the 5500 series)
- **config interface dhcp management** *ip-address-of-primary-dhcp-server* [*ip-address-of-secondary-dhcp-server*]
- **config interface acl management** *access-control-list-name*

b) **Using IPv6 Address**

- **config ipv6 interface address management** *primary ip-address prefix-length IPv6_Gateway_Address*

  Note Once the Primary IPv6 Address, Prefix Length, and Primary IPv6 Gateway are configured on the management interface, they cannot be changed back to default values (:: /128). A configuration backup must be carried out before configuring IPv6 in case the user wants to revert back to IPv4 only management interface.
- **config interface quarantine vlan management** *vlan_id*

  Note Use the **config interface quarantine vlan management** *vlan_id* command to configure a quarantine VLAN on the management interface.
- **config interface vlan management** {*vlan-id* | *0*}

  Note Enter 0 for an untagged VLAN or a nonzero value for a tagged VLAN. We recommend using tagged VLANs for the management interface.

- **config interface ap-manager management** {**enable** | **disable**} (for Cisco 5500 Series Controllers only)

  Note Use the **config interface ap-manager management** {**enable** | **disable**} command to enable or disable dynamic AP management for the management interface. For Cisco 5500 Series Controllers, the management interface acts like an AP-manager interface by default. If desired, you can disable the management interface as an AP-manager interface and create another dynamic interface as an AP manager.

- **config interface port management** *physical-ds-port-number* (for all controllers except the 5500 series)
- **config interface dhcp management** *ip-address-of-primary-dhcp-server* [*ip-address-of-secondary-dhcp-server*]
- **config ipv6 interface acl management** *access-control-list-name*

Step 4 Enter these commands if you want to be able to deploy your Cisco 5500 Series Controller behind a router or other gateway device that is using one-to-one mapping network address translation (NAT):

- **config interface nat-address management** {**enable** | **disable**}
- **config interface nat-address management set** *public_IP_address*

NAT allows a device, such as a router, to act as an agent between the Internet (public) and a local network (private). In this case, it maps the controller's intranet IP addresses to a corresponding external address. The controller's dynamic AP-manager interface must be configured with the external NAT IP address so that the controller can send the correct IP address in the Discovery Response.

Note These commands are supported for use only with one-to-one-mapping NAT, where each private client has a direct and fixed mapping to a global address. These commands do not support one-to-many NAT, which uses source port mapping to enable a group of clients to be represented by a single IP address.

Step 5 Enter the **save config** command.

Step 6 Enter the **show interface detailed management** command to verify that your changes have been saved.

Step 7 If you made any changes to the management interface, enter the **reset system** command to reboot the controller in order for the changes to take effect.

Configuring the AP-Manager Interface

Information About AP-Manager Interface

A controller configured with IPv4 has one or more AP-manager interfaces, which are used for all Layer 3 communications between the controller and lightweight access points after the access points have joined the controller.

Note A controller configured with IPv6 has only one AP-manager and is applicable on management interface. You cannot remove the AP-manager configured on management interface.

The AP-manager IP address is used as the tunnel source for CAPWAP packets from the controller to the access point and as the destination for CAPWAP packets from the access point to the controller.

Note The controller does not support transmitting the jumbo frames. To avoid having the controller transmit CAPWAP packets to the AP that will necessitate fragmentation and reassembly, reduce MTU/MSS on the client side.

The AP-manager interface communicates through any distribution system port by listening across the Layer 3 network for access point CAPWAP or LWAPP join messages to associate and communicate with as many lightweight access points as possible.

A controller configured with IPv6 does not support Dynamic AP-Manager. By default, the management interface acts like an AP-manager interface. Link Aggregation (LAG) is used for IPv6 AP load balancing.

Guidelines and Limitations

- An AP-manager interface is not required to be configured. The management interface acts like an AP-manager interface by default, and the access points can join on this interface.
- The MAC address of the management interface and the AP-manager interface is the same as the base LAG MAC address.
- If only one distribution system port can be used, you should use distribution system port 1.
- If link aggregation (LAG) is enabled, there can be only one AP-manager interface. But when LAG is disabled, one or more AP-manager interfaces can be created, generally one per physical port.
- Port redundancy for the AP-manager interface is not supported. You cannot map the AP-manager interface to a backup port.

Configuring the AP-Manager Interface (GUI)

Step 1 Choose **Controller > Interfaces** to open the Interfaces page.

Step 2 Click AP-Manager Interface.
The **Interface > Edit** page appears.

Note For IPv6 only—A controller configured with IPv6 address does not support Dynamic AP-Manager. By default, the management interface acts like an AP-manager interface.

Step 3 Set the AP-Manager Interface parameters:

Note For Cisco 5500 Series Controllers, you are not required to configure an AP-manager interface. The management interface acts like an AP-manager interface by default.

- Physical port assignment
- VLAN identifier

Note Enter 0 for an untagged VLAN or a nonzero value for a tagged VLAN. We recommend using tagged VLANs for the AP-manager interface.

Note The gig/wired subinterface is numbered with VLAN number and dot11 subinterface is numbered with the WLAN ID. The first configured WLAN becomes dot11 0.1 & dot11 1.1 and second WLAN ID subinterface becomes dot11 0.2 & dot11 1.2 onwards. This dot11 sub interface number cannot be mapped with a VLAN ID because multiple WLAN can be assigned with a same VLAN number. We cannot have duplicate subinterface created in the system. The native subinterface configuration in wired interface is the AP native VLAN configuration, if VLAN support is enabled in FlexConnect mode or else the native interface is always gig prime interface in AP(Local / Flex with no VLAN support).

- Fixed IP address, IP netmask, and default gateway
- Primary and secondary DHCP servers
- Access control list (ACL) name, if required

Step 4 Click **Save Configuration** to save your changes.

Step 5 If you made any changes to the management or virtual interface, reboot the controller so that your changes take effect.

Configuring the AP Manager Interface (CLI)

Before You Begin

For Cisco 5500 Series Controllers, you are not required to configure an AP-manager interface. The management interface acts like an AP-manager interface by default.

Note A controller configured with IPv6 address does not support Dynamic AP-Manager. The management interface acts like an AP-manager interface by default.

Step 1 Enter the **show interface summary** command to view the current interfaces.

Note If the system is operating in Layer 2 mode, the AP-manager interface is not listed.

Step 2 Enter the **show interface detailed ap-manager** command to view the current AP-manager interface settings.

Step 3 Enter the **config wlan disable** *wlan-number* command to disable each WLAN that uses the AP-manager interface for distribution system communication.

Step 4 Enter these commands to define the AP-manager interface:

- **config interface address ap-manager** *ip-addr ip-netmask gateway*
- **config interface vlan ap-manager** {*vlan-id* | *0*}

  Note Enter *0* for an untagged VLAN or a nonzero value for a tagged VLAN. We recommend using tagged VLANs for the AP-manager interface.

- **config interface port ap-manager** *physical-ds-port-number*
- **config interface dhcp ap-manager** *ip-address-of-primary-dhcp-server* [*ip-address-of-secondary-dhcp-server*]

- **config interface acl ap-manager** *access-control-list-name*

Step 5 Enter the **save config** command to save your changes.

Step 6 Enter the **show interface detailed ap-manager** command to verify that your changes have been saved.

Configuring Virtual Interfaces

Information About the Virtual Interface

The virtual interface is used to support mobility management, Dynamic Host Configuration Protocol (DHCP) relay, and embedded Layer 3 security such as guest web authentication and VPN termination. It also maintains the DNS gateway host name used by Layer 3 security and mobility managers to verify the source of certificates when Layer 3 web authorization is enabled.

Specifically, the virtual interface plays these two primary roles:

- Acts as the DHCP server placeholder for wireless clients that obtain their IP address from a DHCP server.
- Serves as the redirect address for the web authentication login page.

The virtual interface IP address is used only in communications between the controller and wireless clients. It never appears as the source or destination address of a packet that goes out a distribution system port and onto the switched network. For the system to operate correctly, the virtual interface IP address must be set (it cannot be 0.0.0.0), and no other device on the network can have the same address as the virtual interface. Therefore, the virtual interface must be configured with an unassigned and unused gateway IP address. The virtual interface IP address is not pingable and should not exist in any routing table in your network. In addition, the virtual interface cannot be mapped to a physical port.

Note All controllers within a mobility group must be configured with the same virtual interface IP address. Otherwise, inter-controller roaming may appear to work, but the handoff does not complete, and the client loses connectivity for a period of time.

Configuring Virtual Interfaces (GUI)

Step 1 Choose **Controller > Interfaces** to open the Interfaces page.

Step 2 Click **Virtual.**
The Interfaces > Edit page appears.

Step 3 Enter the following parameters:

- Any fictitious, unassigned, and unused gateway IP address
- DNS gateway hostname

Note To ensure connectivity and web authentication, the DNS server should always point to the virtual interface. If a DNS hostname is configured for the virtual interface, then the same DNS host name must be configured on the DNS server(s) used by the client.

Step 4 Click **Save Configuration**.

Step 5 If you made any changes to the management or virtual interface, reboot the controller so that your changes take effect.

Configuring Virtual Interfaces (CLI)

Step 1 Enter the **show interface detailed virtual** command to view the current virtual interface settings.

Step 2 Enter the **config wlan disable wlan-number** command to disable each WLAN that uses the virtual interface for distribution system communication.

Step 3 Enter these commands to define the virtual interface:

- **config interface address virtual** *ip-address*

  Note For *ip-address*, enter any fictitious, unassigned, and unused gateway IP address.

- **config interface hostname virtual** *dns-host-name*

Step 4 Enter the **reset system** command. At the confirmation prompt, enter Y to save your configuration changes to NVRAM. The controller reboots.

Step 5 Enter the **show interface detailed virtual** command to verify that your changes have been saved.

Configuring Service-Port Interfaces

Information About Service-Port Interfaces

The service-port interface controls communications through and is statically mapped by the system to the service port.

The service port can obtain an IPv4 address using DHCP, or it can be assigned a static IPv4 address, but a default gateway cannot be assigned to the service-port interface. Static IPv4 routes can be defined through the controller for remote network access to the service port.

If the service port is in use, the management interface must be on a different supernet from the service-port interface.

Similarly, the service port can be statically assigned an IPv6 address or select an IPv6 address using Stateless Address Auto-Configuration (SLAAC). The default gateway cannot be assigned to the service-port interface. Static IPv6 routes can be defined through the controller for remote network access to the service port.

Note This is the only SLAAC interface on the controller, all other interfaces must be statically assigned (just like for IPv4).

Note User does not require IPv6 static routes to reach service port from the same network, but IPv6 routes requires to access service port from different network. The IPv6 static routes should be as same as IPv4.

Restrictions for Configuring Service-Port Interfaces

- Only Cisco 7500 Series Controllers and Cisco 5500 Series Controllers have a physical service-port interface that is reachable from the external network.
- You must not use the service-port for continuous SNMP polling and management functions except when the management interface of the controller is unreachable.

Configuring Service-Port Interfaces Using IPv4 (GUI)

Step 1 Choose **Controller** > **Interfaces** to open the Interfaces page.

Step 2 Click the service-port link to open the Interfaces > Edit page.

Step 3 Enter the Service-Port Interface parameters:

Note The service-port interface uses the controller's factory-set service-port MAC address.

- DHCP protocol (enabled)
- DHCP protocol (disabled) and IP address and IP netmask

Step 4 Click **Save Configuration** to save your changes.

Step 5 If you made any changes to the management or virtual interface, reboot the controller so that your changes take effect.

Configuring Service-Port Interfaces Using IPv4 (CLI)

Step 1 To view the current service-port interface settings, enter this command:

show interface detailed service-port

Note The service-port interface uses the controller's factory-set service-port MAC address.

Step 2 Enter these commands to define the service-port interface:

- To configure the DHCP server, enter this command:

  config interface dhcp service-port enable

- To disable the DHCP server, enter this command:

  config interface dhcp service-port disable

- To configure the IPv4 address, enter this command:

  config interface address service-port *ip-addr ip-netmask*

Step 3 The service port is used for out-of-band management of the controller. If the management workstation is in a remote subnet, you may need to add a IPv4 route on the controller in order to manage the controller from that remote workstation. To do so, enter this command:
config route add *network-ip-addr ip-netmask gateway*

Step 4 To remove the IPv4 route on the controller, enter this command:
config route delete *ip_address*

Step 5 Enter the **save config** command to save your changes.

Step 6 Enter the **show interface detailed service-port** command to verify that your changes have been saved.

Configuring Dynamic Interfaces

Information About Dynamic Interface

Dynamic interfaces, also known as VLAN interfaces, are created by users and designed to be analogous to VLANs for wireless LAN clients. A controller can support up to 512 dynamic interfaces (VLANs). Each dynamic interface is individually configured and allows separate communication streams to exist on any or all of a controller's distribution system ports. Each dynamic interface controls VLANs and other communications between controllers and all other network devices, and each acts as a DHCP relay for wireless clients associated to WLANs mapped to the interface. You can assign dynamic interfaces to distribution system ports, WLANs, the Layer 2 management interface, and the Layer 3 AP-manager interface, and you can map the dynamic interface to a backup port.

You can configure zero, one, or multiple dynamic interfaces on a distribution system port. However, all dynamic interfaces must be on a different VLAN or IP subnet from all other interfaces configured on the port. If the port is untagged, all dynamic interfaces must be on a different IP subnet from any other interface configured on the port.

This table lists the maximum number of VLANs supported on the various controller platforms.

Table 1: Maximum number of VLANs supported on Cisco Wireless Controllers

Wireless Controllers	Maximum VLANs
Cisco Virtual Wireless Controller	512
Cisco Wireless Controller Module for ISR G2	16
Cisco 2500 Series Wireless Controllers	16
Cisco 5500 Series Wireless Controller	512
Cisco Catalyst 6500 Series Wireless Services Module2 (WiSM2)	512
Cisco Flex 7500 Series Cloud Controller	4,096
Cisco 8500 Series Controller	4,096

Note You must not configure a dynamic interface in the same network as that of Local Mobility Anchor (LMA). If you do so, the GRE tunnel between the controller and LMA does not come up.

Guidelines and Limitations

- If you are using DHCP proxy and/or a RADIUS source interface, ensure that the dynamic interface has a valid routable address. Duplicate or overlapping addresses across controller interfaces are not supported.
- We recommend using tagged VLANs for dynamic interfaces.
- You must not configure a dynamic interface in the same sub-network as a server that is reachable by the controller CPU, like a RADIUS server, as it might cause asymmetric routing issues.
- For SNMP requests that come from a subnet that is configured as a dynamic interface, the controller responds but the response does not reach the device that initiated the conversation.

Configuring Dynamic Interfaces (GUI)

Step 1 Choose **Controller > Interfaces** to open the Interfaces page.

Step 2 Perform one of the following:

- To create a new dynamic interface, click **New**. The **Interfaces > New page** appears. Go to *Step 3*.

- To modify the settings of an existing dynamic interface, click the name of the interface. The **Interfaces > Edit** page for that interface appears. Go to *Step 5*.
- To delete an existing dynamic interface, hover your cursor over the blue drop-down arrow for the desired interface and choose **Remove**.

Step 3 Enter an interface name and a VLAN identifier, as shown in the figure above.

Step 4 Click **Apply** to commit your changes. The Interfaces > Edit page appears.

Step 5 Configure the following parameters:

- Guest LAN, if applicable
- Quarantine and quarantine VLAN ID, if applicable

  Note Select the **Quarantine** check box if you want to configure this VLAN as unhealthy or you want to configure network access control (NAC) out-of-band integration. Doing so causes the data traffic of any client that is assigned to this VLAN to pass through the controller.

- Physical port assignment (for all controllers except the 5500 series)
- NAT address (only for Cisco 5500 Series Controllers configured for dynamic AP management)

  Note Select the **Enable NAT Address** check box and enter the external NAT IP address if you want to be able to deploy your Cisco 5500 Series Controller behind a router or other gateway device that is using one-to-one mapping network address translation (NAT). NAT allows a device, such as a router, to act as an agent between the Internet (public) and a local network (private). In this case, it maps the controller's intranet IP addresses to a corresponding external address. The controller's dynamic AP-manager interface must be configured with the external NAT IP address so that the controller can send the correct IP address in the Discovery Response.

  Note The NAT parameters are supported for use only with one-to-one-mapping NAT, where each private client has a direct and fixed mapping to a global address. The NAT parameters do not support one-to-many NAT, which uses source port mapping to enable a group of clients to be represented by a single IP address.

- Dynamic AP management

  Note When you enable this feature, this dynamic interface is configured as an AP-manager interface (only one AP-manager interface is allowed per physical port). A dynamic interface that is marked as an AP-manager interface cannot be used as a WLAN interface.

  Note Set the APs in a VLAN that is different than the dynamic interface configured on the controller. If the APs are in the same VLAN as the dynamic interface, the APs are not registered on the controller and the "LWAPP discovery rejected" and "Layer 3 discovery request not received on management VLAN" errors are logged on the controller.

- VLAN identifier
- Fixed IP address, IP netmask, and default gateway
- Primary and secondary DHCP servers
- Access control list (ACL) name, if required

  Note To ensure proper operation, you must set the Port Number and Primary DHCP Server parameters.

Step 6 Click **Save Configuration** to save your changes.

Step 7 Repeat this procedure for each dynamic interface that you want to create or edit.

Configuring Dynamic Interfaces (CLI)

Step 1 Enter the **show interface summary** command to view the current dynamic interfaces.

Step 2 View the details of a specific dynamic interface by entering this command:
show interface detailed *operator_defined_interface_name*.

Note Interface names that contain spaces must be enclosed in double quotes. For example: **config interface create** *"vlan 25"*

Step 3 Enter the **config wlan disable** *wlan_id* command to disable each WLAN that uses the dynamic interface for distribution system communication.

Step 4 Enter these commands to configure dynamic interfaces:

- **config interface create** *operator_defined_interface_name* {*vlan_id* | *x*}
- **config interface address interface** *ip_addr ip_netmask* [**gateway**]
- **config interface vlan** *operator_defined_interface_name* {*vlan_id* | *o*}
- **config interface port** *operator_defined_interface_name* physical_ds_port_number
- **config interface ap-manager** *operator_defined_interface_name* {**enable** | **disable**}

  Note Use the **config interface ap-manager operator_defined_interface_name** {**enable** | **disable}** command to enable or disable dynamic AP management. When you enable this feature, this dynamic interface is configured as an AP-manager interface (only one AP-manager interface is allowed per physical port). A dynamic interface that is marked as an AP-manager interface cannot be used as a WLAN interface.

- **config interface dhcp** *operator_defined_interface_name ip_address_of_primary_dhcp_server* [*ip_address_of_secondary_dhcp_server*]
- **config interface quarantine vlan** *interface_name vlan_id*

  Note Use the **config interface quarantine vlan** *interface_name vlan_id* command to configure a quarantine VLAN on any interface.

- **config interface acl** *operator_defined_interface_name* access_control_list_name

Step 5 Enter these commands if you want to be able to deploy your Cisco 5500 Series Controller behind a router or other gateway device that is using one-to-one mapping network address translation (NAT):

- **config interface nat-address dynamic-interface** *operator_defined_interface_name* {**enable** | **disable**}
- **config interface nat-address dynamic-interface** *operator_defined_interface_name* **set** *public_IP_address*

NAT allows a device, such as a router, to act as an agent between the Internet (public) and a local network (private). In this case, it maps the controller's intranet IP addresses to a corresponding external address. The controller's dynamic

AP-manager interface must be configured with the external NAT IP address so that the controller can send the correct IP address in the Discovery Response.

Note These commands are supported for use only with one-to-one-mapping NAT, whereby each private client has a direct and fixed mapping to a global address. These commands do not support one-to-many NAT, which uses source port mapping to enable a group of clients to be represented by a single IP address.

Step 6 Enter the **config wlan enable** *wlan_id* command to reenable each WLAN that uses the dynamic interface for distribution system communication.

Step 7 Enter the **save config** command to save your changes.

Step 8 Enter the **show interface detailed** *operator_defined_interface_name* command and *show interface summary* command to verify that your changes have been saved.

Note If desired, you can enter the **config interface delete** *operator_defined_interface_name* command to delete a dynamic interface.

Information About Dynamic AP Management

A dynamic interface is created as a WLAN interface by default. However, any dynamic interface can be configured as an AP-manager interface, with one AP-manager interface allowed per physical port. A dynamic interface with the Dynamic AP Management option enabled is used as the tunnel source for packets from the controller to the access point and as the destination for CAPWAP packets from the access point to the controller. The dynamic interfaces for AP management must have a unique IP address and are usually configured on the same subnet as the management interface.

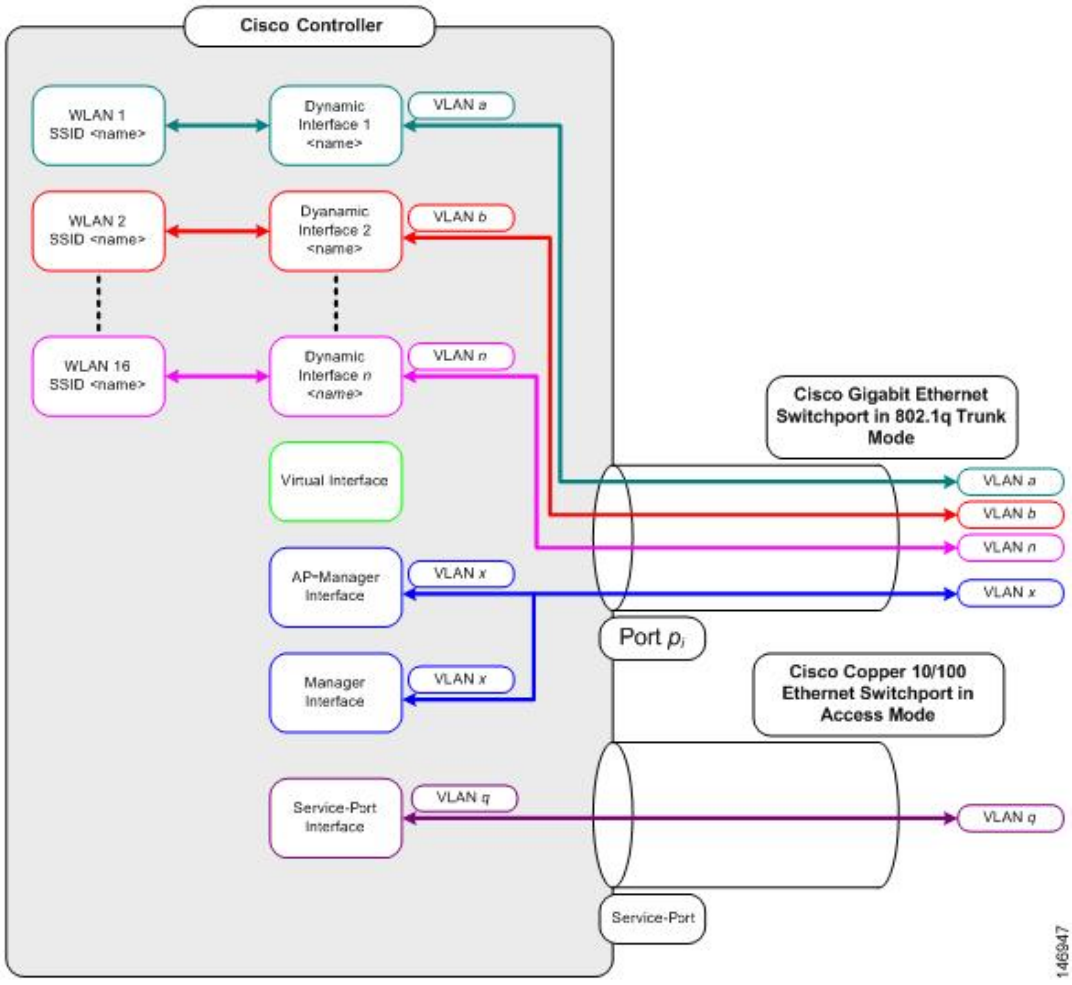
Note If link aggregation (LAG) is enabled, there can be only one AP-manager interface.

We recommend having a separate dynamic AP-manager interface per controller port.

Information About WLANs

A WLAN associates a service set identifier (SSID) to an interface or an interface group. It is configured with security, quality of service (QoS), radio policies, and other wireless network parameters. Up to 512 WLANs can be configured per controller.

Figure 2: Relationship between Ports, Interfaces, and WLANs



Each controller port connection is an 802.1Q trunk and should be configured as such on the neighbor switch. On Cisco switches, the native VLAN of an 802.1Q trunk is an untagged VLAN. If you configure an interface to use the native VLAN on a neighboring Cisco switch, make sure you configure the interface on the controller to be untagged.

Note A zero value for the VLAN identifier (on the **Controller > Interfaces** page) means that the interface is untagged.

The default (untagged) native VLAN on Cisco switches is VLAN 1. When controller interfaces are configured as tagged (meaning that the VLAN identifier is set to a nonzero value), the VLAN must be allowed on the 802.1Q trunk configuration on the neighbor switch and not be the native untagged VLAN.

We recommend that tagged VLANs be used on the controller. You should also allow only relevant VLANs on the neighbor switch's 802.1Q trunk connections to controller ports. All other VLANs should be disallowed or pruned in the switch port trunk configuration. This practice is extremely important for optimal performance of the controller.

Note We recommend that you assign one set of VLANs for WLANs and a different set of VLANs for management interfaces to ensure that controllers properly route VLAN traffic.

Configuring Ports (GUI)

The controller's ports are configured with factory-default settings designed to make the controllers' ports operational without additional configuration. However, you can view the status of the controller's ports and edit their configuration parameters at any time.

Step 1 Choose **Controller** > **Ports** to open the Ports page.
This page shows the current configuration for each of the controller's ports.

If you want to change the settings of any port, click the number for that specific port. The **Port > Configure** page appears.

Note If the management and AP-manager interfaces are mapped to the same port and are members of the same VLAN, you must disable the WLAN before making a port-mapping change to either interface. If the management and AP-manager interfaces are assigned to different VLANs, you do not need to disable the WLAN.

Note The number of parameters available on the Port > Configure page depends on your controller type.

The following show the current status of the port:

- Port Number—Number of the current port.
- Admin Status—Current state of the port. Values: Enable or Disable
- Physical Mode—Configuration of the port physical interface. The mode varies by the controller type.
- Physical Status—The data rate being used by the port. The available data rates vary based on controller type.
  - 2500 series - 1 Gbps full duplex
  - WiSM2 - 10 Gbps full duplex
  - 7500 series - 10 Gbps full duplex
- Link Status—Link status of the port. Values: Link Up or Link Down
- Link Trap—Whether the port is set to send a trap when the link status changes. Values: Enable or Disable
- Power over Ethernet (PoE)—If the connecting device is equipped to receive power through the Ethernet cable and if so, provides –48 VDC. Values: Enable or Disable

Note Some older Cisco access points do not draw PoE even if it is enabled on the controller port. In such cases, contact the Cisco Technical Assistance Center (TAC).

The following is a list of the port's configurable parameters.

1 **Admin Status—**Enables or disables the flow of traffic through the port. Options: Enable or Disable, with default option of Enable.

   Note When a primary port link goes down, messages may get logged internally only and not be posted to a syslog server. It may take up to 40 seconds to restore logging to the syslog server.

2 **Physical Mode—**Determines whether the port's data rate is set automatically or specified by the user. The supported data rates vary based on the controller type. Default: Auto.

3 **Link Trap—**Causes the port to send a trap when the port's link status changes. Options: Enable or Disable, with default option of Enable.

Step 2 Click **Apply**.

Step 3 Click **Save Configuration**.

Step 4 Click **Back** to return to the Ports page and review your changes.

Step 5 Repeat this procedure for each additional port that you want to configure.

Configuring Port Mirroring

Information About Port Mirroring

Mirror mode enables you to duplicate to another port all of the traffic originating from or terminating at a single client device or access point. It is useful in diagnosing specific network problems. Mirror mode should be enabled only on an unused port as any connections to this port become unresponsive.

Guidelines and Limitations

- Port mirroring is not supported when link aggregation (LAG) is enabled on the controller.
- We recommend that you do not mirror traffic from one controller port to another as this setup could cause network problems.

Enabling Port Mirroring (GUI)

Step 1 Choose **Controller > Ports** to open the Ports page.

Step 2 Click the number of the unused port for which you want to enable mirror mode. The Port > Configure page appears.

Step 3 Set the Mirror Mode parameter to **Enable**.

Step 4 Click **Apply** to commit your changes.

Step 5 Perform one of the following:

a) If you want to choose a specific client device that will mirror its traffic to the port you selected on the controller, choose **Wireless > Clients** to open the Clients page.
b) Click the MAC address of the client for which you want to enable mirror mode. The Clients > Detail page appears.
c) Under Client Details, set the Mirror Mode parameter to **Enable**.

OR

a) If you want to choose an access point that will mirror its traffic to the port you selected on the controller, choose **Wireless > Access Points > All APs** to open the All APs page.
b) Click the name of the access point for which you want to enable mirror mode. The All APs > Details page appears.
c) Choose the **Advanced** tab.
d) Set the Mirror Mode parameter to **Enable**.

Step 6 Click **Save Configuration** to save your changes.

Using the Cisco 5500 Series Controller USB Console Port

USB Console OS Compatibility

Before You Begin

These operating systems are compatible with the USB console:

- Microsoft Windows 2000, Windows XP, Windows Vista, Windows 7 (Cisco Windows USB console driver required)
- Apple Mac OS X 10.5.2 (no driver required)
- Linux (no driver required)

Step 1 Download the USB_Console.inf driver file as follows:

a) Click this URL to go to the Software Center: http://tools.cisco.com/support/downloads/go/Redirect.x?mdfid=278875243
b) Click **Wireless LAN Controllers**.
c) Click **Standalone Controllers**.

d) Click **Cisco 5500 Series Wireless LAN Controllers**.
e) Click **Cisco 5508 Wireless LAN Controller**.
f) Choose the USB driver file.
g) Save the file to your hard drive.

Step 2 Connect the Type A connector to a USB port on your PC.

Step 3 Connect the mini Type B connector to the USB console port on the controller.

Step 4 When prompted for a driver, browse to the USB_Console.inf file on your PC. Follow the prompts to install the USB driver.

Note Some systems might also require an additional system file. You can download the Usbser.sys file from Microsoft's Website.

Changing the Cisco USB Systems Management Console COM Port to an Unused Port

Before You Begin

The USB driver is mapped to COM port 6. Some terminal emulation programs do not recognize a port higher than COM 4. If necessary, you must change the Cisco USB systems management console COM port to an unused port of COM 4 or lower.

Step 1 From your Windows desktop, right-click **My Computer** and choose **Manage**.

Step 2 From the list on the left side, choose **Device Manager**.

Step 3 From the device list on the right side, double-click **Ports (COM & LPT)**.

Step 4 Right-click **Cisco USB System Management Console 0108** and choose **Properties**.

Step 5 Click the **Port Settings** tab and click the **Advanced** button.

Step 6 From the COM Port Number drop-down list, choose an unused COM port of 4 or lower.

Step 7 Click **OK** to save and then close the Advanced Settings dialog box.

Step 8 Click **OK** to save and then close the Communications Port Properties dialog box.

Choosing Between Link Aggregation and Multiple AP-Manager Interfaces

Cisco 5500 Series Controllers have no restrictions on the number of access points per port, but we recommend using LAG or multiple AP-manager interfaces on each Gigabit Ethernet port to automatically balance the load.

The following factors should help you decide which method to use if your controller is set for Layer 3 operation:

- With LAG, all of the controller ports need to connect to the same neighbor switch. If the neighbor switch goes down, the controller loses connectivity.
- With multiple AP-manager interfaces, you can connect your ports to different neighbor devices. If one of the neighbor switches goes down, the controller still has connectivity. However, using multiple AP-manager interfaces presents certain challenges when port redundancy is a concern.

Configuring Link Aggregation

Information About Link Aggregation

Link aggregation (LAG) is a partial implementation of the 802.3ad port aggregation standard. It bundles all of the controller's distribution system ports into a single 802.3ad port channel, thereby reducing the number of IP addresses needed 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 user.

LAG simplifies controller configuration because you no longer need to configure primary and secondary 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.

Cisco WLC does not send CDP advertisements on a LAG interface.

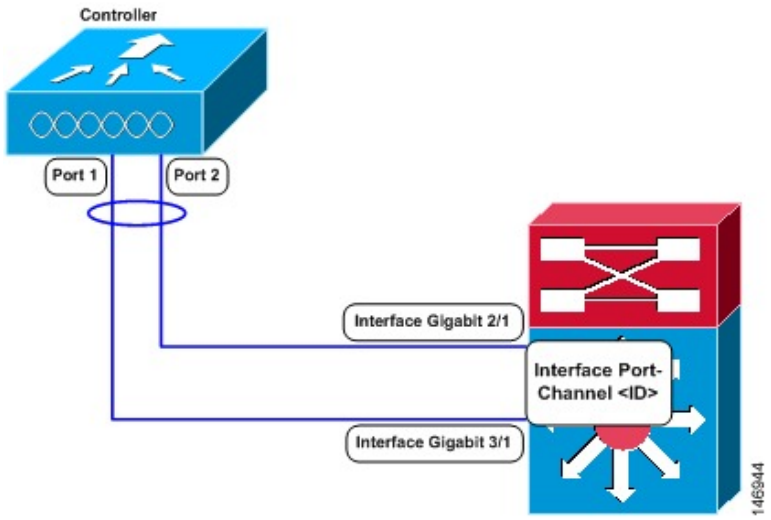
Note LAG is supported across switches.

Restrictions for Link Aggregation

- You can bundle all eight ports on a Cisco 5508 Controller into a single link.
- Terminating on two different modules within a single Catalyst 6500 series switch provides redundancy and ensures that connectivity between the switch and the controller is maintained when one module fails. The controller's port 1 is connected to Gigabit interface 3/1, and the controller's port 2 is connected to Gigabit interface 2/1 on the Catalyst 6500 series switch. Both switch ports are assigned to the same channel group.
- LAG requires the EtherChannel to be configured for 'mode on' on both the controller and the Catalyst switch.
- Once the EtherChannel is configured as on at both ends of the link, the Catalyst switch should not be configured for either Link Aggregation Control Protocol (LACP) or Cisco proprietary Port Aggregation Protocol (PAgP) but be set unconditionally to LAG. Because no channel negotiation is done between the controller and the switch, the controller does not answer to negotiation frames and the LAG is not formed if a dynamic form of LAG is set on the switch. Additionally, LACP and PAgP are not supported on the controller.

- If the recommended load-balancing method cannot be configured on the Catalyst switch, then configure the LAG connection as a single member link or disable LAG on the controller.

Figure 3: Link Aggregation with the Catalyst 6500 Series Neighbor Switch



- You cannot configure the controller's ports into separate LAG groups. Only one LAG group is supported per controller. Therefore, you can connect a controller in LAG mode to only one neighbor device.
- When you enable LAG or make any changes to the LAG configuration, you must immediately reboot the controller.
- When you enable LAG, you can configure only one AP-manager interface because only one logical port is needed. LAG removes the requirement for supporting multiple AP-manager interfaces.
- When you enable LAG, all dynamic AP-manager interfaces and untagged interfaces are deleted, and all WLANs are disabled and mapped to the management interface. Also, the management, static AP-manager, and VLAN-tagged dynamic interfaces are moved to the LAG port.
- Multiple untagged interfaces to the same port are not allowed.
- When you enable LAG, you cannot create interfaces with a primary port other than 29.
- When you enable LAG, all ports participate in LAG by default. You must configure LAG for all of the connected ports in the neighbor switch.
- When you enable LAG, if any single link goes down, traffic migrates to the other links.
- When you enable LAG, only one functional physical port is needed for the controller to pass client traffic.
- When you enable LAG, access points remain connected to the controller until you reboot the controller, which is needed to activate the LAG mode change, and data service for users continues uninterrupted.
- When you enable LAG, you eliminate the need to configure primary and secondary ports for each interface.
- When you enable LAG, the controller sends packets out on the same port on which it received them. If a CAPWAP packet from an access point enters the controller on physical port 1, the controller removes

the CAPWAP wrapper, processes the packet, and forwards it to the network on physical port 1. This may not be the case if you disable LAG.

- When you disable LAG, the management, static AP-manager, and dynamic interfaces are moved to port 1.
- When you disable LAG, you must configure primary and secondary ports for all interfaces.
- When you disable LAG, you must assign an AP-manager interface to each port on the controller. Otherwise, access points are unable to join.
- Cisco 5500 Series Controllers support a single static link aggregation bundle.
- LAG is typically configured using the Startup Wizard, but you can enable or disable it at any time through either the GUI or CLI.
- When you enable LAG on Cisco 2500 Series Controller to which the direct-connect access point is associated, the direct connect access point is disconnected since LAG enabling is still in the transition state. You must reboot the controller immediately after enabling LAG.
- In 8500 when more than 1000 APs joining WLC flapping occurs, to avoid this do not add more than 1000 Aps on a single catalyst switch for Capwap IPv6.

Configuring Link Aggregation (GUI)

Step 1 Choose **Controller > General** to open the General page.

Step 2 Set the LAG Mode on Next Reboot parameter to Enabled.

Step 3 Save the configuration.

Step 4 Reboot Cisco WLC.

Step 5 Assign the WLAN to the appropriate VLAN.

Configuring Link Aggregation (CLI)

Step 1 Enter the **config lag enable** command to enable LAG.

Note Enter the **config lag disable** command if you want to disable LAG.

Step 2 Enter the **save config** command to save your settings.

Step 3 Reboot Cisco WLC.

Verifying Link Aggregation Settings (CLI)

To verify your LAG settings, enter this command:

show lag summary

Information similar to the following appears:

```
LAG Enabled
```

Configuring Neighbor Devices to Support Link Aggregation

The controller's neighbor devices must also be properly configured to support LAG.

- Each neighbor port to which the controller is connected should be configured as follows:

```
interface GigabitEthernet <interface id>
 switchport
 channel-group <id> mode on
 no shutdown
```

- The port channel on the neighbor switch should be configured as follows:

```
interface port-channel <id>
 switchport
 switchport trunk encapsulation dot1q
 switchport trunk native vlan <native vlan id>
 switchport trunk allowed vlan <allowed vlans>
 switchport mode trunk
 no shutdown
```

Configuring Multiple AP-Manager Interfaces

Information About Multiple AP-Manager Interfaces

When you create two or more AP-manager interfaces, each one is mapped to a different port. The ports should be configured in sequential order so that AP-manager interface 2 is on port 2, AP-manager interface 3 is on port 3, and AP-manager interface 4 is on port 4.

Before an access point joins a controller, it sends out a discovery request. From the discovery response that it receives, the access point can tell the number of AP-manager interfaces on the controller and the number of access points on each AP-manager interface. The access point generally joins the AP-manager with the least number of access points. In this way, the access point load is dynamically distributed across the multiple AP-manager interfaces.

Note Access points may not be distributed completely evenly across all of the AP-manager interfaces, but a certain level of load balancing occurs.

Guidelines and Limitations

- Only Cisco 5500 Series Controllers support the use of multiple AP-manager interfaces.
- AP-manager interfaces do not need to be on the same VLAN or IP subnet, and they may or may not be on the same VLAN or IP subnet as the management interface. However, we recommend that you configure all AP-manager interfaces on the same VLAN or IP subnet.
- You must assign an AP-manager interface to each port on the controller.
- Before implementing multiple AP-manager interfaces, you should consider how they would impact your controller's port redundancy.

If the port of one of the AP-manager interfaces fails, the controller clears the state of the access points, and the access points must reboot to reestablish communication with the controller using the normal controller join process. The controller no longer includes the failed AP-manager interface in the CAPWAP or LWAPP discovery responses. The access points then rejoin the controller and are load balanced among the available AP-manager interfaces.

Creating Multiple AP-Manager Interfaces (GUI)

Step 1 Choose **Controller > Interfaces** to open the Interfaces page.

Step 2 Click **New**.
The Interfaces > New page appears.

Step 3 Enter an AP-manager interface name and a VLAN identifier.

Step 4 Click **Apply** to commit your changes. The Interfaces > Edit page appears.

Step 5 Enter the appropriate interface parameters.

Note Every interface supports primary and backup port with the following exceptions

- Dynamic interface is converted to AP manager which does not support backup of port configuration.
- If AP manager is enabled on management interface and when management interface moves to backup port because of primary port failure, the AP manager will be disabled.

Step 6 To make this interface an AP-manager interface, select the **Enable Dynamic AP Management** check box.

Note Only one AP-manager interface is allowed per physical port. A dynamic interface that is marked as an AP-manager interface cannot be used as a WLAN interface.

Step 7 Click **Save Configuration** to save your settings.

Step 8 Repeat this procedure for each additional AP-manager interface that you want to create.

Creating Multiple AP-Manager Interfaces (CLI)

Step 1 Enter these commands to create a new interface:

- **config interface create** *operator_defined_interface_name* {*vlan_id* | *x*}
- **config interface address** *operator_defined_interface_name ip_addr ip_netmask* [*gateway*]
- **config interface vlan** *operator_defined_interface_name* {*vlan_id* | *o*}
- **config interface port** *operator_defined_interface_name physical_ds_port_number*
- **config interface dhcp** *operator_defined_interface_name ip_address_of_primary_dhcp_server* [*ip_address_of_secondary_dhcp_server*]
- **config interface quarantine vlan** *interface_name vlan_id*

  Note Use this command to configure a quarantine VLAN on any interface.

- **config interface acl** *operator_defined_interface_name access_control_list_name*

Step 2 To make this interface an AP-manager interface, enter this command:
{**config interface ap-manager** *operator_defined_interface_name* **enable | disable**}

Note Only one AP-manager interface is allowed per physical port. A dynamic interface that is marked as an AP-manager interface cannot be used as a WLAN interface.

Step 3 Enter **save config** command to save your changes.

Step 4 Repeat this procedure for each additional AP-manager interface that you want to create.

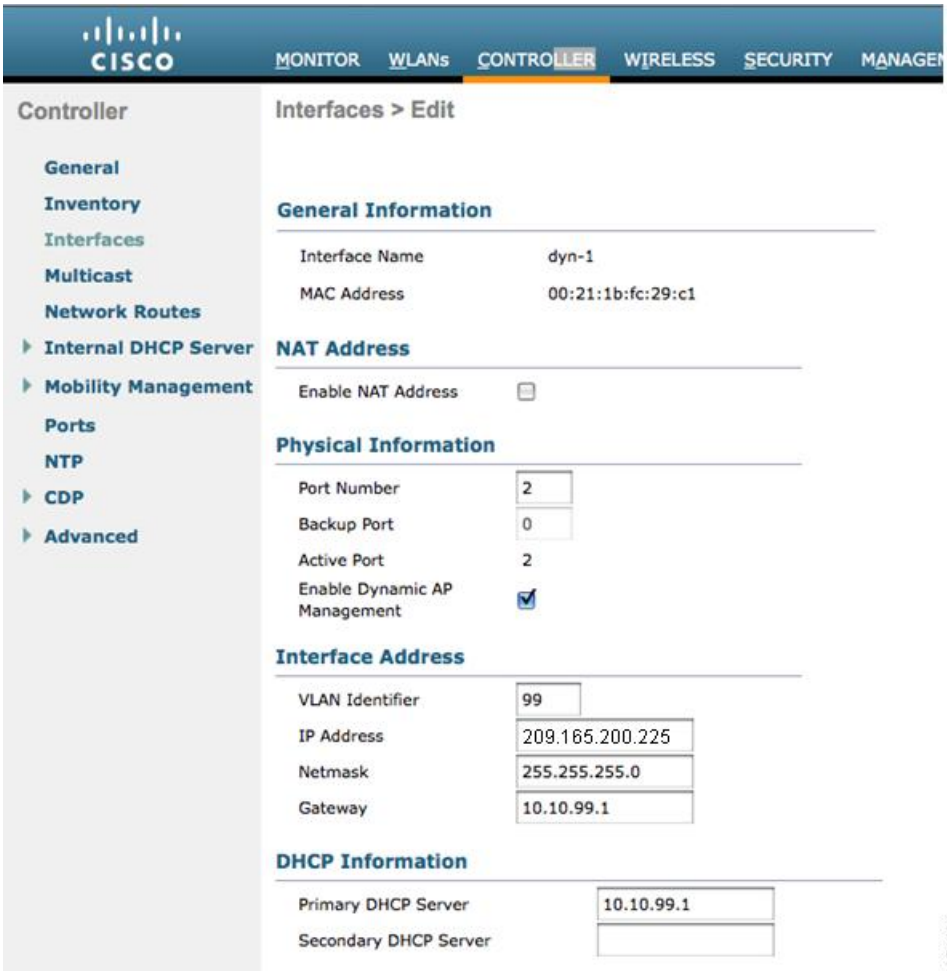
Configuration Example: Configuring AP-Manager on a Cisco 5500 Series Controller

For a Cisco 5500 Series Controller, we recommend that you have eight dynamic AP-manager interfaces and associate them to the eight Gigabit ports of the controller when LAG is not used. If you are using the management interface, which acts like an AP-manager interface by default, you must create only seven more dynamic AP-manager interfaces and associate them to the remaining seven Gigabit ports.

Note For IPv6 only—A controller configured with IPv6 address does not support Dynamic AP-Manager. By default, the management interface acts like an AP-manager interface. Use LAG for IPv6 AP load balancing.

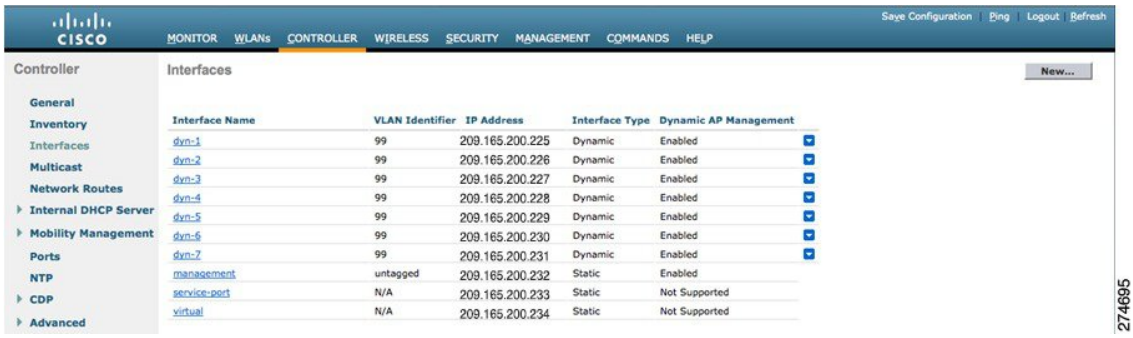
This figure shows a dynamic interface that is enabled as a dynamic AP-manager interface and associated to port number 2.

Figure 4: Dynamic Interface Example with Dynamic AP Management



This figure shows a Cisco 5500 Series Controller with LAG disabled, the management interface used as one dynamic AP-manager interface, and seven additional dynamic AP-manager interfaces, each mapped to a different Gigabit port.

Figure 5: Cisco 5500 Series Controller Interface Configuration Example



Configuring VLAN Select

Information About VLAN Select

Whenever a wireless client connects to a wireless network (WLAN), the client is placed in a VLAN that is associated with the WLAN. In a large venue such as an auditorium, a stadium, or a conference where there may be numerous wireless clients, having only a single WLAN to accommodate many clients might be a challenge.

The VLAN select feature enables you to use a single WLAN that can support multiple VLANs. Clients can get assigned to one of the configured VLANs. This feature enables you to map a WLAN to a single or multiple interface VLANs using interface groups. Wireless clients that associate to the WLAN get an IP address from a pool of subnets identified by the interfaces. The IP address is derived by an algorithm based on the MAC address of the wireless client. This feature also extends the current AP group architecture where AP groups can override an interface or interface group to which the WLAN is mapped to, with multiple interfaces using the interface groups. This feature also provides the solution to auto anchor restrictions where a wireless guest user on a foreign location can get an IP address from multiple subnets based on their foreign locations or foreign controllers from the same anchor controller.

When a client roams from one controller to another, the foreign controller sends the VLAN information as part of the mobility announce message. Based on the VLAN information received, the anchor decides whether the tunnel should be created between the anchor controller and the foreign controller. If the same VLAN is available on the foreign controller, the client context is completely deleted from the anchor and the foreign controller becomes the new anchor controller for the client.

If an interface (int-1) in a subnet is untagged in one controller (Vlan ID 0) and the interface (int-2) in the same subnet is tagged to another controller (Vlan ID 1), then with the VLAN select, client joining the first controller over this interface may not undergo an L2 roam while it moves to the second controller. Hence, for L2 roaming to happen between two controllers with VLAN select, all the interfaces in the same subnet should be either tagged or untagged.

As part of the VLAN select feature, the mobility announce message carries an additional vendor payload that contains the list of VLAN interfaces in an interface group mapped to a foreign controller's WLAN. This VLAN list enables the anchor to differentiate from a local to local or local to foreign handoff.

Restrictions for Configuring VLAN Select

- The VLAN select feature enables you to use a single WLAN that can support multiple VLANs.

Configuring Interface Groups

Information About Interface Groups

Interface groups are logical groups of interfaces. Interface groups facilitate user configuration where the same interface group can be configured on multiple WLANs or while overriding a WLAN interface per AP group. An interface group can exclusively contain either quarantine or nonquarantine interfaces. An interface can be part of multiple interface groups.

A WLAN can be associated with an interface or interface group. The interface group name and the interface name cannot be the same.

This feature also enables you to associate a client to specific subnets based on the foreign controller that they are connected to. The anchor controller WLAN can be configured to maintain a mapping between foreign controller MAC and a specific interface or interface group (Foreign maps) as needed. If this mapping is not configured, clients on that foreign controller gets VLANs associated in a round robin fashion from interface group configured on WLAN.

You can also configure AAA override for interface groups. This feature extends the current access point group and AAA override architecture where access point groups and AAA override can be configured to override the interface group WLAN that the interface is mapped to. This is done with multiple interfaces using interface groups.

This feature enables network administrators to configure guest anchor restrictions where a wireless guest user at a foreign location can obtain an IP address from multiple subnets on the foreign location and controllers from within the same anchor controller.

Controller marks VLAN as dirty when the clients are unable to receive IP address using DHCP. The VLAN interface is marked as dirty based on two methods:

Aggressive Method—When only one failure is counted per association per client and controller marks VLAN as dirty interface when a failure occurs three times for a client or for three different clients.

Non-Aggressive Method—When only one failure is counted per association per client and controller marks VLAN as a dirty interface only when three or more clients fail.

Creating Interface Groups (GUI)

Step 1 Choose **Controller** > **Interface Groups**.
The Interface Groups page appears with the list of interface groups already created.

Note To remove an interface group, hover your mouse pointer over the blue drop-down icon and choose **Remove**.

Step 2 Click **Add Group**.

The Add New Interface Group page appears.

Step 3 Enter the details of the interface group:

- **Interface Group Name—**Specify the name of the interface group.
- **Description—**Add a brief description of the interface group.

Step 4 Click **Add**.

Creating Interface Groups (CLI)

- **config interface group** {**create** | **delete**} *interface_group_name***—**Creates or deletes an interface group
- **config interface group description** *interface_group_name description***—**Adds a description to the interface group

Adding Interfaces to Interface Groups (GUI)

Step 1 Choose **Controller > Interface Groups**.
The Interface Groups page appears with a list of all interface groups.

Step 2 Click the name of the interface group to which you want to add interfaces.
The Interface Groups > Edit page appears.

Step 3 Choose the interface name that you want to add to this interface group from the Interface Name drop-down list.

Step 4 Click **Add Interface** to add the interface to the Interface group.

Step 5 Repeat Steps 2 and 3 if you want to add multiple interfaces to this interface group.

Note To remove an interface from the interface group, hover your mouse pointer over the blue drop-down arrow and choose **Remove**.

Adding Interfaces to Interface Groups (CLI)

To add interfaces to interface groups, use the **config interface group interface add** *interface_group interface_name* command.

Viewing VLANs in Interface Groups (CLI)

To view a list of VLANs in the interface groups, use the **show interface group detailed** *interface-group-name* command.

Adding an Interface Group to a WLAN (GUI)

Step 1 Choose the **WLAN** tab.
The WLANs page appears listing the available WLANs.

Step 2 Click the WLAN ID of the WLAN to which you want to add the interface group.

Step 3 In the **General** tab, choose the interface group from the Interface/Interface Group (G) drop-down list.

Step 4 Click **Apply**.

Note Suppose that the interface group that you add to a WLAN has RADIUS Server Overwrite interface enabled. In this case, when a client requests for authentication, the controller selects the first IP address from the interface group as the RADIUS server.

Adding an Interface Group to a WLAN (CLI)

To add an interface group to a WLAN, enter the **config wlan interface** *wlan_id interface_group_name* command.

Configuring Multicast Optimization

Information About Multicast Optimization

Prior to the 7.0.116.0 release, multicast was based on the grouping of the multicast address and the VLAN as one entity, MGID. With VLAN select and VLAN pooling, there is a possibility that you might increase duplicate packets. With the VLAN select feature, every client listens to the multicast stream on a different VLAN. As a result, the controller creates different MGIDs for each multicast address and VLAN. Therefore, the upstream router sends one copy for each VLAN, which results, in the worst case, in as many copies as there are VLANs in the pool. Since the WLAN is still the same for all clients, multiple copies of the multicast packet are sent over the air. To suppress the duplication of a multicast stream on the wireless medium and between the controller and access points, you can use the multicast optimization feature.

Multicast optimization enables you to create a multicast VLAN which you can use for multicast traffic. You can configure one of the VLANs of the WLAN as a multicast VLAN where multicast groups are registered. Clients are allowed to listen to a multicast stream on the multicast VLAN. The MGID is generated using mulicast VLAN and multicast IP addresses. If multiple clients on the VLAN pool of the same WLAN are listening to a single multicast IP address, a single MGID is generated. The controller makes sure that all multicast streams from the clients on this VLAN pool always go out on the multicast VLAN to ensure that the upstream router has one entry for all the VLANs of the VLAN pool. Only one multicast stream hits the VLAN pool even if the clients are on different VLANs. Therefore, the multicast packets that are sent out over the air is just one stream.

Configuring a Multicast VLAN (GUI)

Step 1 Choose **WLANs** > **WLAN ID**. The WLAN > Edit page appears.

Step 2 In the **General** tab, select the **Multicast VLAN feature** check box to enable multicast VLAN for the WLAN. The Multicast Interface drop-down list appears.

Step 3 Choose the VLAN from the Multicast Interface drop-down list.

Step 4 Click **Apply**.

Configuring a Multicast VLAN (CLI)

Use the **config wlan multicast interface** *wlan_id* **enable** *interface_name* command to configure the multicast VLAN feature.