Cisco Catalyst 6500 Series Wireless LAN Services Module Configuration Note

This document provides configuration procedures for the Cisco Catalyst 6500 series Wireless LAN Services Module (WLSM) and contains these sections:

- Introduction, page 2
- Understanding Wireless LAN Services, page 2
- Understanding WDS, page 3
- Layer 2 and Layer 3 Mobility, page 4
- New Features in Release 2.1.1, page 6
- Configuring the Wireless LAN Services Module, page 8
- Configuring Local Authentication, page 15
- Configuring the Access Points, page 15
- Displaying Layer 3 Mobility and Wireless Network Information, page 15
- Configuring the DHCP Snooping Database, page 19
- Configuring Graceful Tunnel Resiliency, page 20
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Introduction

The Cisco wireless solution provides the framework to integrate and extend wireless networks efficiently and economically. The solution extends wireless into important elements of the network infrastructure, providing the same level of security, scalability, reliability, ease of deployment, and management for wireless LANs. This document provides information about configuring the Cisco Catalyst 6500 series WLSM in a typical wireless network.

The WLSM is one component in the larger wireless LAN solution. The following are additional required components:

- Catalyst 6500 Series Switch running Cisco IOS Release 12.2(18)XSF2
- Catalyst 6500 Series WLSM release 2.1.1
- Cisco Aironet 1100, 1130AG, 1200, 1230AG, and 1240AG Series Access Points running Cisco IOS Release 12.3(8)JA
- Cisco Aironet 1300 Series Outdoor Access Point/Bridge running Cisco IOS Release 12.3(8)JA
- CiscoWorks Wireless LAN Solution Engine (WLSE) release 2.13

For more information on configuring the solution and for sample configurations, go to this URL:

Understanding Wireless LAN Services

The WLSM provides the following features for 802.11 wireless clients on Catalyst 6500 series switches:

- Fast, uninterrupted, secure Layer 2 and Layer 3 wireless roaming
- Radio-management aggregation
- WLSM scalability (support for up to 600 access points)
- Graceful tunnel resiliency and redundancy
- RADIUS assigned mobility group
- Improved multicast support
- Support for 240 mobility groups
- Support for WDS information MIB

Figure 1 shows the system view for the WLSM. Traffic between the access point and the Catalyst 6500 series switch is IP directed. The two devices may be separated by bridges or routers.
Understanding WDS

WDS is a feature for access points in Cisco IOS software and the basis of the Catalyst 6500 series WLSM. WDS is a core function that enables other features such as these:

- Fast Secure Roaming
- Wireless LAN Solution Engine (WLSE) interaction
- Radio Management

You must establish relationships between the access points that participate in WDS and the Wireless LAN Services Module, before any other WDS-based features work. One of the purposes of WDS is to reduce the time required for client authentication by eliminating the need for the authentication server to validate user credentials.

In order to use WDS, you must designate one access point or the Wireless LAN Services Module as the WDS. A WDS access point must establish a relationship to an authentication server by authenticating to it with a WDS username and password. The authentication server can be either an external RADIUS server or the Local RADIUS Server feature in the WDS access point. The Wireless LAN Services Module must have a relationship with the authentication server, even though it does not need to authenticate to the server.

Other access points, called infrastructure access points, communicate with the WDS. Before registration occurs, the infrastructure access points must authenticate themselves to the WDS. An infrastructure server group on the WDS defines this infrastructure authentication.

Client authentication is defined by one or more client server groups on the WDS.
Layer 2 and Layer 3 Mobility

When a client attempts to associate to an infrastructure access point, the infrastructure access point passes the credentials of the user to the WDS for validation. If it is the first time that the WDS sees the credentials, it turns to the authentication server to validate the credentials. The WDS then caches the credentials so that it does not have to return to the authentication server when that user attempts authentication again. Reauthentication can occur under any of the following conditions:

- When the access points rekey
- When the client roams between access points
- When the user starts up the client device

Any RADIUS-based Extensible Authentication Protocol (EAP) can be tunneled through WDS, such as these protocols:

- Lightweight EAP (LEAP)
- Protected EAP (PEAP)
- EAP-Transport Layer Security (EAP-TLS)
- EAP-Flexible Authentication through Secure Tunneling (EAP-FAST)

The WDS and the infrastructure access points communicate over WLCCP. These multicast messages cannot be routed, so a WDS and its associated infrastructure access points must be in the same IP subnet and on the same LAN segment. Between the WDS and the WLSE, WLCCP uses TCP and User Datagram Protocol (UDP) on port 2887. When the WDS and WLSE are on different subnets, the packets cannot be translated with a protocol like Network Address Translation (NAT).

Current design recommendations specify one WDS access point per thirty infrastructure access points. The Wireless LAN Services Module can handle up to 600 infrastructure access points.

Layer 2 and Layer 3 Mobility

Layer mobility occurs when a wireless LAN client moves between wireless access points that are within the same IP subnet. Layer 3 mobility occurs when a wireless LAN client moves between wireless access points that are in different IP subnets. (See Figure 2.)

Fast secure roaming enables a client to change its connection between access points in the same subnet (Layer 2 mobility) or between subnets (Layer 3 mobility) to support time-sensitive applications such as VoIP, video on demand, VPN over wireless, and client/server-based applications.
Layer 2 Mobility

Layer 2 mobility occurs when a wireless LAN device physically moves enough so that its radio associates to a different access point. The original and the updated access points offer coverage for the same IP subnet, so that the wireless LAN client is still valid after the roam.

Layer 3 Mobility

Mobility in a wireless LAN environment can present a challenge as the physical reach of the network grows. Applications such as voice require roam times below 150 ms and require IP address continuity regardless of the Layer 3 boundaries that are crossed. Deploying a sprawling Layer 2 network can subject user traffic to delays and loss of service due to issues such as broadcast storms and Spanning Tree Protocol (STP) reconvergence times.

Layer 3 mobility provides a better performing and more scalable approach. Access points may be deployed in any location in a large Layer 3 network without requiring a single VLAN to be carried throughout the wired switch infrastructure. An overlay of multipoint GRE (mGRE) tunnels allows clients to roam to other access points residing on different Layer 3 subnets without loss of connectivity or a change in IP addressing.

The Cisco Layer 3 mobility solution consists of various hardware and software components. For more information about the Cisco wireless solution go to cisco.com:


The primary devices are as follows:

- Cisco Aironet 1100, 1130AG, 1200, 1230AG, and 1240AG Series Access Points and Cisco Aironet 1300 Series Outdoor Access Point/Bridges
- Catalyst 6500 Series Switch (and its Supervisor 720 Module)
- Catalyst 6500 Series WLSM
Wireless Domain Services (WDS) coordinates these devices and the mobile nodes. The WDS runs on the WLSM. These components must be configured to work together as a unified system.

Configuring Layer 3 mobility requires linkage between different hardware and software components. Linkage is best accomplished by separating the functional components into modules, configuring each module individually, and verifying that each module works properly before proceeding to the next.

New Features in Release 2.1.1

The following sections describe the new features supported in Release 2.1.1:

- Increased Access Point Scalability, page 6
- Multiple WLSMs per Catalyst 6500 Chassis, page 6
- Graceful Tunnel Resiliency, page 6
- Graceful Tunnel Resiliency, page 6
- Improved Multicast Support, page 7
- RADIUS Assigned Mobility Groups, page 7
- Support for WDS Information MIB, page 8

Increased Access Point Scalability

Memory and software improvements have increased scalability from 300 to 600 access points.

Multiple WLSMs per Catalyst 6500 Chassis

In Release 2.1.1, the Supervisor 720 now supports two WLSMs in a chassis. In this configuration, only one WLSM can be active; the other is operating in a standby state. If the active WLSM fails, the standby WLSM becomes active in a matter of seconds, and combined with graceful tunnel resiliency, the WLSM switchover is seamless and transparent to the user. New clients and roaming clients are minimally affected because of the short time it takes to bring the standby WLSM to the active state.

Running Hot Standby Router Protocol (HSRP) on all WLSMs achieves intra-switch and inter-switch hot standby WLSM redundancy. In order to avoid unnecessary failovers and make use of a graceful recovery feature, disable preemption for HSRP.

Graceful Tunnel Resiliency

Graceful tunnel resiliency is a high availability feature that provides near Stateful Switchover (SSO) capability. In the event of a WLSM failure, graceful tunnel resiliency maintains data traffic forwarding for all existing Mobile Nodes (MNs) that are authenticated. This is done for a configurable grace period. MN authentication and session states are refreshed without disruption to their data traffic after the WLSM reboots or a backup WLSM takes over. Only new authentications or roaming is affected when the WLSM is down or in a recovery state.
Support for 240 Mobility Groups

This feature provides increased scalability and flexibility by supporting up to 240 mobility groups. A larger number of mobility groups allows for multiple policies based on user posture validation. Also, each mobility domain may be set as a smaller group to address big flat IP subnet concerns.

No additional WLSM configuration is required for this feature.

Improved Multicast Support

Release 2.1.1 provides an IGMP snooping-based multicast solution. IGMP snooping is performed on the access point to allow forwarding of downstream multicast traffic from the native network infrastructure to clients of dynamic RADIUS-assigned mobility groups. Multicast traffic forwarding for any mobility group can be turned on or off with the CLI on the Supervisor 720.

The Catalyst 6500 series wireless LAN handles multicast traffic differently from unicast IP traffic. When a wireless user sends upstream IP multicast traffic, the access point encapsulates the packet with a GRE header and forwards the packet over the tunnel. The only exception in this scenario (upstream IP multicast traffic flow) is Internet Group Management Protocol (IGMP) join messages, which are locally bridged by the access point to the local infrastructure.

Downstream IP multicast traffic from the Supervisor 720 to the access point is not sent via the fast secure roaming tunnel. Instead, IP multicast traffic sent to the access point is forwarded using the underlying network infrastructure. Via the locally bridged IGMP messages, the access point dynamically constructs a wireless client-to-multicast group association table. This IGMP snooping operation permits flexible creation of a multicast group-to-wireless client association table at the access point and permits the access point to efficiently use bandwidth by only forwarding multicast traffic when there is a multicast-requesting client associated. However, due to the asymmetric multicast traffic flow, all network nodes between the supervisor engine and the access point must be configured to enable downstream multicast traffic to reach its destination.

RADIUS Assigned Mobility Groups

The fast secure roaming tunnels used with the Catalyst 6500 series WLSM are the components of the solution which permits Layer 3 mobility and fast secure roaming. The fast secure roaming tunnels may be assigned statically by associating a network-ID with each SSID at the access point, or dynamically per user via RADIUS authentication. The primary advantage of RADIUS-based mobility group or tunnel assignment is that it dramatically simplifies the configuration of access points because they are dynamically assigned the necessary mobility groups for users. The access point needs only to be configured for a single SSID. This permits the segmentation of different user groups on the access point (such as employees, contractors, guests, etc.) to different mobility groups and different network access policies from the Catalyst 6500 series switch.

It is also possible to combine the following deployment models to assign the desired mobility group or fast secure roaming tunnel for clients that use RADIUS authentication:

- Creation of static tunnels for clients that do not support RADIUS authentication
- RADIUS vendor-specific attributes
No extra configuration on the WLSM or Supervisor 720 is required to enable dynamic mobility group assignment. The configuration of the access point and RADIUS server control whether mobility groups are dynamically assigned at the access point using the WLSM's authentication transactions. Mobility group/tunnel IDs must be configured at the Supervisor 720 for either static or dynamic mobility group operation.

Support for WDS Information MIB

Release 2.1.1 greatly improves MIB support for the WLSM by supporting the CISCO-WDS-INFO-MIB by introducing the capability of querying the WLSM for client, access point, and WLSE status and statistics. This information may be used to query the WLSM for client association, roaming and performance data, or custom SNMP applications.

Configuring the Wireless LAN Services Module

The initial Wireless LAN Services Module configuration consists of the following tasks:

- Configuring VLANs on the Switch, page 8
- Configuring Layer 3 Interfaces, page 9
- Adding the Wireless LAN Services Module to the Corresponding VLAN, page 10
- Configuring the Loopback Interface, page 10
- Configuring the Wireless mGRE Tunnel, page 10
- Configuring VLANs on the Wireless LAN Services Module, page 12
- Configuring Telnet Remote Access, page 13
- Configuring Wireless Domain Services, page 14
- Configuring Local Authentication, page 15
- Configuring the DHCP Snooping Database, page 19
- Configuring Graceful Tunnel Resiliency, page 20

Note

The initial Wireless LAN Services Module configuration must be made through a direct connection to the console port on the module.

Configuring VLANs on the Switch

Note

VLAN IDs must be the same for the switch and the module. Refer to the “Configuring VLANs” chapter in the Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide for details.

Note

The wireless LAN software supports the extended-range VLANs (2 through 1005).
To configure VLANs on the switch, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td>Enters configuration mode and selects the terminal option.</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
</tr>
<tr>
<td>Router(config)# vlan vlan_ID</td>
<td>Enters VLAN configuration mode and adds a VLAN. The valid range is 2 through 4094.</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
</tr>
<tr>
<td>Router(config-vlan)# exit</td>
<td>Updates the VLAN database and returns to privileged EXEC mode.</td>
</tr>
</tbody>
</table>

This example shows how to configure VLANs on the switch:

Router> enable
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# vlan 100
Router(config-vlan)# exit
Router(config)#

### Configuring Layer 3 Interfaces

To configure the corresponding Layer 3 VLAN interface, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>Router(config)# interface vlan vlan_ID</td>
<td>Selects an interface to configure.</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
</tr>
<tr>
<td>Router(config-if)# ip address ip_address subnet_mask</td>
<td>Configures the IP address and IP subnet.</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
</tr>
<tr>
<td>Router(config-if)# no shutdown</td>
<td>Enables the interface.</td>
</tr>
<tr>
<td>Step 4</td>
<td></td>
</tr>
<tr>
<td>Router(config-if)# exit</td>
<td>Exits configuration mode.</td>
</tr>
</tbody>
</table>

This example shows how to configure the Layer 3 VLAN interface:

Router# configure terminal
Router(config)# interface vlan 100
Router(config-if)# ip address 10.10.1.10 255.255.255.0
Router(config-if)# no shutdown
Router(config-if)# exit
Adding the Wireless LAN Services Module to the Corresponding VLAN

**Note**

By default, the Wireless LAN Services Module is in trunking mode with native VLAN 1.

To add the Wireless LAN Services Module to the corresponding VLAN, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>Router(config)# wlan module mod allowed-vlan vlan_ID</code></td>
<td>Configures the VLANs allowed over the trunk to the Wireless LAN Services Module.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>One of the allowed VLANs must be the admin VLAN.</td>
</tr>
</tbody>
</table>

This example shows how to add a Wireless LAN Services Module that is installed in slot 5 to a specific VLAN:

```
Router(config)# wlan module 5 allowed-vlan 100
Router(config)# end
```

Configuring the Loopback Interface

The loopback interface is a software-only virtual interface that emulates an interface.

To configure the loopback interface, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> <code>Router(config)# interface loopback number</code></td>
<td>Configures a loopback interface and enters interface configuration mode. The <code>number</code> argument specifies the number of the loopback interface that you want to create or configure. There is no limit on the number of loopback interfaces that you can create.</td>
</tr>
<tr>
<td><strong>Step 2</strong> <code>Router(config-if)# ip address ip_addr [subnet]</code></td>
<td>Assigns an IP network address and network mask to the interface.</td>
</tr>
<tr>
<td><strong>Step 3</strong> <code>Router(config-if)# exit</code></td>
<td>Exits configuration mode.</td>
</tr>
</tbody>
</table>

The following example shows how to configure a loopback interface:

```
Router(config)# interface loopback 0
Router(config-if)# ip address 10.1.1.2 255.255.255.0
Router(config-if)# exit
```

Configuring the Wireless mGRE Tunnel

The infrastructure that enables Layer 3 mobility consists of Multipoint Generic Routing Encapsulation (mGRE) tunnels. Each tunnel has a single termination point on the Supervisor 720 module of the Catalyst 6500 that hosts the WLSM. The other logical endpoint of the tunnel exists on all access points participating in the Layer 3 mobility network. Clients that associate to a participating access point associate to a particular SSID. The SSID is mapped (either statically or dynamically via RADIUS) to a
mobility network that tunnels all client traffic to the Catalyst 6500. The Supervisor 720 maintains a
database of the clients (mobile nodes) and the access points to which they are associated. Roaming from
one access point to another simply requires updating the database and changing the forwarding
information for that mobile node.

To configure wireless mGRE tunnels, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><strong>Router(config)# ip dhcp snooping</strong> (Optional) Enables DHCP snooping. <strong>Note</strong> This command is required if you enable DHCP snooping on the tunnel interface for untrusted wireless networks. <strong>Note</strong> See the “Configuring the DHCP Snooping Database” section on page 19 for information on the DHCP snooping database for untrusted networks.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><strong>Router(config)# interface tunnel number</strong> (Optional) Configures a tunnel interface and enters interface configuration mode. The <em>number</em> argument specifies the number of the tunnel interface that you want to create or configure.</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td><strong>Router(config-if)# ip address ip_addr [subnet_mask]</strong> Specifies the tunnel IP and the mGRE tunnel overlay subnet.</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td><strong>Router(config-if)# ip mtu bytes</strong> (Optional) Sets the maximum transmission unit (MTU) size, in bytes, of IP packets sent on an interface. The default value for <em>bytes</em> is 1476; the minimum is 512.</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td><strong>Router(config-if)# tunnel source loopback interface</strong> Configures the tunnel source. Each tunnel must have a different tunnel source.</td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td><strong>Router(config-if)# tunnel mode gre multipoint</strong> Sets the encapsulation mode to mGRE for the tunnel interface.</td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td><strong>Router(config-if)# mac-address mac_addr</strong> (Optional) Specifies the MAC address of the router. <strong>Note</strong> Entering the router MAC address allows mobile nodes to detect if their IP address is duplicated on the network.</td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td><strong>Router(config-if)# mobility network-id [id]</strong> Specifies the wireless network ID for the mGRE tunnel. Valid values for <em>id</em> are 1 through 4095.</td>
</tr>
<tr>
<td><strong>Step 9</strong></td>
<td><strong>Router(config-if)# mobility trust [ip-discovery]</strong> (Optional) Specifies the trusted network. A trusted network can use DHCP or static IP addresses. An untrusted network supports only DHCP clients. The default is untrusted. The ip-discovery option provides the capability to discover the IP addresses of passive wireless client devices associated to an infrastructure access point.</td>
</tr>
</tbody>
</table>
Configuring the Wireless LAN Services Module

This example shows how to configure wireless mGRE tunnels:

Router(config)# ip dhcp snooping
Router(config)# interface tunnel 0
Router(config-if)# ip address 10.1.1.2 255.255.255.0
Router(config-if)# ip mtu 1024
Router(config-if)# tunnel source loopback 0
Router(config-if)# tunnel mode gre multipoint
Router(config-if)# mobility network-id 10
Router(config-if)# ip dhcp snooping packets
Router(config-if)# exit

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Router(config-if)# mobility broadcast</td>
<td>(Optional) Specifies the mGRE tunnel to convert nonbroadcast multiaccess (NBMA) to broadcast multiaccess (BMA).</td>
</tr>
<tr>
<td>11</td>
<td>Router(config-if)# ip dhcp snooping packets</td>
<td>(Optional) Enables DHCP snooping for the untrusted wireless network ID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: You must enable DHCP snooping globally before enabling DHCP snooping on the tunnel interface by entering the <code>ip dhcp snooping</code> command.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: See the “Configuring the DHCP Snooping Database” section on page 19 for information on the DHCP snooping database for untrusted networks.</td>
</tr>
<tr>
<td>12</td>
<td>Router(config-if)# exit</td>
<td>Exits configuration mode.</td>
</tr>
</tbody>
</table>

Configuring VLANs on the Wireless LAN Services Module

When you configure VLANs on the Wireless LAN Services Module, configure one of the VLANs as an administrative VLAN. The system adds the default route through the gateway of the administrative VLAN.

Note The wireless LAN software supports only one admin VLAN. Configuring the admin VLAN is required for using the wireless domain services.

Note VLAN IDs must be the same for the switch and the module. Refer to the “Configuring VLANs” chapter in the Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide for details.
To configure VLANs on the Wireless LAN Services Module, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> wlan(config)# wlan vlan vlan_ID</td>
<td>Configures the wireless LAN VLANs and enters VLAN mode. <strong>Note</strong> If this is the admin VLAN, enter the same <code>vlan_ID</code> that you entered for the switch. (See the “Configuring VLANs on the Switch” section on page 8.)</td>
</tr>
<tr>
<td><strong>Step 2</strong> wlan(config-vlan)# ipaddr ip_addr netmask</td>
<td>Configures an IP address for the wireless LAN VLAN. <strong>Note</strong> Configure the IP address in the same subnet as the VLAN IP address.</td>
</tr>
<tr>
<td><strong>Step 3</strong> wlan(config-vlan)# gateway gateway_addr</td>
<td>Configures the gateway IP address. <strong>Note</strong> If this is the admin VLAN, enter the same IP address for the gateway as you entered for the switch. (See the “Configuring Layer 3 Interfaces” section on page 9.)</td>
</tr>
<tr>
<td><strong>Step 4</strong> wlan(config-vlan)# standby [group-number] ip [ip-address]</td>
<td>(Optional) Configures the Hot Standby Router Protocol (HSRP).</td>
</tr>
<tr>
<td><strong>Step 5</strong> wlan(config-vlan)# route ip_addr netmask gateway ip_addr</td>
<td>(Optional) Configures a static route for servers that are one or more Layer 3 hops away from the Wireless LAN Services Module.</td>
</tr>
<tr>
<td><strong>Step 6</strong> wlan(config-vlan)# admin</td>
<td>(Optional) Configures the VLAN as the administrative VLAN.</td>
</tr>
</tbody>
</table>

1. The administrative VLAN is for management traffic. Specify only one VLAN as the administrative VLAN.

This example shows how to configure the VLAN and specify the IP address, the subnet mask, and the global gateway, and it also specifies the VLAN as the administrative VLAN:

```
wlan(config)# wlan vlan 100 admin
wlan(config-vlan)# ipaddr 10.10.1.20 255.255.255.0
gateway 10.10.1.10
wlan(config-vlan)# admin
wlan(config-vlan)# end
wlan#
```

**Configuring Telnet Remote Access**

To configure the Wireless LAN Services Module for Telnet remote access, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> wlan(config)# aaa authentication login default line</td>
<td>Creates a default authentication list for login purposes. The line password is used for the default authentication list.</td>
</tr>
<tr>
<td><strong>Step 2</strong> wlan(config)# enable password password</td>
<td>Specifies a local enable password.</td>
</tr>
</tbody>
</table>
Configuring the Wireless LAN Services Module

This example shows how to configure the Wireless LAN Services Module for remote access:

```
wlan(config)# aaa authentication login default line
wlan(config)# enable password cisco
wlan(config)# line vty 0 4
wlan(config-line)# login authentication default
wlan(config-line)# password cisco
wlan(config-line)# exit
wlan(config)#
```

### Configuring Wireless Domain Services

To configure the Wireless LAN Services Module as the WDS device, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>wlan(config)# aaa new-model</td>
<td>Enables the AAA access control model.</td>
</tr>
<tr>
<td>wlan(config)# aaa authentication login leap-devices group radius</td>
<td>Defines a group used to authenticate Extensible Authentication Protocol (LEAP) devices.</td>
</tr>
<tr>
<td>wlan(config)# aaa authentication login default enable</td>
<td>Specifies the enable password as the login authentication method.</td>
</tr>
<tr>
<td>wlan(config)# radius-server host {hostname</td>
<td>ip_address} [auth-port port_number] [acct-port port_number]</td>
</tr>
<tr>
<td>wlan(config)# radius-server key string</td>
<td>Sets the authentication and encryption key for all RADIUS communications between the module and the RADIUS server. The <code>radius-server key</code> command has no default value; however, the key must match the encryption key used on the RADIUS server.</td>
</tr>
<tr>
<td>wlan(config)# wlccp authentication-server infrastructure leap-devices</td>
<td>Defines a method that authenticates the other access points.</td>
</tr>
<tr>
<td>wlan(config)# wlccp authentication-server client any leap-devices</td>
<td>Defines a method that authenticates the client devices (a client server group) and what EAP types those clients use.</td>
</tr>
</tbody>
</table>
This example shows how to configure the Wireless LAN Services Module as the WDS device:

```
wlan# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
wlan(config)# aaa new-model
wlan(config)# aaa authentication login leap-devices group radius
wlan(config)# aaa authentication login default enable
wlan(config)# radius-server host 10.91.104.76 auth-port 1645 acct-port 1646
wlan(config)# radius-server key cisco
wlan(config)# end
```

### Configuring Local Authentication

To configure the WLSM as a local authenticator, refer to Chapter 8, “Configuring an Access Point as a Local Authenticator,” in the *Cisco IOS Software Configuration Guide for Cisco Aironet Access Points* at this URL:

http://www.cisco.com/univercd/cc/td/doc/product/wireless/airo1100/accesspts/i12215ja/i12215sc/s15local.htm

### Configuring the Access Points

To configure the access points to use the WDS, refer to Chapter 11, “Configuring WDS, Fast Secure Roaming, and Radio Management,” in the *Cisco IOS Software Configuration Guide for Cisco Aironet Access Points* at this URL:

http://www.cisco.com/univercd/cc/td/doc/product/wireless/airo1100/accesspts/i12215ja/i12215sc/s15roamg.htm

### Displaying Layer 3 Mobility and Wireless Network Information

To display Layer 3 mobility and wireless network information, perform these tasks from the supervisor engine:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router# show mobility [ap</td>
<td>mn</td>
</tr>
<tr>
<td>Router# show mls cef adjacency [all</td>
<td>decap-tunnel</td>
</tr>
</tbody>
</table>
This example shows the output of the various `show mobility` commands issued from a Supervisor 720:

Sup720...`show mobility ap`
Codes: * - dynamic network ID, otherwise - static network ID

<table>
<thead>
<tr>
<th>AP IP Address</th>
<th>AP Mac Address</th>
<th>Wireless Network-ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.10.0.36</td>
<td>0013.5f0c.41c5</td>
<td></td>
</tr>
<tr>
<td>10.10.0.64</td>
<td>000b.5f19.665f</td>
<td>100 101 102 103</td>
</tr>
<tr>
<td>10.10.0.65</td>
<td>0005.9a39.b03a</td>
<td></td>
</tr>
<tr>
<td>10.10.0.67</td>
<td>000b.fcfb.7ca6</td>
<td>*102</td>
</tr>
</tbody>
</table>

Sup720...`show mobility ap 10.10.0.67 detail`
IP Address : 10.10.0.67
MAC Address : 000b.fcfb.7ca6
Participating Wireless Tunnels:
102, Dynamic (Dynamic MN = 1)
Registered Mobile Nodes on AP :

<table>
<thead>
<tr>
<th>MN Mac Address</th>
<th>MN IP Address</th>
<th>AP IP Address</th>
<th>Wireless Network-ID</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>0007.0eb9.3d78</td>
<td>172.16.3.26</td>
<td>10.10.0.67</td>
<td>102</td>
<td>D</td>
</tr>
</tbody>
</table>

Flags: D=Dynamic network ID, F=Fresh, G=Grace Period

Sup720...`show mobility mn`

<table>
<thead>
<tr>
<th>MN Mac Address</th>
<th>MN IP Address</th>
<th>AP IP Address</th>
<th>Wireless Network-ID</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>0007.0eb9.3d78</td>
<td>172.16.3.26</td>
<td>10.10.0.67</td>
<td>102</td>
<td>D</td>
</tr>
</tbody>
</table>

Flags: D=Dynamic network ID, F=Fresh, G=Grace Period

Sup720...`show mobility mn ip 172.16.3.26`

<table>
<thead>
<tr>
<th>MN Mac Address</th>
<th>MN IP Address</th>
<th>AP IP Address</th>
<th>Wireless Network-ID</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>0007.0eb9.3d78</td>
<td>172.16.3.26</td>
<td>10.10.0.67</td>
<td>102</td>
<td>D</td>
</tr>
</tbody>
</table>

Flags: D=Dynamic network ID, F=Fresh, G=Grace Period

Sup720...`show mobility network 102`

Wireless Network ID : 102
Wireless Tunnel Source IP Address : 10.80.0.3
Wireless Network Attributes : Trusted, Broadcast Enabled, Multicast Enabled
Wireless Network State : Up
Registered Access Point on Wireless Network 102:
Codes: * - dynamic network ID, otherwise - static network ID

<table>
<thead>
<tr>
<th>AP IP Address</th>
<th>AP Mac Address</th>
<th>Wireless Network-ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.10.0.64</td>
<td>000b.5f19.665f</td>
<td>100 101 102 103</td>
</tr>
<tr>
<td>10.10.0.67</td>
<td>000b.fcfb.7ca6</td>
<td>*102</td>
</tr>
</tbody>
</table>

Registered Mobile Nodes on Wireless Network 102:

<table>
<thead>
<tr>
<th>MN Mac Address</th>
<th>MN IP Address</th>
<th>AP IP Address</th>
<th>Wireless Network-ID</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>0007.0eb9.3d78</td>
<td>172.16.3.26</td>
<td>10.10.0.67</td>
<td>102</td>
<td>D</td>
</tr>
</tbody>
</table>

Flags: D=Dynamic network ID, F=Fresh, G=Grace Period
Sup720...#show mobility status

Primary WLAN Module is located in Slot: 1 (HSRP State: Not Applicable)
LCP Communication status : up
No Secondary WLAN Module in the system
WLSM recovery period remaining: 0 seconds
MAC address used for Proxy ARP: 0005.5f54.5800
Number of Wireless Tunnels : 4
Number of Access Points : 4
Number of Mobile Nodes : 1

Wireless Tunnel Bindings:
Tunnel       Src IP Address   Wireless Network-ID  Flags
---------------  ---------------  -------------------  -------
Tunnel100      10.80.0.1        100                  TB  M
Tunnel101      10.80.0.2        101                  TB  M
Tunnel102      10.80.0.3        102                  TB  M
Tunnel103      10.80.0.4        103                      M

Flags: T=Trusted, B=IP Broadcast enabled, M=IP Multicast enabled
       A=TCP Adjust-mss enabled, D=Discover passive MN's IP address

To display Layer 3 mobility and wireless network information, perform these tasks from the Wireless LAN Services Module:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>wlan# show wlccp wds [aggregator</td>
<td>ap</td>
</tr>
<tr>
<td>wlan# show wlccp wds statistics</td>
<td>Displays the current WLCCP statistics.</td>
</tr>
<tr>
<td>wlan# show wlan [admin-info</td>
<td>crash-info</td>
</tr>
</tbody>
</table>

This example shows the output of the various show wlccp wds commands issued from the WLSM:

WLSM>show wlccp wds aggregator ap

RM Aggregator APs Status [Maximum APs Supported 1024]:

<table>
<thead>
<tr>
<th>NUM</th>
<th>IPADDR</th>
<th>REQ</th>
<th>ACK</th>
<th>RPT</th>
<th>AGG-RPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.10.0.52</td>
<td>54</td>
<td>54</td>
<td>2965</td>
<td>899</td>
</tr>
<tr>
<td>2</td>
<td>10.10.0.65</td>
<td>318</td>
<td>318</td>
<td>70750</td>
<td>14573</td>
</tr>
<tr>
<td>3</td>
<td>10.10.0.54</td>
<td>2413</td>
<td>2235</td>
<td>86445</td>
<td>33665</td>
</tr>
<tr>
<td>4</td>
<td>10.10.0.64</td>
<td>522</td>
<td>472</td>
<td>14823</td>
<td>7106</td>
</tr>
<tr>
<td>5</td>
<td>10.10.0.51</td>
<td>37</td>
<td>37</td>
<td>10477</td>
<td>1874</td>
</tr>
<tr>
<td>6</td>
<td>10.10.0.55</td>
<td>1594</td>
<td>1594</td>
<td>386476</td>
<td>70712</td>
</tr>
</tbody>
</table>

Total APs: 6

WLSM>show wlccp wds aggregator statistics

RM Aggregator Statistics:

Maximum Size of the Requests Received: 1124
Requests Received Count: 3332
Request Acknowledgment Sent Count: 3332
Route Response Sent Count: 4717
Route Response Partially Sent Count: 7

Request Sent to APs Count: 4938
Request to AP Send Failure Count: 0
Request to AP Send Failure due to Unregistered APs Count: 21
Request Acks Received Count: 4710
RM Reports Received Count: 571948
Aggregated RM Reports Sent Count: 128832
General Event Reports Received Count: 0
Oversize AP-RM Reports Drop Count: 0
Oversize WLSE-RM Reports Drop Count: 0
Invalid WLCCP Message Received Count: 0
Decode Errors Count: 0
Encode Errors Count: 0
Malloc Errors Count: 0
RM Library Statistics:
  Protocol Errors: 0
  MIC Errors: 0
  Packet Allocation Errors: 0
  Memory Allocation Errors: 0
  Data Enqueue Errors: 0
  Zero Length Packet Errors: 0
  Most Recent Error:

WLSM> show wlccp wds ap

+ HOSTNAME + MAC-ADDR      + IP-ADDR          + STATE
  +-------------------+-------------------+-------------------+--------
  AP1200_25          000b.5f19.665f  10.10.0.64      REGISTERED
  Seagle_ap1         000b.fcfb.7ca6  10.10.0.67      REGISTERED
  Cisco_AP           0013.5f0c.41c5  10.10.0.36      REGISTERED

WLSM> show wlccp wds mn

+ MAC-ADDR + IP-ADDR          + Cur-AP            + STATE
  +-----------+-------------------+-------------------+--------
  0007.0eb9.3d78 172.16.3.26     000b.fcfb.7ca6      REGISTERED

WLSM> show wlccp wds mobility network-id 102

Mobile Nodes in Wireless Network 102

+ MAC Address + IP Address + Current AP IP + Old AP IP + State
  +-------------+-------------+-------------------+-------------------+--------
  0007.0eb9.3d78 172.16.3.26     10.10.0.67      10.10.0.67      REGISTERED

WLSM> show wlccp wds statistics

WDS Statistics for last 6w6d:
  Current AP count: 4
  Current MN count: 1
  AAA Auth Attempt count: 90342
  AAA Auth Success count: 650
  AAA Auth Failure count: 80486
  MAC Spoofing Block count: 0
  Roaming without AAA Auth count: 0
  Roaming with full AAA Auth count: 36
  Fast Secured Roaming count: 0
  MSC Failure count: 0
  KSC Failure count: 0
  MIC Failure count: 0
  RN Mismatch count: 0

WLSM> show wlccp wds statistics roaming

MN Roamings five seconds avg: 5; one minute avg: 3; five minutes avg: 3
Start time: 07:44:18.199 UTC Tue Apr 19 2005

<table>
<thead>
<tr>
<th>WNID</th>
<th>Total</th>
<th>NO Auth</th>
<th>AAA Auth</th>
<th>Fast Secured</th>
<th>5Sec</th>
<th>1Min</th>
<th>5Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>1200</td>
<td>400</td>
<td>500</td>
<td>300</td>
<td>10</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>
Configuring the DHCP Snooping Database

Wireless clients, or mobile nodes, assigned to an untrusted wireless network must be configured to use DHCP to obtain IP addresses from a DHCP server. The switch should have DHCP snooping enabled on the tunnel corresponding to the wireless network. Because the DHCP snooping database is not synchronized between the active and standby Supervisor 720, Cisco recommends that you store the DHCP snooping database on an external server. Storing the database on an external server allows the standby Supervisor to retrieve the accumulated states if a switchover occurs.
To configure DHCP snooping database options, perform these tasks:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| Router(config)# ip dhcp snooping database (url) | Specifies the URL that stores the DHCP snooping database entries; `url` takes the following forms:  
  - `tftp://host/filename`  
  - `ftp://user:password@host/filename`  
  - `rcp://user@host/filename`  
  - `bootflash://filename`  

| Router(config)# ip dhcp snooping database write-delay seconds | Specifies (in seconds) the duration for which the database transfer should be delayed after the database changes. The default is 300 seconds. The range is from 15 to 86400 seconds. |

1. Due to issues with storing the DHCP snooping database on the bootflash device, as documented in caveat CSCee23185, and the limited storage capacity on the bootflash device, we recommend that you store the database on an external server. When a file is stored in a remote location that is accessible through FTP, TFTP, or RCP, a redundant supervisor engine configured with RPR or SSO takes over the database when a switchover occurs.

This example shows how to specify the database URL using TFTP:

```
Router(config)# ip dhcp snooping database tftp://90.90.90.90/snooping-rp2
```

This example shows how to specify the amount of time before writing DHCP snooping entries:

```
Router(config)# ip dhcp snooping database write-delay 15
```

**Note**

When you configure RPR and RPR+ redundancy, you must store the DHCP snooping database to an external server. Otherwise, mobile nodes in an untrusted network will lose connectivity after the supervisor engine switchover.

When you configure SSO redundancy, tunnel endpoints for mobile nodes are always synchronized to the standby supervisor engine. As a result, mobile nodes do not lose connectivity after a supervisor engine switchover, even if DHCP snooping database entries are not stored externally. However, after the switchover, the DHCP snooping database is emptied. Therefore, it is always advisable to have the DHCP snooping database to be stored externally for all modes of redundancy so that it will be retrieved automatically by the new active supervisor engine.

---

**Configuring Graceful Tunnel Resiliency**

To configure graceful tunnel resiliency, you need to configure the wireless LAN recovery time on the Supervisor 720. This parameter is set to 0 by default. Setting the recovery time to a value establishes the period of time that the Supervisor 720 maintains data communications with authenticated mobile nodes. If a WLSM failure occurs, the graceful recovery begins and the recovery timer starts.

When the WLSM comes back online, it reauthenticates the mobile nodes at a specific rate determined by the `wlccp wds recovery rate` value, which is the number of mobile nodes the WLSM reauthenticates per second. The default value is 40 authentications per second.

No configuration is required on the access points.
To enable and set the wireless LAN recovery time on the Supervisor 720, begin from the Privileged EXEC mode and perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 Router #configure terminal</td>
<td>Enters configuration mode.</td>
</tr>
<tr>
<td>Step 1 Router (config)# wlan recovery time</td>
<td>Specifies the recovery time or grace period in seconds for client</td>
</tr>
<tr>
<td>seconds</td>
<td>operation without refreshing wireless LAN session context after a</td>
</tr>
<tr>
<td>Step 1 WLSM (config)# end</td>
<td>Exit configuration mode.</td>
</tr>
<tr>
<td>Step 1 WLSM# write mem</td>
<td>Saves configuration to NVRAM.</td>
</tr>
</tbody>
</table>

To verify or change the WLSM recovery rate setting, open the WLSM console, begin from Privileged EXEC mode, and perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 WLSM# configure terminal</td>
<td>Enters configuration mode.</td>
</tr>
<tr>
<td>Step 2 WLSM (config)# wlccp wds recovery</td>
<td>Specifies the number of MN re-authentications per second that the</td>
</tr>
<tr>
<td>rate seconds</td>
<td>the AAA server processes after a WLSM comes back online. The recovery</td>
</tr>
<tr>
<td>Step 3 WLSM (config)# end</td>
<td>Exit configuration mode.</td>
</tr>
<tr>
<td>Step 4 WLSM# write mem</td>
<td>Saves configuration to NVRAM.</td>
</tr>
</tbody>
</table>

Use the `show mobility mn` command to check the output on the Supervisor 720 during a recovery period, as shown in the following example:

```
Router# show mobility mn  
MN Mac Address  MN IP Address  AP IP Address  Wireless Network-ID  Flags  
-----------------  -------------  -------------  -----------------  -----  
0007.0eb9.3d78  172.16.3.26    10.10.0.67     102   G

Flags:  D=Dynamic network ID,  F=Fresh,  G=Grace Period
```

You can check the status of a mobile node using the `show dot11 associations` command on the access point. This mobile node would be shown in a `rediscover` state, as shown in the following example:

```
ap# show dot11 associations  
802.11 Client Stations on Dot11Radio0:  
SSID: [test]  
MAC Address  IP Address  Device  Name  Parent  State  
0007.0eb9.3d78  10.10.0.67  350-client  testap1  self  Rediscover
```
Configuring Two WLSMs on One Chassis

To configure two WLSMs on the same chassis, use the `standby ip` command to activate HSRP on each WDS. Beginning in the Privileged EXEC mode, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 WLSM# config terminal</td>
<td>Enters configuration mode.</td>
</tr>
<tr>
<td>Step 2 WLSM (config)# wlan vlan x</td>
<td>Accesses the VLAN used for Supervisor 720 and WLSM communications.</td>
</tr>
<tr>
<td>Step 3 WLSM (config-vlan)# standby group # ip ip address</td>
<td>Configures the standby HSRP group and virtual IP address.</td>
</tr>
<tr>
<td>Step 4 WLSM (config-vlan)# end</td>
<td>Exit configuration mode.</td>
</tr>
<tr>
<td>Step 5 WLSM# write mem</td>
<td>Save config to NVRAM.</td>
</tr>
</tbody>
</table>

WLSM Graceful Tunnel Resiliency Performance Limitations

Performance is limited during the graceful recovery process. During the period that the WLSM is down, you can expect the following limitations:

- No new authentications are allowed.
- If a client attempts to roam, it is deauthenticated.
- When the WLSM is back up, fast roaming (CCKM) is not available and client roaming requires a full reauthentication until the WLSM mobile node session context is refreshed.

Previous versions of wireless LAN software supported only one WLSM per chassis. Release 2.1.1 supports two WLSMs per chassis, and combined with graceful tunnel resiliency, provides a near intra-chassis WLSM switchover. In a two-WLSM per chassis configuration, only one WLSM can be active; the other is designated the standby WLSM. If the active WLSM fails, the standby WLSM takes over. Because the switchover takes place almost instantaneously, you should experience no traffic loss.
**Configuration Examples**

Figure 3 shows the configuration for Supervisor 720 and two WLSMs in a single chassis. The Supervisor 720 configuration is a selected portion from a complete configuration; however the WLSM configuration is complete.

**Figure 3  Two WLSMs in a Single Chassis**

![Diagram of network topology with Supervisor 720, WLSMs, ACS Server, DHCP Server, Router 1, Router 2, Access points, and Wireless node]

**Supervisor 720 configuration**

```plaintext
upgrade fpd auto
version 12.2
service timestamps debug datetime msec show-timezone
service timestamps log datetime msec show-timezone
service password-encryption
service internal
service counters max age 10
! hostname interswitch-rp1
! boot system flash disk0:
  enable password 7 1042081B
! no aaa new-model
clock timezone PST -8
wlan module 3 allowed-vlan 100
wlan module 9 allowed-vlan 100
wlan recovery time 300
ip subnet-zero
!```
ip dhcp snooping database tftp://90.90.90.91/snooping-rp1.txt
ip dhcp snooping database write-delay 15
ip dhcp snooping database timeout 10
ip dhcp snooping
ipv6 mfib hardware-switching replication-mode ingress
vtp domain cathay
vtp mode transparent
mls ip multicast flow-stat-timer 9
no mls flow ip
no mls flow ipv6
no mls acl tcam share-global
mls cef error action freeze

redundancy
mode sso
main-cpu
auto-sync running-config
auto-sync standard
spanning-tree mode pvst

power redundancy-mode combined
error-detection packet-buffer action none
diagnostic cns publish cisco.cns.device.diag_results
diagnostic cns subscribe cisco.cns.device.diag_commands
port-channel per-module load-balance

interface Loopback62
ip address 62.0.0.1 255.255.255.255

interface Loopback63
ip address 63.0.0.1 255.255.255.255

interface Tunnel251
ip address 113.0.0.1 255.0.0.0
ip helper-address 83.0.0.100
no ip redirects
ip directed-broadcast
ip dhcp snooping packets
tunnel source Loopback63
tunnel mode gre multipoint
mobility network-id 251
mobility trust
mobility multicast

interface Tunnel300
ip address 115.0.0.1 255.0.0.0
ip helper-address 83.0.0.100
no ip redirects
ip directed-broadcast
ip dhcp snooping packets
tunnel source Loopback62
tunnel mode gre multipoint
mobility network-id 300
mobility multicast

interface Vlan100
ip address 100.0.0.100 255.0.0.0
WLSM 1 configuration

! version 12.3
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname wlsm1-mod-3
!
boot-start-marker
boot-end-marker
!
logging buffered 8000000 debugging
enable password lab
!
username cisco password 0 cisco
spd headroom 512
aaa new-model
!
!
aaa authentication login CONSOLE none
aaa authentication login SHAREDAAA group radius none
aaa authentication login locally local
aaa session-id common
ip subnet-zero
!
!
ip tftp source-interface Ethernet0/0.100
!
wlan vlan 100
ipaddr 100.0.0.201 255.0.0.0
gateway 100.0.0.100
admin
standby 1 ip 100.0.0.25
!
!
!
no crypto isakmp enable
!
buffers huge size 46080
!
interface Ethernet0/0
mac-address 000d.29f0.c2f9
no ip address
no cdp enable
hold-queue 2048 in
!
interface Ethernet0/0.100
encapsulation dot1Q 100
ip address 100.0.0.201 255.0.0.0
no cdp enable
standby 1 ip 100.0.0.25
!
ip classless
ip route 0.0.0.0 0.0.0.0 100.0.0.100
ip http server
no ip http secure-server
!
!
snmp-server view iso iso included
snmp-server view isoview iso included
snmp-server community public view iso RW
snmp-server enable traps tty
no cdp run
radius-server host 20.1.0.1 auth-port 1645 acct-port 1646 key cisco123
!
control-plane
!
wlccp authentication-server infrastructure SHAREDAAA
wlccp authentication-server client any SHAREDAAA
wlccp wds interface Ethernet0/0.100
!
line con 0
exec-timeout 0 0
transport preferred all
transport output all
stopbits 1
line 1 3
no exec
transport preferred all
transport input all
transport output none
flowcontrol software
line vty 0 4
login authentication locally
transport preferred all
transport input all
transport output all

WLSM 2 configuration

!
version 12.3
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname wlsm2-mod-4
!
boot-start-marker
boot-end-marker
!
logging buffered 8000000 debugging
enable password lab
!
username cisco password 0 cisco
spd headroom 512
aaa new-model
!
!
aaa authentication login CONSOLE none
aaa authentication login SHAREDAAA group radius none
aaa authentication login locally local
aaa session-id common
ip subnet-zero
!
!
ip tftp source-interface Ethernet0/0.100
!
Figure 4 shows an interswitch redundancy configuration. The two switches are connected in a back-to-back configuration using f1/38 on Switch 1 and f2/38 on Switch 2. The access points communicate with the Wireless LAN Services Module through IP address 100.0.0.25, which is the HSRP IP address configured on both Wireless LAN Services Modules.

**Switch 1 Configuration**

This example shows the configuration of the Wireless LAN Services Module configured with HSRP:

```
wlan vlan 100
ipaddr 100.0.0.200 255.0.0.0
gateway 100.0.0.100
admin
standby 1 ip 100.0.0.25
```

This example shows the configuration of the tunnel interface on the Supervisor Engine 720:

```
interface Tunnel252
ip address 113.0.0.1 255.0.0.0
ip helper-address 90.90.90.90
no ip redirects
ip dhcp snooping packets
tunnel source Loopback62
tunnel mode gre multipoint
mobility network-ld 252
mobility trust
end
```
This example shows the configuration of the loopback interface. The loopback interface is configured as
the source IP address for the tunnel between the Supervisor Engine 720 and the access point:

```
interface Loopback62
ip address 62.0.0.1 255.255.255.255
end
```

This example shows the configuration of VLAN 100. The IP address assigned to VLAN 100 is used as
the default gateway on the Wireless LAN Services Module. The Wireless LAN Services Module sends
packets destined for the ACS server to the default gateway IP address:

```
interface Vlan100
ip address 100.0.0.100 255.0.0.0
end
```

This example shows the configuration of the interface between the Supervisor Engine 720 in Switch 1
and the Supervisor Engine 720 in Switch 2. This interface can be a trunk or access port. This port carries
the VLAN that is used for HSRP. In this example, the two Wireless LAN Services Module use VLAN
100 and HSRP IP address 100.0.0.25.

```
interface FastEthernet1/38
no ip address
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 1,6,100
switchport mode trunk
end
```

**Switch 2 Configuration**

This example shows the configuration of the Wireless LAN Services Module configured with HSRP:

```
wlan vlan 100
ipaddr 100.0.0.250 255.0.0.0
gateway 100.0.0.150
admin
standby 1 ip 100.0.0.25
```

This example shows the configuration of the tunnel interface on the Supervisor Engine 720:

```
interface Tunnel252
ip address 113.0.0.2 255.0.0.0
ip helper-address 90.90.90.90
no ip redirects
ip dhcp snooping packets
tunnel source Loopback62
tunnel mode gre multipoint
mobility network-id 252
mobility trust
end
```

This example shows the configuration of the loopback interface. The loopback interface is configured as
the source IP address for the tunnel between the Supervisor Engine 720 and the access point:

```
interface Loopback62
ip address 62.0.0.2 255.255.255.255
end
```
This example shows the configuration of VLAN 100. The IP address assigned to VLAN 100 is used as the default gateway on the Wireless LAN Services Module. The Wireless LAN Services Module sends packets destined for the ACS server to the default gateway IP address:

```
interface Vlan100
  ip address 100.0.0.150 255.0.0.0
end
```

This example shows the configuration of the interface between the Supervisor Engine 720 in Switch 2 and the Supervisor Engine 720 in Switch 1. This interface can be a trunk or access port. This port carries the VLAN that is used for HSRP. In this example, the two Wireless LAN Services Module use VLAN 100 and HSRP IP address 100.0.0.25.

```
interface FastEthernet2/38
  no ip address
  switchport
  switchport trunk encapsulation dot1q
  switchport trunk allowed vlan 1,6,100
  switchport mode trunk
end
```

Use the `show wlccp wds mobility` command to verify HSRP status:

```
WLSM> show wlccp wds mobility
LCP link status: up
HSRP state: Active
Total # of registered AP: 3
Total # of registered MN: 2

Tunnel Bindings:
<table>
<thead>
<tr>
<th>Network ID</th>
<th>Tunnel IP</th>
<th>MTU</th>
<th>EPOC ID</th>
<th>FLAGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>10.80.0.1</td>
<td>1476</td>
<td>0</td>
<td>TB M</td>
</tr>
<tr>
<td>101</td>
<td>10.80.0.2</td>
<td>1476</td>
<td>0</td>
<td>TB M</td>
</tr>
<tr>
<td>102</td>
<td>10.80.0.3</td>
<td>1476</td>
<td>0</td>
<td>TB M</td>
</tr>
<tr>
<td>103</td>
<td>10.80.0.4</td>
<td>1476</td>
<td>0</td>
<td>M</td>
</tr>
</tbody>
</table>

Flags:T=Trusted, B=IP Broadcast enabled, S=TCP MSS Adjust, M=IP Multicast enabled, I=MN IP Discovery, N=Noneexistent

Use the `show mobility status` command to check the redundancy status of each WLSM on the Supervisor 720:

```
Sup720...#show mobility status
Primary WLAN Module is located in Slot: 1 (HSRP State: Active)
LCP Communication status : up
Secondary WLAN Module is located in Slot: 2(HSRP State: Standby)
LCP Communication status : up
WLSM recovery period remaining: 0 seconds
MAC address used for Proxy ARP: 0005.5f54.5800
Number of Wireless Tunnels : 4
Number of Access Points : 3
Number of Mobile Nodes : 1
```
Wireless Tunnel Bindings:

<table>
<thead>
<tr>
<th>Tunnel</th>
<th>Src IP Address</th>
<th>Wireless Network-ID</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnel100</td>
<td>10.80.0.1</td>
<td>100</td>
<td>TB</td>
</tr>
<tr>
<td>Tunnel101</td>
<td>10.80.0.2</td>
<td>101</td>
<td>TB</td>
</tr>
<tr>
<td>Tunnel102</td>
<td>10.80.0.3</td>
<td>102</td>
<td>TB</td>
</tr>
<tr>
<td>Tunnel103</td>
<td>10.80.0.4</td>
<td>103</td>
<td>M</td>
</tr>
</tbody>
</table>

Flags: T=Trusted, B=IP Broadcast enabled, M=IP Multicast enabled
A=TCP Adjust-mss enabled, D=Discover passive MN's IP address

Use the `show redundancy states` command to check the redundancy status on the Supervisor 720:

```
Sup720...#show redundancy states
my state = 13 -ACTIVE
peer state = 8 -STANDBY HOT
Mode = Duplex
Unit = Primary
Unit ID = 6
Redundancy Mode (Operational) = sso
Redundancy Mode (Configured) = sso
Redundancy State = sso
Split Mode = Disabled
Manual Swact = Enabled
Communications = Up

client count = 60
client_notification_TMR = 30000 milliseconds
  keep_alive TMR = 9000 milliseconds
  keep_alive count = 0
  keep_alive threshold = 18
  RF debug mask = 0x0
```

Additional information about supervisor engine redundancy is covered in the “Configuring Supervisor Engine Redundancy” chapter in the *Catalyst 6500 Series Cisco IOS Software Configuration Guide, 12.2 SX*.

### HSRP Configuration Guidelines for Interswitch Topology

The above HSRP examples observe these guidelines:

- **NAT tables are not synchronized between the switches; therefore, NAT tables are lost after an interswitch failover.**

- **In this example, an external DHCP server is mandatory so that the mobile nodes receive the same IP address after an interswitch failover.**

- **Configure the DHCP server so that it sends both tunnel IP addresses as the default gateways. Although you can specify either of the IP addresses as the default gateway, it is beneficial to the mobile client to see both gateways when they display their IP configuration.**

- **The Wireless LAN Services Module communicates with the ACS server, the DHCP server, and the Wireless LAN Solution Engine by using the VLAN IP address of the wireless LAN and not the HSRP IP address. Since Router 1 might have equal-cost routes to the VLAN IP subnet of the wireless LAN (100.0.0.0/8), you should configure static routes on Router 1 to reach the VLAN IP addresses of the wireless LAN. For example, Router 1 should point to Switch 1 to reach the Wireless LAN Services Module wireless LAN VLAN IP address in Switch 1, and Router 1 should also point to Switch 2 to reach the Wireless LAN Services Module wireless LAN VLAN IP address in Switch 2.**
If you do not configure the static routes, Router 1 can still use dynamic routing to send packets to the active Wireless LAN Services Module. However, Router1 sees equal-cost routes for the Wireless LAN Services Module VLAN subnet and uses both switches to send packets to the active Wireless LAN Services Module. As a result, some packets travel an extra hop through the switch with the standby Wireless LAN Services Module. Also, if one of the switches crashes, Router 1 will not know about it immediately, and there is a chance that some packets may be lost during this period.

- The loopback62 interface on both switches is configured with a host route IP address. This IP address is used as the destination IP address for the GRE packets for mobile nodes in tunnel 252. As a result, Router 2 should know the host-specific routes to reach these IP addresses. If OSPF is used, then there will not be any issues because OSPF by default advertises loopback addresses as host routes, and Router 2 can send the tunnel packets to the correct switch.

For example, if Switch 1 has the active Wireless LAN Services Module, then the access point sends packets to 62.0.0.1, and if Switch 2 has the active Wireless LAN Services Module, then the access point sends packets to 62.0.0.2. Router 2 should know that to reach 62.0.0.1, it need to send packets to Switch 1, and to reach Switch 2, it should send packets to 62.0.0.2.

Another option is to configure the IP address for the loopback62 interface for each switch in a different subnet, so that Router 2 sees the different subnets from only one switch.

- When using route processor redundancy (RPR) or stateful switchover (SSO), the `standby ip` configuration in the examples is adequate; there is no need to configure other HSRP options.

- When using route processor redundancy plus (RPR+), you should change the default HSRP timer configuration to avoid unnecessary transitions between the Wireless LAN Services Modules after an RPR+ switchover.

For example, Wireless LAN Services Module 2 (with IP address 100.0.0.250) is the active module and Wireless LAN Services Module 1 (with IP address 100.0.0.200) is the standby module. The HSRP timers are set to the default (hello timer of 3 seconds and holdtime timer of 10 seconds). If an RPR+ switchover occurs on Switch 2, Wireless LAN Services Module 1 becomes active. However, from the Wireless LAN Services Module 2 point of view, it is still active and keeps sending HSRP hellos, but the hellos will not reach Wireless LAN Services Module 1. Once the system is stabilized after the RPR+ switchover, Wireless LAN Services Module 2 starts seeing the hellos from Wireless LAN Services Module 1. Because Wireless LAN Services Module 2 is already in active state and its IP address is higher than that of Wireless LAN Services Module 1, Wireless LAN Services Module 2 sends a coup message to Wireless LAN Services Module 1, which returns to standby state.

To avoid this unnecessary transition of states, enter the `standby group_number timers hello time holdtime` command under wireless LAN VLAN configuration on both the Wireless LAN Services Modules to increase the HSRP timers. (For example, set the hello timer to 60 seconds, and set the holdtime timer to 180 seconds.)
# Recovering a Lost Password

**Note** You can download the password recovery script from the Cisco.com software center.

**Note** You must have access to the supervisor engine to perform the WLSM password recovery procedures. To recover the enable password on the supervisor engine, refer to the software configuration guide for your software platform.

**Note** To run the password recovery script, the WLSM must be in the application partition (AP).

To recover a lost password on the WLSM, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Router&gt; enable</td>
</tr>
<tr>
<td>Step 2</td>
<td>Router# copy tftp: pclc#mod-fs:</td>
</tr>
<tr>
<td>Step 3</td>
<td>wlan(config)# enable password password</td>
</tr>
<tr>
<td>Step 4</td>
<td>wlan(config)# line vty starting-line-number ending-line-number</td>
</tr>
<tr>
<td>Step 5</td>
<td>wlan(config-line)# login</td>
</tr>
<tr>
<td>Step 6</td>
<td>wlan(config-line)# password password</td>
</tr>
<tr>
<td>Step 7</td>
<td>wlan(config-line)# end</td>
</tr>
<tr>
<td>Step 8</td>
<td>wlan# copy system:running-config nvram:startup-config</td>
</tr>
<tr>
<td>Step 9</td>
<td>Router# hw-module module mod reset cf:4</td>
</tr>
</tbody>
</table>

This example shows how to recover a lost password on the WLSM that is installed in slot 5:

```
Router> enable
Password:
Router# copy tftp: pclc#5-fs:
Address or name of remote host [ ]? 10.1.1.100
Source filename [ ]? image/c6svc-wlan-k9w7.passwd.recovery.1.1.1.bin
Destination filename [ ]? image/c6svc-wlan-k9w7.passwd.recovery.1.1.1.bin?
Accessing tftp://10.1.1.100/image/c6svc-wlan-k9w7.passwd.recovery.1.1.1.bin...
Loading image/c6svc-wlan-k9w7.passwd.recovery.1.1.1.bin from 10.1.1.100(via Vlan999):
[OK - 435 bytes]
435 bytes copied in 0.092 secs (4728 bytes/sec)
```
Upgrading the Images

The compact Flash on the Wireless LAN Services Module has two bootable partitions: application partition (AP) and maintenance partition (MP). By default, the application partition boots every time. The application partition contains the binaries necessary to run the wireless LAN image. The maintenance partition is booted if you need to upgrade the application partition.

You can upgrade both the application software and the maintenance software. However, you are not required to upgrade both images at the same time. Refer to the release notes for the Wireless LAN Services Module for the latest application partition and maintenance partition software versions.

The entire application and maintenance partitions are stored on the FTP or TFTP server. The images are downloaded and extracted to the application partition or maintenance partition depending on which image is being upgraded.

To upgrade the application partition, change the boot sequence to boot the module from the maintenance partition. To upgrade the maintenance partition, change the boot sequence to boot the module from the application partition. Set the boot sequence for the module using the supervisor engine CLI commands. The maintenance partition downloads and installs the application image. The supervisor engine must be executing the run-time image to provide network access to the maintenance partition.

Before starting the upgrade process, you will need to download the application partition image or maintenance partition image to the TFTP server.

A TFTP or FTP server is required to copy the images. The TFTP server should be connected to the switch, and the port connecting to the TFTP server should be included in any VLAN on the switch.
These sections describe how to upgrade the images:

- Upgrading the Application Software, page 35
- Upgrading the Maintenance Software, page 39

**Upgrading the Application Software**

How you upgrade the application software depends on whether you are using Cisco IOS software or the Catalyst operating system software.

The following sections describe how to upgrade the application software from the CLI for each switch operating system:

- Cisco IOS Software, page 35
- Catalyst Operating System Software, page 37

**Cisco IOS Software**

**Note**

Do not reset the module until the image is upgraded. The total time to upgrade the image takes up to eight minutes.

To upgrade the application partition software, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Reboots the module from the maintenance partition.</td>
</tr>
<tr>
<td><strong>Router# hw-module module mod reset cf:1</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Displays that the maintenance partition for the module has booted.</td>
</tr>
<tr>
<td><strong>Router# show module mod</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Downloads the image.</td>
</tr>
<tr>
<td><strong>Router# copy tftp: pclc#mod-fs:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Resets the module.</td>
</tr>
<tr>
<td><strong>Router# hw-module module mod reset</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Displays that the application partition for the module has booted.</td>
</tr>
<tr>
<td><strong>Router# show module mod</strong></td>
<td></td>
</tr>
</tbody>
</table>

This example shows how to upgrade the application partition software:

```
Router# hw-module module 3 reset cf:1
Device BOOT variable for reset = <cf:1>
Warning: Device list is not verified.

Proceed with reload of module? [confirm]y

% reset issued for module 3

02:11:18: SP: The PC in slot 3 is shutting down. Please wait ...
02:11:31: SP: PC shutdown completed for module 3
02:11:31: %C6KPWR-SP-4-DISABLED: power to module in slot 3 set off (Reset)
02:14:21: SP: OS_BOOT_STATUS(3) MP OS Boot Status: finished booting
02:14:28: %DIAG-SP-6-RUN_MINIMUM: Module 3: Running Minimum Online Diagnostics...
02:14:34: %DIAG-SP-6-DIAG_OK: Module 3: Passed Online Diagnostics
```
02:14:34: %OIR-SP-6-INSCARD: Card inserted in slot 3, interfaces are now online

Router# show module 3

<table>
<thead>
<tr>
<th>Mod</th>
<th>Ports</th>
<th>Card Type</th>
<th>Model</th>
<th>Serial No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>Wireless LAN Module (MP)</td>
<td>WS-SVC-WLAN-1-K9</td>
<td>SAD0744000Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mod MAC addresses</th>
<th>Hw</th>
<th>Fw</th>
<th>Sw</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 0003.fead.14b4 to 0003.fead.14bb</td>
<td>2.0</td>
<td>7.2(1)</td>
<td>2.1(0.4)m</td>
<td>Ok</td>
</tr>
</tbody>
</table>

Mod Online Diag Status
--- -------------------
3 Pass

Router# copy tftp: pclc#3-fs:
Address or name of remote host []? 10.1.1.1

Source filename []? c6svc-wlan-k9w7.2-x-y.bin

Destination filename [c6svc-wlan-k9w7.2-x-y.bin]?

Accessing tftp://10.1.1.1/c6svc-wlan-k9w7.2-x-y.bin...
Loading c6svc-wlan-k9w7.2-x-y.bin from 10.1.1.1 (via Vlan2):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
<output truncated>

[OK - 14918353 bytes]

14918353 bytes copied in 643.232 secs (23193 bytes/sec)

Router#
02:29:23: %SVCLC-SP-5-STRRECVD: mod 3: <Application upgrade has started>
02:29:23: %SVCLC-SP-5-STRRECVD: mod 3: <Do not reset the module till upgrade completes!!>
02:36:07: %SVCLC-SP-5-STRRECVD: mod 3: <Application upgrade has succeded>
02:36:07: %SVCLC-SP-5-STRRECVD: mod 3: <You can now reset the module>>

Router# hw-module module 3 reset
Device BOOT variable for reset = <empty>
Warning:Device list is not verified.

Proceed with reload of module? [confirm]y

% reset issued for module 3

Router#
02:36:57:SP: The PC in slot 3 is shutting down. Please wait ...
02:37:17:SP:PC shutdown completed for module 3
02:37:17:%C6KPWR-SP-4-DISABLED: power to module in slot 3 set off (Reset)
02:38:39:SP:OS_BOOT_STATUS(3) AP OS Boot Status: finished booting
02:39:27:%DIAG-SP-6-RUN_COMPLETE: Module 3: Running Complete Online Diagnostics...
02:39:29:%DIAG-SP-6-DIAG_OK: Module 3: Passed Online Diagnostics
02:39:29:%OIR-SP-6-INSCARD: Card inserted in slot 3, interfaces are now online
Router# show module 3

<table>
<thead>
<tr>
<th>Mod Ports</th>
<th>Card Type</th>
<th>Model</th>
<th>Serial No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 1</td>
<td>Wireless LAN Module</td>
<td>WS-SVC-WLAN-1-K9</td>
<td>SAD0744000Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mod MAC addresses</th>
<th>Hw</th>
<th>Fw</th>
<th>Sw</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>0003.fead.14b4 to 0003.fead.14bb</td>
<td>2.0</td>
<td>7.2(1)</td>
<td>2.x(y)</td>
<td>Ok</td>
</tr>
</tbody>
</table>

Mod Online Diag Status
--- -------------------
3 Pass

**Catalyst Operating System Software**

**Note**
Do not reset the module until the image is upgraded. The total time to upgrade the image takes up to eight minutes.

To upgrade the application partition software, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Console (enable) set boot device cf:1 mod</td>
</tr>
<tr>
<td></td>
<td>Sets the module to boot the maintenance partition.</td>
</tr>
<tr>
<td>Step 2</td>
<td>Console (enable) reset mod</td>
</tr>
<tr>
<td></td>
<td>Resets the module to the maintenance partition.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> The SUP_OSBOOTSTATUS system message shows that the maintenance partition (MP) has booted.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Console (enable) show module [mod]</td>
</tr>
<tr>
<td></td>
<td>Displays that the maintenance partition for the module has booted.</td>
</tr>
<tr>
<td>Step 4</td>
<td>Console (enable) session [mod]</td>
</tr>
<tr>
<td></td>
<td>Access the MSFC from the switch CLI using a Telnet session.</td>
</tr>
<tr>
<td>Step 5</td>
<td>Router# copy tftp: pclc#mod-fs:</td>
</tr>
<tr>
<td></td>
<td>Downloads the image.</td>
</tr>
<tr>
<td>Step 6</td>
<td>Router# exit</td>
</tr>
<tr>
<td></td>
<td>Exits the MSFC CLI and returns to the switch CLI.</td>
</tr>
<tr>
<td>Step 7</td>
<td>Console (enable) set boot device cf:4 mod</td>
</tr>
<tr>
<td></td>
<td>Sets the module to boot the application partition.</td>
</tr>
<tr>
<td>Step 8</td>
<td>Console (enable) reset mod</td>
</tr>
<tr>
<td></td>
<td>Resets the module to the application partition.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> The SUP_OSBOOTSTATUS system message shows that the application partition (AP) has booted.</td>
</tr>
<tr>
<td>Step 9</td>
<td>Console (enable) show module [mod]</td>
</tr>
<tr>
<td></td>
<td>Displays that the application partition for the module has booted.</td>
</tr>
</tbody>
</table>

1. To access the MSFC from the switch CLI directly connected to the supervisor engine console port, enter the `switch console mod` command. To exit from the MSFC CLI and return to the switch CLI, press `Ctrl-C` three times at the `Router>` prompt.

This example shows how to upgrade the application partition software:

```
Console> (enable) set boot device cf:1 6
Device BOOT variable = cf:1
Memory-test set to PARTIAL
Warning:Device list is not verified but still set in the boot string.
Console> (enable)
```
Upgrading the Images

Console> (enable) reset 6 cf:1
This command will reset module 6.
Unsaved configuration on module 6 will be lost
Do you want to continue (y/n) [n]? y
Module 6 shut down in progress, please don't remove module until shutdown completed.
Console> (enable) Module 6 shutdown completed. Module resetting...

2003 Jan 17 08:34:07 %SYS-3-SUP_OSBOOTSTATUS:MP OS Boot Status:finished booting
2003 Jan 17 08:34:23 %SYS-5-MOD_OK:Module 6 is online
2003 Jan 17 08:34:23 %DTP-5-TRUNKPORTON:Port 6/1 has become dot1q trunk

Console> (enable) show module 6

--- ---- ----- ------------------------- ------------------- --- --------
6 6 1 Secure Socket Layer Module WS-SVC-SSL-1        no  ok

--- -------------------- -----------
6                        SAD063801FY

--- -------------------------------------- ------ ---------- -----------------
6   00-01-64-46-a1-d2                      0.401  7.2(1)     1.2(0.15)m

Console> (enable) session 15
Trying Router-15...
Connected to Router-15.
Type ^C^C^C to switch back...
Router>

Router# copy tftp: pclc#6-fs:
    copy tftp: pclc#6-fs:
Address or name of remote host []? 10.1.1.1
Source filename []? c6svc-ssl-k9y9.1-x-y.bin
Destination filename [c6svc-ssl-k9y9.1-x-y.bin]? 

Accessing tftp://10.1.1.1/c6svc-ssl-k9y9.1-x-y.bin...
Loading c6svc-ssl-k9y9.1-x-y.bin from 10.1.1.1 (via Vlan2):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
<output truncated>
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 1491835 bytes]

1491835 bytes copied in 643.232 secs (23193 bytes/sec)
Router#
02:29:23: %SVCLC-SP-5-STRRECVED: mod 6: <Application upgrade has started>
02:29:23: %SVCLC-SP-5-STRRECVED: mod 6: <Do not reset the module till upgrade completes!!>
02:36:07: %SVCLC-SP-5-STRRECVED: mod 6: <Application upgrade has succeeded>
02:36:07: %SVCLC-SP-5-STRRECVED: mod 6: <You can now reset the module>
Router# exit

Console> (enable) set boot device cf:4 6
Device BOOT variable = cf:4
Memory-test set to PARTIAL
Warning:Device list is not verified but still set in the boot string.
Console> (enable) reset 6
This command will reset module 6.
Unsaved configuration on module 6 will be lost
Do you want to continue (y/n) [n]? y
Module 6 shut down in progress, please don't remove module until shutdown completed.
Console> (enable) Module 6 shutdown completed. Module resetting...
Upgrading the Maintenance Software

How you upgrade the maintenance software depends on whether you are using Cisco IOS software or the Catalyst operating system software.

The following sections describe how to upgrade the maintenance software from the CLI for each switch operating system:

- Cisco IOS Software, page 39
- Catalyst Operating System Software, page 40

Cisco IOS Software

Note

Do not reset the module until the image is upgraded. The total time required to upgrade the image may be as much as eight minutes.

To upgrade the maintenance partition software, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Router# hw-module module mod reset</td>
<td>Reboots the module from the application partition.</td>
</tr>
<tr>
<td>Step 2: Router# copy tftp: pclc# mod-fs:</td>
<td>Downloads the image.</td>
</tr>
<tr>
<td>Step 3: Router# hw-module module mod reset cf:1</td>
<td>Resets the module in the maintenance partition.</td>
</tr>
<tr>
<td>Step 4: Router# show module mod</td>
<td>Displays that the maintenance partition for the module has booted.</td>
</tr>
</tbody>
</table>

This example shows how to upgrade the maintenance partition software:

Router# hw-module module 3 reset
Device BOOT variable for reset = <empty>
Warning:Device list is not verified.
Proceed with reload of module? [confirm]y
% reset issued for module 3
Router# 02:36:57:SP:The PC in slot 3 is shutting down. Please wait ... 02:37:17:SP:PC shutdown completed for module 3
02:37:17:%C6KPWR-SP-4-DISABLED:power to module in slot 3 set off (Reset)
1w0d:SP:OS_BOOT_STATUS(3) AP OS Boot Status:finished booting
1w0d:%OIR-SP-6-INSCARD:Card inserted in slot 3, interfaces are now online
Router# copy tftp:pclc#3-fs:
Address or name of remote host []? 10.1.1.1
Source filename []? mp.3-x-y.bin.gz
Destination filename [mp.3-x-y.bin.gz]? Accessing tftp://10.1.1.1/mp.3-x-y.bin.gz...
Loading mp.3-x-y.bin.gz from 10.1.1.1 (via Vlan2): !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 10380103 bytes]
Upgrading the Images

10380103 bytes copied in 76.952 secs (134891 bytes/sec)

Router#
1w0d: %SVCLC-SP-5-STRRECVD: mod 3: <MP upgrade/Password Recovery started.>
1w0d: %SVCLC-SP-5-STRRECVD: mod 3: <Uncompress of the file succeeded. Continuing upgrade/recovery.>
1w0d: %SVCLC-SP-5-STRRECVD: mod 3: <This file appears to be a MP upgrade. Continuing upgrade.>
1w0d: %SVCLC-SP-5-STRRECVD: mod 3: <Install of the MBR succeeded. Continuing upgrade.>
1w0d: %SVCLC-SP-5-STRRECVD: mod 3: <Install of GRUB succeeded. Continuing upgrade.>
1w0d: %SVCLC-SP-5-STRRECVD: mod 3: <Copying of MP succeeded. Continuing upgrade.>
1w0d: %SVCLC-SP-5-STRRECVD: mod 3: <fsck of MP partition succeeded.>
1w0d: %SVCLC-SP-5-STRRECVD: mod 3: <Upgrade of MP was successful. You can now boot MP.>

Router# hw-module module 3 reset cf:1
Device BOOT variable for reset = <cf:1>
Warning: Device list is not verified.

Proceed with reload of module? [confirm]y
% reset issued for module 3

Router#
1w0d: SP: The PC in slot 3 is shutting down. Please wait ...
1w0d: SP: PC shutdown completed for module 3
1w0d: %C6KPWR-SP-4-DISABLED: power to module in slot 3 set off (Reset)
1w0d: SP: OS_BOOT_STATUS(3) MP OS Boot Status: finished booting
1w0d: %DIAG-SP-6-RUN_MINIMUM: Module 3: Running Minimum Diagnostics...
1w0d: %DIAG-SP-6-DIAG_OK: Module 3: Passed Online Diagnostics
1w0d: %OIR-SP-6-INSCARD: Card inserted in slot 3, interfaces are now online

Router# show module 3

<table>
<thead>
<tr>
<th>Mod</th>
<th>Ports</th>
<th>Card Type</th>
<th>Model</th>
<th>Serial No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>Wireless LAN Module (MP)</td>
<td>WS-SVC-WLAN-1-K9</td>
<td>SAD0744000Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mod</th>
<th>MAC addresses</th>
<th>Hw</th>
<th>Fw</th>
<th>Sw</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0003.fead.14b4 to 0003.fead.14bb</td>
<td>2.0</td>
<td>7.2(1)</td>
<td>3.x(y)mp</td>
<td>Ok</td>
</tr>
</tbody>
</table>

Mod Online Diag Status
--- -------------------
3 Pass

Catalyst Operating System Software

Do not reset the module until the image is upgraded. The total time to upgrade the image takes up to 8 minutes. To upgrade the maintenance partition software, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Console (enable) <code>set boot device cf:4 mod</code></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Console (enable) <code>reset mod</code></td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>The SUP_OSBOOTSTATUS system message shows that the application partition (AP) has booted.</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Console (enable) <code>show module [mod]</code></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Console (enable) <code>session [mod]</code></td>
</tr>
</tbody>
</table>
Upgrading the Images

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 5</td>
<td>Router# copy tftp: pclc#mod-fs:</td>
</tr>
<tr>
<td>Step 6</td>
<td>Router# exit</td>
</tr>
<tr>
<td>Step 7</td>
<td>Console (enable) set boot device cf:1 mod</td>
</tr>
<tr>
<td>Step 8</td>
<td>Console (enable) reset mod</td>
</tr>
<tr>
<td>Note</td>
<td>The SUP_OSBOOTSTATUS system message shows that the maintenance partition (MP) has booted.</td>
</tr>
<tr>
<td>Step 9</td>
<td>Console (enable) show module [mod]</td>
</tr>
</tbody>
</table>

1. To access the MSFC from the switch CLI directly connected to the supervisor engine console port, enter the switch console mod command. To exit from the MSFC CLI and return to the switch CLI, press Ctrl-C three times at the Router> prompt.

This example shows how to upgrade the maintenance partition software:

```bash
Console> (enable) set boot device cf:4 6
Device BOOT variable = cf:4
Memory-test set to PARTIAL
Warning:Device list is not verified but still set in the boot string.
Console> (enable) reset 6
This command will reset module 6.
Unsaved configuration on module 6 will be lost
Do you want to continue (y/n) [n]? y
Module 6 shut down in progress, please don't remove module until shutdown completed.
Console> (enable) Module 6 shutdown completed. Module resetting...
2003 Jan 17 08:36:58 %SYS-3-SUP_OSBOOTSTATUS:AP OS Boot Status:finished booting
2003 Jan 17 08:37:51 %SYS-5-MOD_OK:Module 6 is online
2003 Jan 17 08:37:51 %DTP-5-TRUNKPORTON:Port 6/1 has become dot1q trunk
Console> (enable) session 15
Trying Router-15...
Connected to Router-15.
Type ^C^C^C to switch back...
Router>
Router# copy tftp:pclc#6-fs:
Address or name of remote host []? 10.1.1.1
Source filename []? mp.1-2-0-16.bin.gz
Destination filename [mp.1-2-0-16.bin.gz]? 
Accessing tftp://10.1.1.1/mp.1-2-0-16.bin.gz... Loading mp.1-2-0-16.bin.gz from 10.1.1.1 (via Vlan2):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!![
[OK - 9818951 bytes]

9818951 bytes copied in 164.388 secs (59730 bytes/sec)
ssl-proxy>
Router# exit
Console> (enable) set boot device cf:1 6
Device BOOT variable = cf:1
Memory-test set to PARTIAL
Warning:Device list is not verified but still set in the boot string.
Console> (enable)
Console> (enable) reset 6 cf:1
This command will reset module 6.
Unsaved configuration on module 6 will be lost
```
Do you want to continue (y/n) [n]? y
Module 6 shut down in progress, please don't remove module until shutdown completed.
Console> (enable) Module 6 shutdown completed. Module resetting...
2003 Jan 17 08:34:07 %SYS-3-SUP_OSBOOTSTATUS:MP OS Boot Status:finished booting
2003 Jan 17 08:34:23 %SYS-5-MOD_OK:Module 6 is online
2003 Jan 17 08:34:23 %DTP-5-TRUNKPORTON:Port 6/1 has become dot1q trunk

Related Documentation

For more detailed installation and configuration information, refer to the following publications:

- Release Notes for Catalyst 6500 Series Wireless LAN Services Module
- Catalyst 6500 Series Wireless LAN Services Module Installation and Verification Note
- Catalyst 6500 Series Switch Installation Guide
- Catalyst 6500 Series Switch Module Installation Guide
- Catalyst 6500 Series Switch Software Configuration Guide
- Catalyst 6500 Series Switch Command Reference
- Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide
- Catalyst 6500 Series Switch Cisco IOS Command Reference
- Cisco IOS Software Configuration Guide for Cisco Aironet Access Points

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- Emergencies—security-alert@cisco.com

  An emergency is either a condition in which a system is under active attack or a condition for which a severe and urgent security vulnerability should be reported. All other conditions are considered nonemergencies.

- Nonemergencies—psirt@cisco.com

In an emergency, you can also reach PSIRT by telephone:

- 1 877 228-7302
- 1 408 525-6532

![Tip]

We encourage you to use Pretty Good Privacy (PGP) or a compatible product to encrypt any sensitive information that you send to Cisco. PSIRT can work from encrypted information that is compatible with PGP versions 2.x through 8.x.

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The link on this page has the current PGP key ID in use.
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Note

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Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco engineer. The TAC Service Request Tool is located at this URL:

http://www.cisco.com/techsupport/servicerequest

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Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)
EMEA: +32 2 704 55 55
USA: 1 800 553-2447
For a complete list of Cisco TAC contacts, go to this URL:
http://www.cisco.com/techsupport/contacts

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To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—Your network is “down,” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

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Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

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  http://www.cisco.com/packet
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