# High Availability SSO Deployment Guide for Cisco Catalyst 9800 Series Wireless Controllers, Cisco IOS XE Amsterdam 17.1

**First Published:** March 12, 2020

**Cisco Systems, Inc.** www.cisco.com

# Table of Contents

# Introduction

High availability has been a requirement on wireless controllers to minimize downtime in live networks. This document provides information on the theory of operation and configuration for the Catalyst 9800 Wireless Controller as it pertains to supporting stateful switchover of access points and clients (AP and Client SSO). Catalyst 9800 Wireless Controller is the next generation wireless controller that can run on multiple platforms with different scalability goals from low to high scale. AP and Client SSO is supported on the physical appliances and the virtual cloud platforms of the Catalyst 9800 Wireless Controller, namely C9800-L, C9800-40, C9800-80 and C9800-CL. The underlying SSO functionality is the same on all platforms with some differences in the setup process.

# Overview

The High availability SSO capability on wireless controller allows the access point to establish a CAPWAP tunnel with the Active wireless controller and the Active wireless controller to share a mirror copy of the AP and client database with the Standby wireless controller. The APs do not go into the Discovery state and clients do not disconnect when the Active wireless controller fails and the Standby wireless controller takes over the network as the Active wireless controller. There is only one CAPWAP tunnel maintained at a time between the APs and the wireless controller that is in an Active state.

Release 16.10 supports full access point and Client Stateful Switch Over. Client SSO is supported for clients which have already completed the authentication and DHCP phase and have started passing traffic. With Client SSO, a client's information is synced to the Standby wireless controller when the client associates to the wireless controller or the client’s parameters change. Fully authenticated clients, i.e. the ones in Run state, are synced to the Standby and thus, client re-association is avoided on switchover making the failover seamless for the APs as well as for the clients, resulting in zero client service downtime and zero SSID outage. The overall goal for the addition of AP and client SSO support to the Catalyst 9800 Wireless controller is to reduce major downtime in wireless networks due to failure conditions that may occur due to box failover, network failover or power outage on the primary site.

# Feature Description and Functional Behavior

All the control plane activities are centralized and synchronized between the active and standby units. The Active Controller centrally manages all the control and management communication. The network control data traffic is transparently switched from the standby unit to the active unit for centralized processing.

Bulk and Incremental configuration is synced between the two controllers at run-time and both controllers share the same IP address on the management interface. The CAPWAP state of the Access Points that are in Run State is also synched from the active wireless controller to the Hot-Standby wireless controller allowing the Access Points to be state-fully switched over when the Active wireless controller fails. The APs do not go to the Discovery state when Active wireless controller fails, and Standby wireless controller takes over as the Active wireless controller to serve the network.

The two units form a peer connection through a dedicated RP port (this can be a physical copper or fiber port) or a virtual interface for the VM. The Active/Standby election happens at boot time and it’s either based on the highest priority (priority range is <1-2>) or the lowest MAC if the priority is the same. By default the C9800 has a priority of 1. Once the HA pair is formed, all the configuration and AP and client databases are synched between Active and standby. Any configuration is done on the Active is automatically synch to the Standby. The standby is continuously monitoring the Active via keepalives over the RP link. If the Active becomes unavailable, the standby assumes the role of Active. It does that by sending a Gratuitous ARP message advertising to the network that it now owns that wireless management IP address. All the configurations and databases are already in synch, so the standby can take over without service disruption

There is no pre-empt functionality with SSO meaning that when the previous Active wireless controller resumes operation, it will not take back the role as an Active wireless controller but will negotiate its state with the current Active wireless controller and transition to Hot-Standby state.

# Platforms Supported

- Cisco Catalyst C9800-40 Wireless Controller
- Cisco Catalyst C9800-80 Wireless Controller

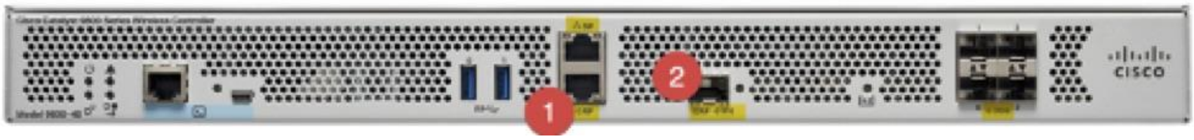
- Cisco Catalyst C9800-CL Wireless Controller
- Cisco Catalyst C9800-L Wireless Controller

# SSO Pre-requisites

- HA Pair can only be form between two wireless controllers of the same form factor
- Both controllers must be running the same software version in order to form the HA Pair
- Maximum RP link latency = 80 ms RTT, minimum bandwidth = 60 Mbps and minimum MTU = 1500
- Connect RPs via switches to enable controller HA. Ensure that the round-trip time between the two controllers is less than 80 milliseconds.

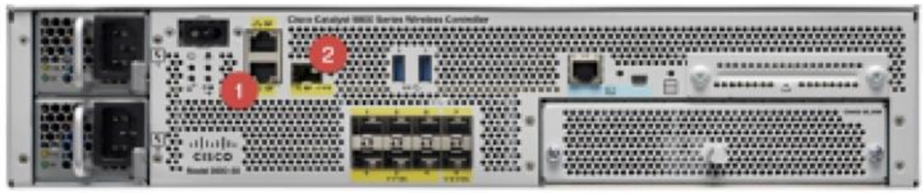
# SSO on Cisco Catalyst C9800-40-K9 and C9800-80-K9 Wireless Controllers

The Cisco C9800-40-K9 wireless controller is an extensible and high performing wireless controller, which can scale up to 2000 access points and 32000 clients. The controller has four 10G data ports and a throughput of 40G.




| | | | |
|---|---|---|---|
| 1 | RP— RJ-45 1G redundancy Ethernet port. | 2 | Gigabit SFP RP port |

The Cisco C9800-80-K9 Wireless Controller is a 100G wireless controller that occupies two rack unit space and supports a pluggable Module slot, and eight built-in 10GE/1GE interfaces.




| | | | |
|---|---|---|---|
| 1 | RP— RJ-45 1G redundancy Ethernet port. | 2 | Gigabit SFP RP port |

Both C9800-40-K9 and C9800-80-K9 Wireless controllers have two RP Ports as shown in the figures above:

- RJ-45 Ethernet Redundancy port
- SFP Gigabit Redundancy Port

If both the Redundancy Ports are connected:

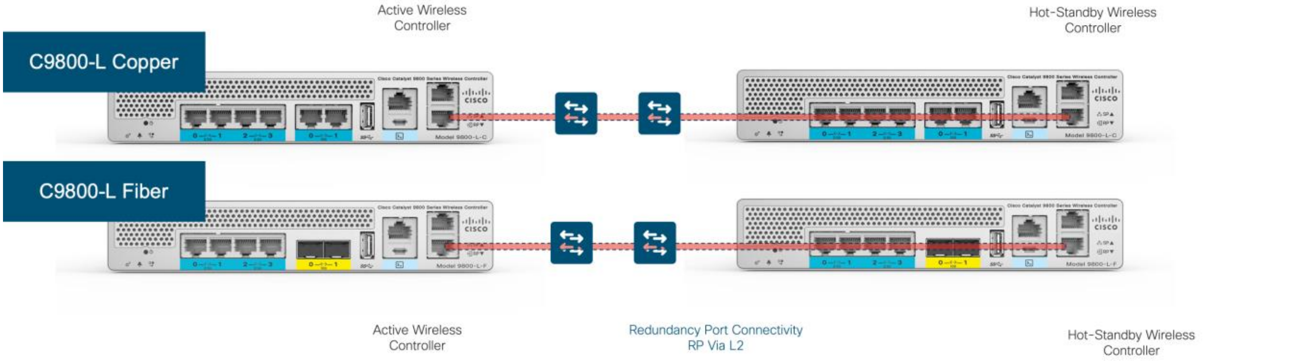
- SFP Gigabit Ethernet port takes precedence if they are connected at same time.
- HA between RJ-45 and SFP Gigabit RP ports is not supported.
- Only Cisco supported SFPs (GLC-LH-SMD and GLC-SX-MMD) are supported for RP port

- When HA link is up via RJ-45, SFPs on HA port should not be inserted even if there is no link between them. As it is a physical level detection, this would cause the HA to go down as precedence is given to SFP

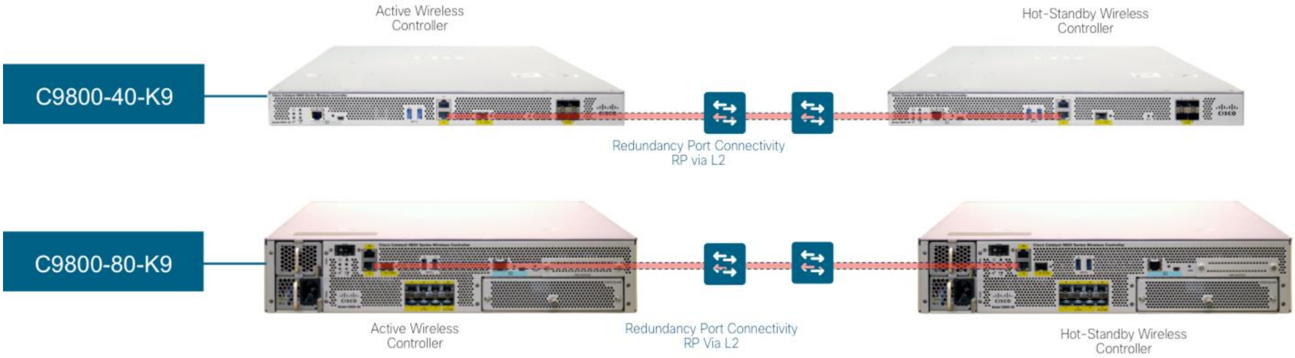
# Physical Connectivity for C9800-L, C9800-40 and C9800-80 Wireless Controller HA SSO

The HA Pair always has one active controller and one standby controller. If the active controller becomes unavailable, the standby assumes the role of the active. The Active wireless controller creates and updates all the wireless information and constantly synchronizes that information with the standby controller. If the active wireless controller fails, the standby wireless controller assumes the role of the active wireless controller and continues to the keep the HA Pair operational. Access Points and clients continue to remain connected during an active-to-standby switchover.

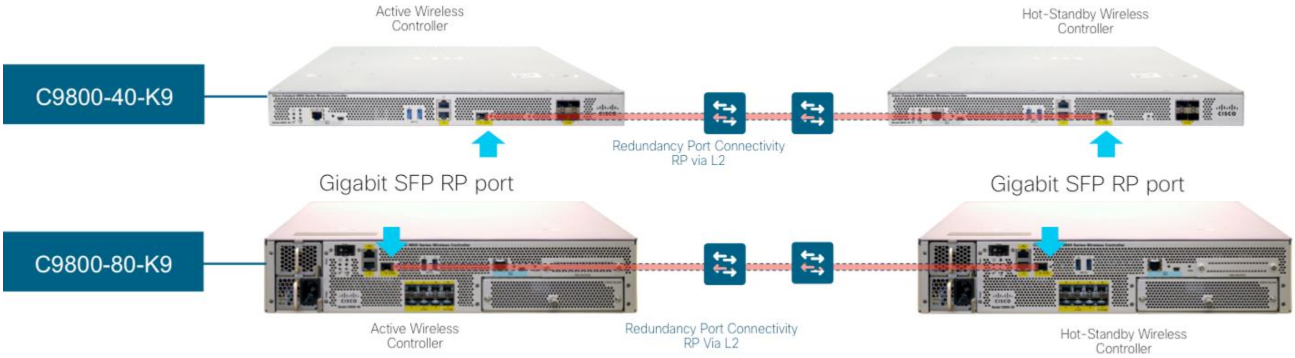
## Connecting C9800-L Wireless Controllers using RJ-45 RP Port for SSO




## Connecting C9800-40 and 9800-80 Wireless Controllers using RJ-45 RP Port for SSO



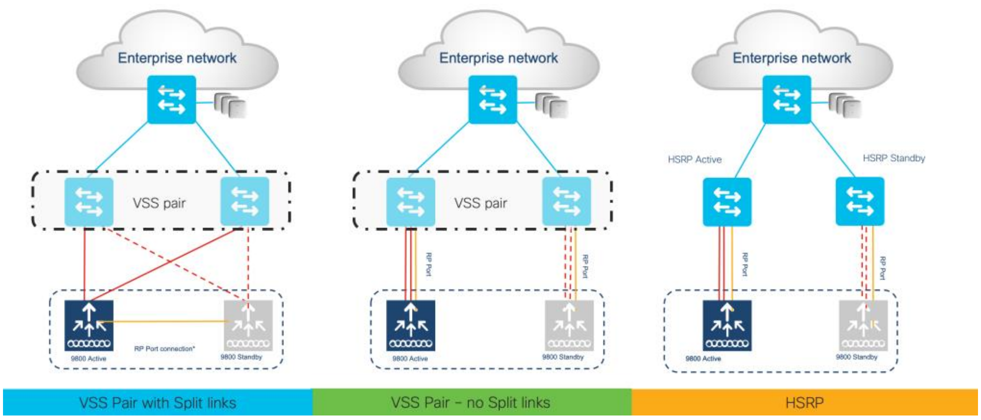
## Connecting C9800-40 and 9800-80 Wireless Controllers using SFP Gigabit RP Port for SSO



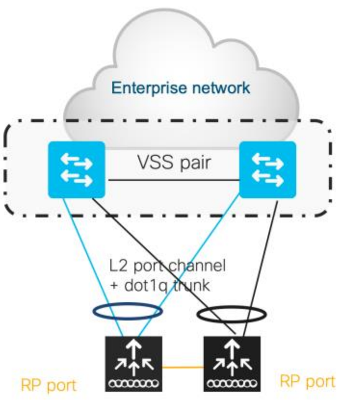

## Connecting a C9800 wireless controller HA pair to upstream switches

Prior to 17.1 following topologies were supported in terms of upstream connectivity to the network:

1. SSO pair connected to upstream VSS pair with split links and RP connected back to back.
2. SSO pair connected to upstream VSS pair with RP connected via the upstream set of switches in order to detect gateway down scenario.
3. SSO pair connected to upstream HSRP active and standby and RP connected via upstream set of switches in order to detect gateway down scenario.



## Option 1: Single VSS switch (or stack/VSL pair/modular switch) with RP back-to-back

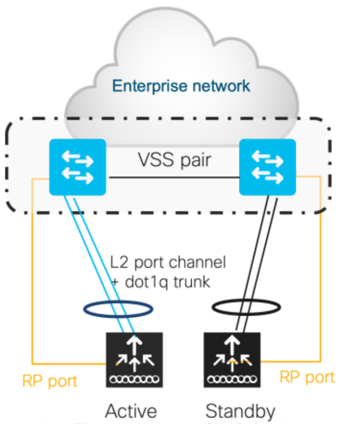



Single L2 port-channel on each box and enable dot1q to carry multiple VLANs. Spread the uplinks of the HA pair across the VSS pair and connect the RP back to back (no L2 network in between). Make sure that switch can scale in terms of ARP and MAC table entries.

This is a recommended topology.

**Note**: In HA SSO topology only LAG with mode ON is supported.

## Option 2: Single VSS switch (or stack/VSL pair/modular switch) with RP via upstream

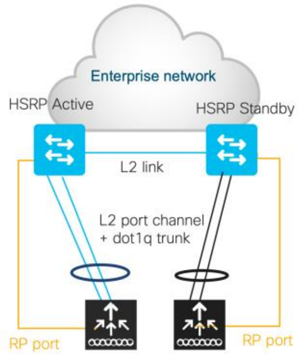



With this topology a single L2 port-channel is created on each box. Enable dot1q to carry multiple VLANs and connect the standby in the same manner. Make sure that switch can scale in terms of ARP and MAC table entries

IMPORTANT: In this topology the links are not spread across the VSS stack. Connect RP port to the same VSS/stack member as the uplinks and not back to back

**Note**: In HA SSO topology only LAG with mode ON is supported.

## Option 3: Dual Distributed switches with HSRP




With this topology a single L2 port-channel is created on each box. Enable dot1q to carry multiple VLANs and connect the standby in the same manner. Make sure that switch can scale in terms of ARP and MAC table entries.

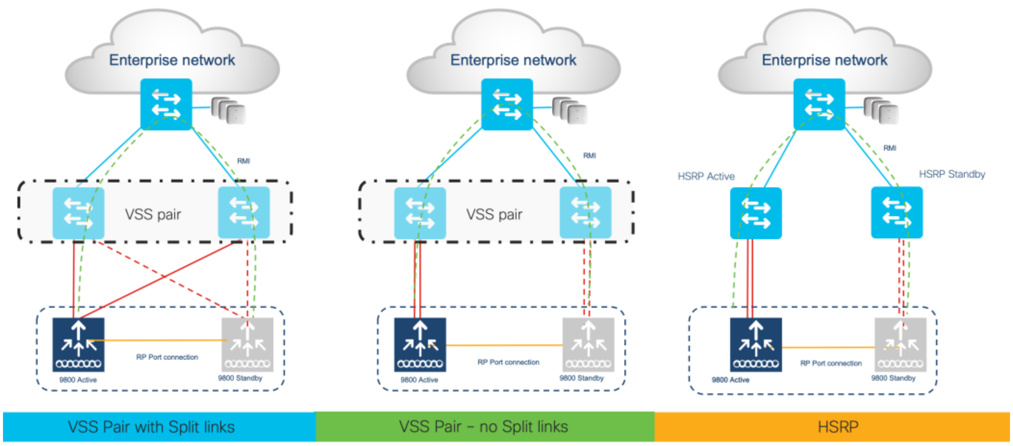
IMPORTANT: Connect RP port to the same distribution switch as the uplinks and not back to back

**Note**: In HA SSO topology only LAG with mode ON is supported prior to release 17.1. With 17.1, we additionally support LACP and PAGP. See the LACP, PAGP support in SSO Pair section for more details

# Connecting a C9800 wireless controller HA pair to upstream switches with Release 17.1 and above

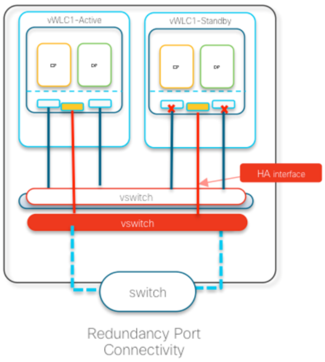
With the option of RMI and default gateway check feature available in release 17.1, the following topologies are now supported and recommended:

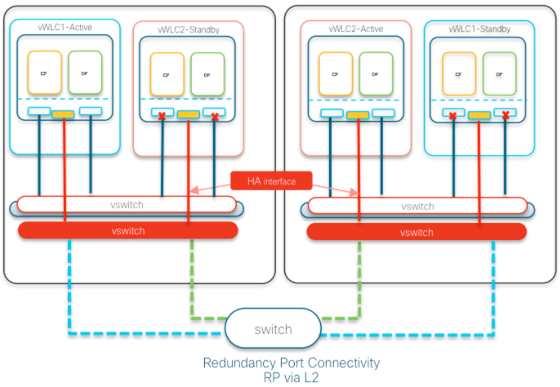
1. SSO pair connected to upstream VSS pair with split links and RP connected back to back.
2. SSO pair connected to upstream VSS pair and RP connected back to back.
3. SSO pair connected to upstream HSRP active and standby and RP connected back to back.




# SSO on Cisco Catalyst C9800-CL running on ESXi, KVM, Hyper-V

The Virtual Catalyst 9800 Wireless controller can be deployed as an HA Pair in a single or dual server setup.



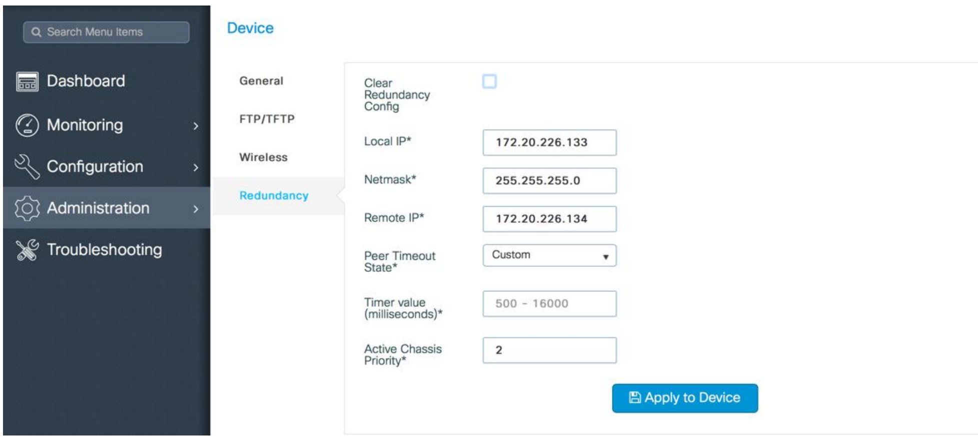

The figure on the left shows Redundant port connected on the same server.

The figure on the right shows Redundant port L2 connected to a separate server.

# Configuring High Availability SSO using GUI

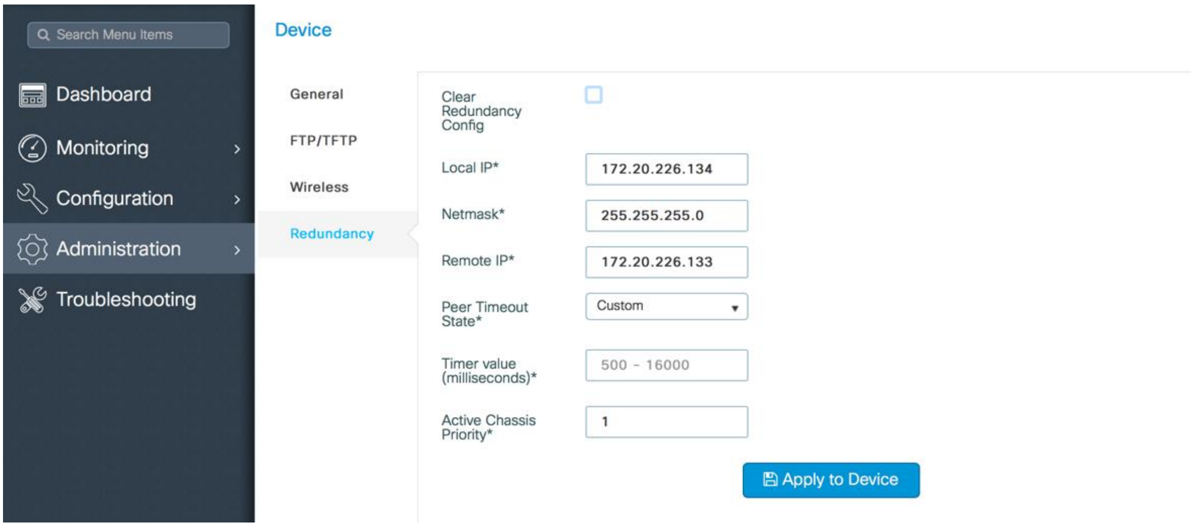
Device redundancy can be configured from **the Administration > Device > Redundancy** page

On the Active controller, the priority is set to a higher value than the standby controller.  The wireless controller with the higher priority value is selected as the active during the active-standby election process. The Remote IP is the IP address of the standby controller's redundancy port IP.




**Note**: This page has changed starting release 17.1 to include an option to configure the HA pair using RMI. Please refer to the Redundancy Management Interface section to see the updated screens for configuration.

On the standby controller, the remote IP is set to the Active controller's redundancy port IP




1) Both IP address for the Local and Remote IP must be in the same subnet.

2) It is suggested to use the 169.254.X.X/16 subnet. The last two octets can be derived from last two octets of the management interface.

3) Avoid using 10.10.10.x/24 subnet for the RP port due to defect in 9800 WLC.

Clear Redundancy config clears the SSO configuration and returns the controller to standalone mode.

**Note**: It is recommended to configure HA using the Redundancy Management Interface (RMI) starting Release 17.1. To see configuration using RMI please see the Redundancy Management Interface section.

## Mobility MAC configuration

Ensure that you configure the mobility MAC address using the wireless mobility mac-address command for High-Availability to work.

```
WLC (config)#wireless mobility mac-address ?
  H.H.H  Enter Mac Address for the mobility messages
```

# Configuring High Availability SSO using CLI

- **On Virtual Catalyst 9800 Wireless controller**, enable High Availability SSO using the following command on each of the two virtual Catalyst 9800 Wireless controller instances

```
chassis redundancy ha-interface <RP interface> local-ip <local IP> <local IP subnet>
remote-ip  <remote IP>
```

e.g.

On Virtual Catalyst 9800 Wireless controller instance-1:

```
chassis redundancy ha-interface Gig 3 local-ip 172.23.174.85 /24 remote-
ip  172.23.174.86
```

On Virtual Catalyst 9800 Wireless controller instance-2:

```
chassis redundancy ha-interface Gig 3 local-ip 172.23.174.86 /24 remote-
ip  172.23.174.85
```

- **On C9800-40 and C9800-80 wireless controller,** enable High Availability SSO using the following command on each of the two wireless controller units

```
chassis redundancy ha-interface local-ip <local IP> <local IP subnet> remote-ip <remote IP>
```

Reload both wireless controllers by executing the command reload from the CLI

**Note**: It is recommended to configure HA using the Redundancy Management Interface (RMI) starting Release 17.1. To see configuration using RMI please see the Redundancy Management Interface section.

**Note**: These commands are not supported on these models:

- Cisco Catalyst CW9800H1 Wireless Controller.
- Cisco Catalyst CW9800H2 Wireless Controller.
- Cisco Catalyst CW9800M Wireless Controller.

RMI-based High Availability is mandatory in the Cisco Catalyst CW9800H1 Wireless Controller, Cisco Catalyst CW9800H2 Wireless Controller and Cisco Catalyst CW9800M Wireless Controller.

# Active and Standby Election Process

An active C9800 wireless controller retains its role as an Active Controller unless one of the following events occur:

- The wireless controller HA pair is reset.
- The active wireless controller is removed from the HA pair.
- The active wireless controller is reset or powered off.
- The active wireless controller fails.

The active wireless controller is elected or re-elected based on one of these factors and in the order listed below:

1. The wireless controller that is currently the active wireless controller.
2. The wireless controller with the highest priority value.

   **Note:** We recommend assigning the highest priority value to the wireless controller C9800 you prefer to be the active controller. This ensures that the controller is re-elected as active controller if a re-election occurs.

   **Setting the Switch Priority Value**

   ```
   chassis chassis -number priority new-priority-number
   ```

   Chassis-number Specifies the chassis number and the new priority for the chassis. The chassis number range is 1 to 2.

   The priority value range is <1-2>

   Example

   ```
   wireless controller#chassis 1 priority 2
   ```

   You can display the current priority value by using the **show chassis** user EXEC command. The new priority value takes effect immediately but does not affect the current Active Controller. The new priority value helps determine which controller is elected as the new Active Controller when the current active wireless controller or HA redundant pair reloads.

3. The wireless controller  with the shortest start-up time.
4. The wireless controller  with the lowest MAC Address.

The HA LED on the chassis can be used to identify the current Active Controller.

# State Transition for HA SSO Pair formation

1. Active wireless controller in Non Redundant mode

```
TLV(0): T=9, L=29, V=KEY_TLV_PACKAGE_COMPATIBILITY
FRU Key detected
TLV(1): T=9, L=11, V=FRU_RP_TYPE
found package fru type FRU_RP_TYPE
TLV(2): T=9, L=24, V=KEY_TLV_PACKAGE_BOOTARCH
ARCH Key detected
TLV(3): T=9, L=14, V=ARCH_i686_TYPE
found package arch type ARCH_i686_TYPE
TLV(4): T=9, L=20, V=KEY_TLV_BOARD_COMPAT
TLV(5): T=9, L=15, V=BOARD_qwlc_TYPE
TLV(6): T=9, L=24, V=KEY_TLV_CRYPTO_KEYSTRING
TLV(7): T=9, L=4, V=none
TLV(8): T=9, L=11, V=CW_BEGIN=$$
TLV(9): T=9, L=16, V=CW_FAMILY=$qwlc$
TLV(10): T=9, L=78, V=CW_IMAGE=$qwlc-universalk9_wlc.BLD_POLARIS_DEV_LATEST_20180310_120257.SSA.bin$
TLV(11): T=9, L=19, V=CW_VERSION=$16.9.1$
TLV(12): T=9, L=52, V=CW_DESCRIPTION=$Cisco IOS Software, IOS-XE Software$
TLV(13): T=9, L=9, V=CW_END=$$
found DIGISIGN TLV type 12 length = 388

RSA Signed DEVELOPMENT Image Signature Verification Successful.
Validating subpackage signatures: addr=0x6e13e3f8, size=01c789ed

initramfs_size: 0x1c78dcd - 0x4b0a38 - 0x3e0 = 0x17c7fb5
Image validated
Booting image with bootparam="root=/dev/ram rw console=tty1 max_loop=64 pciehp.pciehp_force pcie_ports=native SR_BOOT=tftp://172.25.140.118/auto/
tftpboot/maahmed/qwlc-universalk9_wlc.BLD_POLARIS_DEV_LATEST_20180310_120257.SSA.bin rd_start=0xaf06e000 rd_size=0x17c7fb5 pkg_start=0x33f68000
pkg_size=0x3a1d4000 bdinfo_start=0xcd42b000 bdinfo_size=0x35c34"
May  3 15:13:22.585: %BOOT-0-DRV_LOADFAIL: R0/0: binos: Failed to load driver modprobe ( /usr/binos/conf/driver_common.sh: line 99: indigorw:
command not found )
May  3 15:13:43.295: %PMAN-3-PROC_EMPTY_EXEC_FILE: R0/0: pvp: Empty executable used for process bt_logger
May  3 15:13:45.742: %PMAN-3-PROC_EMPTY_EXEC_FILE: R0/0: pvp: Empty executable used for process bt_logger

Waiting for remote chassis to join
```

2. Standby Insertion for HA Pairing

```
Chassis number is 1
All chassis in the stack have been discovered. Accelerating discovery
May  3 15:13:46.276: %PMAN-3-PROC_EMPTY_EXEC_FILE: R0/0: pvp: Empty executable used for process bt_logger
May  3 15:13:46.877: %PMAN-3-PROC_EMPTY_EXEC_FILE: R0/0: pvp: Empty executable used for process bt_logger
May  3 15:13:48.852: %PMAN-3-PROC_EMPTY_EXEC_FILE: R0/0: pvp: Empty executable used for process bt_logger
May  3 15:13:53.654: %PMAN-3-PROC_EMPTY_EXEC_FILE: R0/0: pvp: Empty executable used for process bt_logger
May  3 15:13:56.934: %PMAN-3-PROC_EMPTY_EXEC_FILE: R0/0: pvp: Empty executable used for process bt_logger

                 Restricted Rights Legend

Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

             Cisco Systems, Inc.
             170 West Tasman Drive
             San Jose, California 95134-1706
```

3. HA Sync in Progress

```
directory.
*May  3 15:13:52.681: %STACKMGR-6-STACK_LINK_CHANGE: Chassis 2 R0/0: stack_mgr: Stack port 2 on Chassis 1 is down
*May  3 15:13:52.681: %STACKMGR-6-STACK_LINK_CHANGE: Chassis 2 R0/0: stack_mgr: Stack port 1 on Chassis 1 is up
*May  3 15:13:52.681: %STACKMGR-6-STACK_LINK_CHANGE: Chassis 2 R0/0: stack_mgr: Stack port 2 on Chassis 1 is up
*May  3 15:13:52.682: %STACKMGR-6-CHASSIS_ADDED: Chassis 2 R0/0: stack_mgr: Chassis 2 has been added to the stack.
*May  3 15:13:52.682: %STACKMGR-6-CHASSIS_ADDED: Chassis 2 R0/0: stack_mgr: Chassis 2 has been added to the stack.
*May  3 15:13:52.682: %STACKMGR-6-ACTIVE_ELECTED: Chassis 2 R0/0: stack_mgr: Chassis 1 has been elected ACTIVE.
*May  3 15:13:52.682: %CMRP-3-PFU_MISSING: Chassis 2 R0/0: cmand: The platform does not detect a power supply in slot 1
*May  3 15:14:41.704: %SYS-4-FREEMEMWARNING: SIP0/0: Free Memory has dropped below warning threshold.
*May  3 15:14:46.405: %SYS-6-BOOTTIME: Time taken to reboot after reload = 1073 seconds
*May  3 15:14:46.761: %PNP-6-PNP_DISCOVERY_STOPPED: PnP Discovery stopped (Startup Config Present)
*May  3 15:14:46.789: %SPA_OIR-6-ONLINECARD: SPA (BUILT-IN-4X10G/1G) online in subslot 0/0
*May  3 15:14:46.883: %IOSXE_SPA-6-UPDOWN: Interface TenGigabitEthernet0/0/0, link down due to local fault
*May  3 15:14:46.937: %IOSXE_SPA-6-UPDOWN: Interface TenGigabitEthernet0/0/1, link down due to local fault
*May  3 15:14:46.977: %IOSXE_SPA-6-UPDOWN: Interface TenGigabitEthernet0/0/2, link down due to local fault
*May  3 15:14:47.040: %IOSXE_SPA-6-UPDOWN: Interface TenGigabitEthernet0/0/3, link down due to local fault
*May  3 15:14:48.780: %LINK-3-UPDOWN: Interface TenGigabitEthernet0/0/1, changed state to down
*May  3 15:14:48.783: %LINK-3-UPDOWN: Interface TenGigabitEthernet0/0/2, changed state to down
*May  3 15:14:48.784: %LINK-3-UPDOWN: Interface TenGigabitEthernet0/0/3, changed state to down
*May  3 15:14:49.217: %IOSXE_SPA-6-UPDOWN: Interface TenGigabitEthernet0/0/0, link down due to remote fault
*May  3 15:14:49.032: %LINK-3-UPDOWN: SIP0/0: Interface TenGigabitEthernet0/0/0, changed state to down
*May  3 15:14:49.652: %LINK-3-UPDOWN: Interface TenGigabitEthernet0/0/0, changed state to down
*May  3 15:14:50.043: %LINK-3-UPDOWN: Interface GigabitEthernet0, changed state to up
*May  3 15:14:51.043: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0, changed state to up
*May  3 15:14:54.229: %PKI-2-NON_AUTHORITATIVE_CLOCK: PKI functions can not be initialized until an authoritative time source, like NTP, can be
obtained.
*May  3 15:14:55.456: %LINK-3-UPDOWN: Interface TenGigabitEthernet0/0/0, changed state to up
*May  3 15:14:55.458: %LINK-3-UPDOWN: Interface Vlan1, changed state to down
*May  3 15:14:55.456: %LINK-3-UPDOWN: SIP0/0: Interface TenGigabitEthernet0/0/0, changed state to up
*May  3 15:14:57.892: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet0/0/0, changed state to up
*May  3 15:14:58.891: %LINK-3-UPDOWN: Interface Vlan1, changed state to up
*May  3 15:14:59.892: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up
*May  3 15:15:09.367: %IOSXE_REDUNDANCY-6-PEER: Active detected chassis 2 as standby.
*May  3 15:15:09.365: %STACKMGR-6-STANDBY_ELECTED: Chassis 1 R0/0: stack_mgr: Chassis 2 has been elected STANDBY.
*May  3 15:15:09.652: %PMAN-3-PROC_EMPTY_EXEC_FILE: Chassis 2 R0/0: pvp: Empty executable used for process bt_logger
*May  3 15:15:10.140: %PMAN-3-PROC_EMPTY_EXEC_FILE: Chassis 2 R0/0: pvp: Empty executable used for process ngiolite
*May  3 15:15:14.751: %IOSXE_PEM-6-INSPEM_FM: PEM/FM slot P0 inserted
*May  3 15:15:14.754: %IOSXE_PEM-6-PEMOK: The PEM in slot P0 is functioning properly
*May  3 15:15:14.754: %IOSXE_PEM-6-INSPEM_FM: PEM/FM slot P2 inserted
*May  3 15:15:14.758: %IOSXE_PEM-6-PEMOK: The PEM in slot P2 is functioning properly
WLC>
```

```
WLC#
*May  3 15:15:39.434: %REDUNDANCY-5-PEER_MONITOR_EVENT: Active detected a standby insertion (raw-event=PEER_FOUND(4))

*May  3 15:15:39.434: %REDUNDANCY-5-PEER_MONITOR_EVENT: Active detected a standby insertion (raw-event=PEER_REDUNDANCY_STATE_CHANGE(5))

*May  3 15:15:41.404: % Redundancy mode change to SSO

*May  3 15:15:41.404: %VOICE_HA-7-STATUS: NONE->SSO; SSO mode will not take effect until after a platform reload.
*May  3 15:15:44.413: Syncing vlan database
*May  3 15:15:44.436: Vlan Database sync done from bootflash:vlan.dat to stby-bootflash:vlan.dat (1464 bytes)
WLC#
WLC#
WLC#
WLC#
WLC#
WLC#
WLC#show chas
WLC#show chassis
Chassis/Stack Mac Address : 00a3.8e23.8769 - Local Mac Address
Mac persistency wait time: Indefinite
Local Redundancy Port Type: Twisted Pair
                                          H/W   Current
Chassis#   Role    Mac Address     Priority Version  State                 IP
-------------------------------------------------------------------------------------
*1       Active   00a3.8e23.8769    1      V02     Ready               172.20.226.134
 2       Standby  00a3.8e23.8909    1      V02     HA sync in progress  172.20.226.133
```

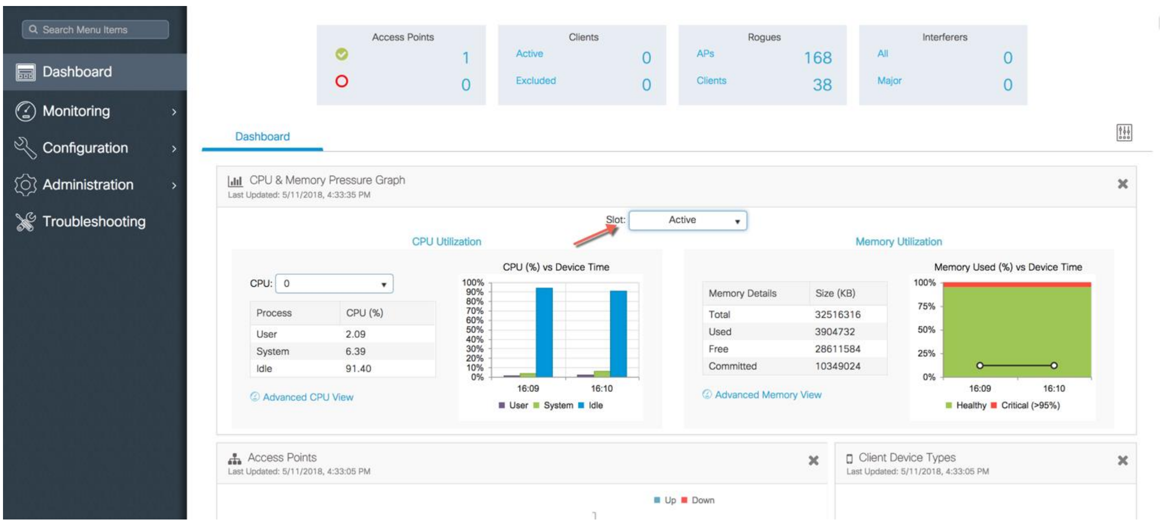
4. Terminal State for SSO

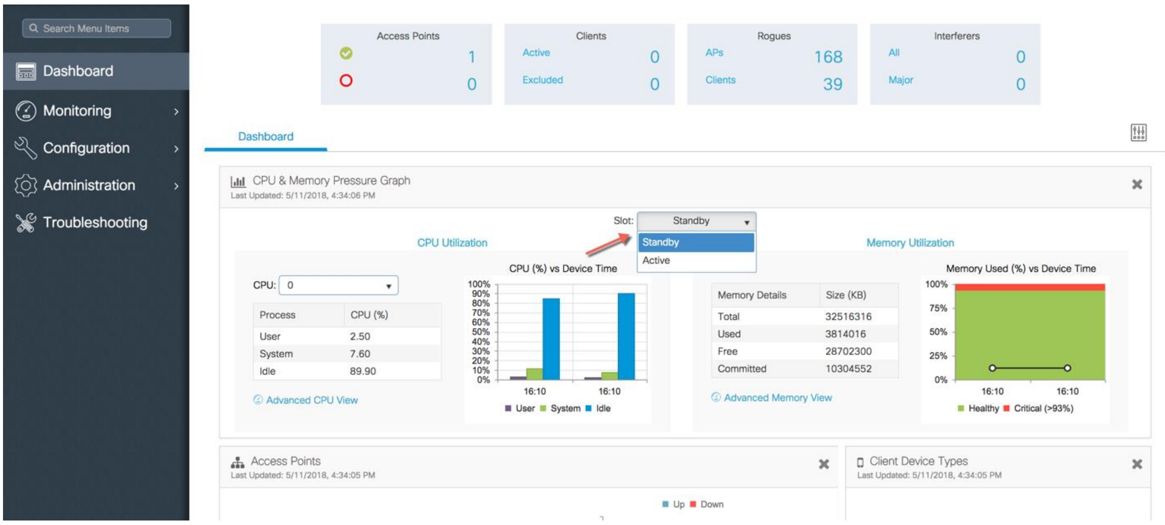
```
*May  3 15:18:46.564: %HA_CONFIG_SYNC-6-BULK_CFGSYNC_SUCCEED: Bulk Sync succee
*May  3 15:18:46.565: %VOICE_HA-7-STATUS: VOICE HA bulk sync done.
*May  3 15:18:47.565: %RF-5-RF_TERMINAL_STATE: Terminal state reached for (SSO)
WLC#show chassis
Chassis/Stack Mac Address : 00a3.8e23.8769 - Local Mac Address
Mac persistency wait time: Indefinite
Local Redundancy Port Type: Twisted Pair
                                          H/W   Current
Chassis#   Role    Mac Address     Priority Version  State                 IP
-------------------------------------------------------------------------------------
*1       Active   [redacted]        1      V02     Ready               [redacted]
 2       Standby  [redacted]        1      V02     Ready
```

**Note**: Breaking the HA Pair : The HA configuration can be disabled by using the chassis clear command followed by a reload

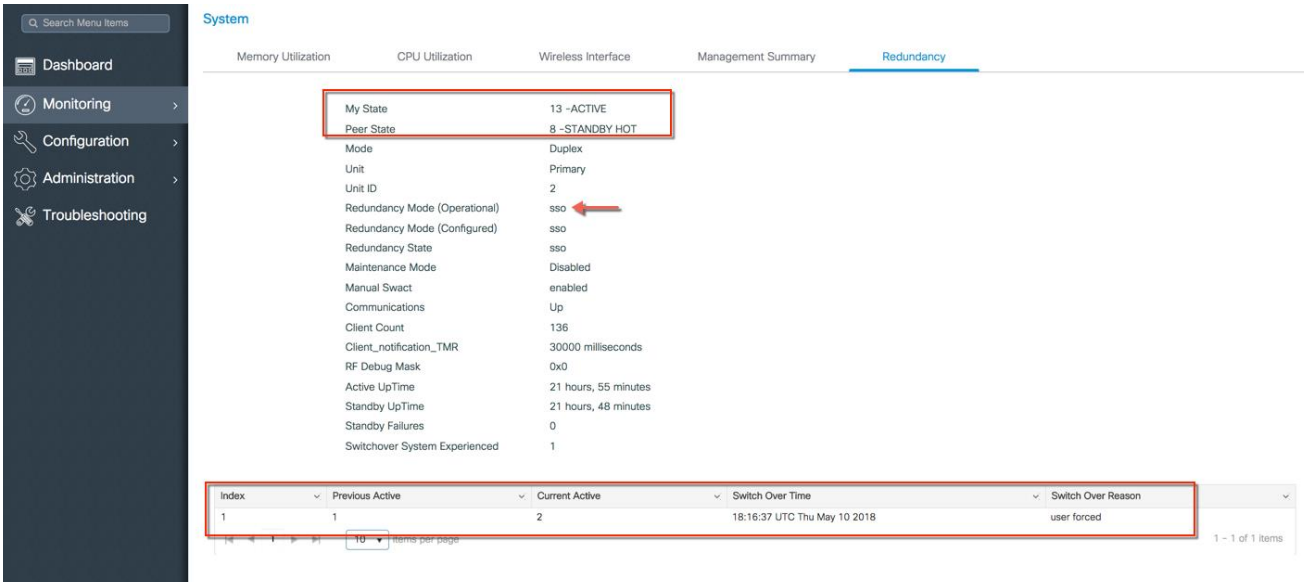
# Monitoring the HA Pair

Both Active and Standby System can be monitored from the Management UI of the Active wireless controller. This includes information about CPU and memory utilization as well and advanced CPU and memory views.






Navigate to Monitoring > System > Redundancy on the controller Web UI. The Redundancy States page is displayed:




| **Parameter** | **Description** |
|---|---|
| My State | Shows the state of the active CPU controller module. Values are as follows:<br>Active<br>Standby HOT<br>Disable |
| Peer State | Displays the state of the peer (or standby) CPU controller module. Values are as follows:<br>Standby HOT |

| | |
|---|---|
| | Disable |
| Mode | Displays the current state of the redundancy peer. Values are as follows:<br>Simplex— Single CPU controller module.<br>Duplex— Two CPU controller modules. |
| Unit ID | Displays the unit ID of the CPU controller module. |
| Redundancy Mode (Operational) | Displays the current operational redundancy mode supported on the unit. |
| Redundancy Mode (Configured) | Displays the current configured redundancy mode supported on the unit. |
| Redundancy State | Displays the current functioning redundancy state of the unit. Values are as follows:<br>SSO<br>Not Redundant |
| Manual Swact | Displays whether manual switchovers have been enabled. |
| Communications | Displays whether communications are up or down between the two controllers. |

The same page displays Switchover history. The description for the following parameters are displayed in the table below:

| **Parameter** | **Description** |
|---|---|
| Index | Displays the index number of the redundant unit. |
| Previous Active | Displays the controller that was active prior to switchover. |
| Current Active | Displays the controller that is currently active. |
| Switch Over Time | Displays the system time when the switchover occurred. |
| Switch Over Reason | Displays the cause of the switchover. |

## Monitoring HA Pair from CLI

The command `show chassis` displays summary information about the HA Pair, including the MAC address, role, switch priority, and current state of each wireless controller in the redundant HA pair. By default, the Local MAC Address of the HA Pair is the MAC address of the first elected Active Controller.

```
WLC#show chassis
Chassis/Stack Mac Address : 00a3.8e23.8760 - Local Mac Address
Mac persistency wait time: Indefinite
Local Redundancy Port Type: Twisted Pair
                                           H/W   Current
Chassis#   Role     Mac Address     Priority Version  State                IP
-------------------------------------------------------------------------------------
 1        Standby  00a3.8e23.8760     1       V02      Ready               172.20.226.133
*2        Active   00a3.8e23.8900     1       V02      Ready               172.20.226.134
```

The `show chassis` command points to the current C9800 wireless controller on the console using the (*) symbol against the chassis number as shown above.

## Verifying Redundancy States

- The command show redundancy can be used to monitor the state of the two units

```
wireless controller#show redundancy ?
  application       box 2 box application information
  clients           Redundancy Facility (RF) client list
  config-sync       Show Redundancy Config Sync status
  counters          Redundancy Facility (RF) operational counters
  domain            Specify the RF domain
  history           Redundancy Facility (RF) history
  idb-sync-history  Redundancy Facility (RF) IDB sync history
  linecard-group    Line card redundancy group information
  rii               Display the redundancy interface identifier for Box to Box
  states            Redundancy Facility (RF) states
  switchover        Redundancy Facility (RF) switchover
  trace             Redundancy Facility (RF) trace
  |                 Output modifiers
  <cr>              <cr>
```

- The command show redundancy displays the redundant system and the current processor information. The redundant system information includes the system uptime, standby failures, switchover reason, hardware mode, and configured and operating redundancy mode. The current processor information displayed includes the image version, active location, software state, BOOT variable, configuration register value, and uptime in the current state, and so on. The Peer Processor information is only available from the Active Controller.

```
WLC#show redundancy
Redundant System Information :
------------------------------
       Available system uptime = 22 hours, 9 minutes
Switchovers system experienced = 1
              Standby failures = 0
        Last switchover reason = user forced

                 Hardware Mode = Duplex
    Configured Redundancy Mode = sso
     Operating Redundancy Mode = sso
              Maintenance Mode = Disabled
                Communications = Up

Current Processor Information :
-------------------------------
               Active Location = slot 2
        Current Software state = ACTIVE
       Uptime in current state = 21 hours, 43 minutes
                 Image Version = Cisco IOS Software [Fuji], WLC9000 Software (X86_64_LINUX_IO
SD-UNIVERSALK9_WLC-M), Experimental Version 16.10.20180509:065558 [polaris_dev-/nobackup/mcpr
e/BLD-BLD_POLARIS_DEV_LATEST_20180509_073715 183]
Copyright (c) 1986-2018 by Cisco Systems, Inc.
Compiled Wed 09-May-18 06:35 by mcpre
                          BOOT = bootflash:qwlc-universalk9_wlc.BLD_POLARIS_DEV_LATEST_201805
09_073715.SSA.bin,1;
                   CONFIG_FILE =
        Configuration register = 0x2102

Peer Processor Information :
----------------------------
              Standby Location = slot 1
        Current Software state = STANDBY HOT
       Uptime in current state = 21 hours, 35 minutes
                 Image Version = Cisco IOS Software [Fuji], WLC9000 Software (X86_64_LINUX_IO
SD-UNIVERSALK9_WLC-M), Experimental Version 16.10.20180509:065558 [polaris_dev-/nobackup/mcpr
e/BLD-BLD_POLARIS_DEV_LATEST_20180509_073715 183]
Copyright (c) 1986-2018 by Cisco Systems, Inc.
Compiled Wed 09-May-18 06:35 by mcpre
                          BOOT = bootflash:qwlc-universalk9_wlc.BLD_POLARIS_DEV_LATEST_201805
09_073715.SSA.bin,1;
                   CONFIG_FILE =
        Configuration register = 0x2102
```

- The command show redundancy states displays all the redundancy states of the active and standby controllers.

```
WLC#show redundancy states ?
  domain  Specify the RF domain
  |       Output modifiers
  <cr>    <cr>

WLC#show redundancy states
       my state = 13 -ACTIVE
     peer state = 8  -STANDBY HOT
           Mode = Duplex
           Unit = Primary
        Unit ID = 2

Redundancy Mode (Operational) = sso
Redundancy Mode (Configured)  = sso
Redundancy State              = sso
     Maintenance Mode = Disabled
    Manual Swact = enabled
 Communications = Up

   client count = 136
 client_notification_TMR = 30000 milliseconds
           RF debug mask = 0x0
```

- Manual Switchover Action (Manual Swact) i.e. the command redundancy force-switchover cannot be executed on the Standby wireless controller and is enabled only on the Active Controller.
- Switchover History can be viewed using the following command

```
WLC#show redundancy switchover history
Index  Previous  Current  Switchover             Switchover
       active    active   reason                 time
-----  --------  -------  ----------             ----------
   1       1        2     user forced            18:16:37 UTC Thu May 10 2018
```

## Accessing standby wireless controller console

The active controller can be accessed through a console connection, Telnet, an SSH, or a Web Browser by using the Management IP address. To use the console on the standby wireless controller, execute the following commands from the active Catalyst 9800 Wireless controller

```
conf t
redundancy
main-cpu
standby console enable
```

The prompt on the Standby console is appended with "-stby" to reflect the Standby wireless controller console as shown below.

```
WLC-stby#show chassis
Chassis/Stack Mac Address : 00a3.8e23.8760 - Local Mac Address
Mac persistency wait time: Indefinite
Local Redundancy Port Type: Twisted Pair
                                          H/W   Current
Chassis#   Role     Mac Address     Priority Version  State                  IP
------------------------------------------------------------------------------------
*1       Standby  00a3.8e23.8760      1       V02     Ready                0.0.0.0
 2       Active   00a3.8e23.8900      1       V02     Ready                0.0.0.0
```

**Note**: The `show chassis` command points to the current C9800 wireless controller on the console using the (*) symbol against the chassis number as shown above. In this case it is the console of the standby Unit.

```
WLC-stby>en
WLC-stby#show red
WLC-stby#show redun
WLC-stby#show redundancy
Redundant System Information :
------------------------------
       Available system uptime = 22 hours, 2 minutes
Switchovers system experienced = 1

                 Hardware Mode = Duplex
    Configured Redundancy Mode = sso
     Operating Redundancy Mode = sso
              Maintenance Mode = Disabled
                Communications = Up

Current Processor Information :
-------------------------------
              Standby Location = slot 1
        Current Software state = STANDBY HOT
       Uptime in current state = 21 hours, 29 minutes
                 Image Version = Cisco IOS Software [Fuji], WLC9000 Software (X86_64_LINUX_IO
SD-UNIVERSALK9_WLC-M), Experimental Version 16.10.20180509:065558 [polaris_dev-/nobackup/mcpr
e/BLD-BLD_POLARIS_DEV_LATEST_20180509_073715 183]
Copyright (c) 1986-2018 by Cisco Systems, Inc.
Compiled Wed 09-May-18 06:35 by mcpre
                          BOOT = bootflash:qwlc-universalk9_wlc.BLD_POLARIS_DEV_LATEST_201805
09_073715.SSA.bin,1;
                   CONFIG_FILE =
        Configuration register = 0x2102

Peer (slot: 2, state: ACTIVE) information is not available because this is the standby proces
sor
```

# Switchover Functionality

## Process Failure Switchover

This type of switch over occurs when any of the key processes running on the Active unit fails or crashes. Upon such a failure, the Active unit reloads and the hot Standby takes over and becomes the new Active unit. When the failed system boots up, it will transition to Hot-Standby state. If the Standby unit is not yet in Hot Standby State, both units are reloaded and there will be no SSO. A process failure on the standby (hot or not) will cause it to reload.

## Power-fail Switchover

This switchover from the Active to Standby unit is caused due to power failure of the current Active unit. The current Standby unit becomes the new Active unit and when the failed system boots up, it will transition to Hot-Standby state.

## Manual Switchover

This is a user initiated forced switchover between the Active and Standby unit. The current Standby unit becomes the new Active unit and when the failed system boots up, it will transition to Hot-Standby state. To perform a manual switchover, execute the redundancy force-switchover command. This command initiates a graceful switchover from the active to the standby controller. The active controller reloads and the standby takes over as the New Active controller.

# Failover Process

## Active wireless controller

```
WLC#show ap summary
Number of APs: 1

AP Name                            Slots    AP Model  Ethernet MAC    Radio MAC       Location              Country     IP Address
State
--------------------------------------------------------------------------------------------------------------------------------
----------------------------------------
AP005D.735C.B544                     3      3802I     005d.735c.b544  b4de.31d0.5800  default location      US          172.20.226.186
Registered


WLC#show wireless client sum
Number of Local Clients: 1

MAC Address    AP Name                          WLAN  State             Protocol Method     Role
------------------------------------------------------------------------------------------------
e8b2.ac94.757e AP005D.735C.B544                 1     Run               11ac     None       Local

Number of Excluded Clients: 0

WLC#redundancy force-switchover

System configuration has been modified. Save? [yes/no]: yes
Building configuration...
[OK]Proceed with switchover to standby RP? [confirm]
    Manual Swact = enabled

Chassis 1 reloading, reason - Non participant detected
```

## Standby wireless controller

An Access Point and client Stateful Switch Over (SSO) implies that all the Access Point and client sessions are switched over state-fully and continue to operate in a network with no loss of sessions, providing improved network availability and reducing service downtime.

Once a redundancy pair is formed, HA is enabled, which means that Access Points and clients continue to remain connected during an active-to-standby switchover.

```
WLC-stby#
May 10 18:16:37.123: %PLATFORM-6-HASTATUS: RP switchover, received chassis event to become active
May 10 18:16:37.169: %REDUNDANCY-3-SWITCHOVER: RP switchover (PEER_NOT_PRESENT)
May 10 18:16:37.169: %REDUNDANCY-3-REDUNDANCY_ALARMS: Unable to assert REDUNDANCY alarm

May 10 18:16:37.169: %REDUNDANCY-3-REDUNDANCY_ALARMS: Unable to assert REDUNDANCY alarm

May 10 18:16:37.169: %REDUNDANCY-3-SWITCHOVER: RP switchover (PEER_DOWN)
May 10 18:16:37.169: %REDUNDANCY-3-SWITCHOVER: RP switchover (PEER_REDUNDANCY_STATE_CHANGE)
May 10 18:16:37.175: %PLATFORM-6-HASTATUS: RP switchover, sent message became active. IOS is ready to switch to primary after chassis
confirmation
May 10 18:16:37.180: %PLATFORM-6-HASTATUS: RP switchover, received chassis event became active
May 10 18:16:37.789: %VOICE_HA-2-SWITCHOVER_IND: SWITCHOVER, from STANDBY_HOT to ACTIVE state.
May 10 18:16:37.797: %LINK-3-UPDOWN: Interface Lsmpi0, changed state to up
May 10 18:16:37.798: %LINK-3-UPDOWN: Interface EOBC0, changed state to up
May 10 18:16:37.798: %LINK-3-UPDOWN: Interface LIIN0, changed state to up
May 10 18:16:38.798: %LINEPROTO-5-UPDOWN: Line protocol on Interface Lsmpi0, changed state to up
May 10 18:16:38.798: %LINEPROTO-5-UPDOWN: Line protocol on Interface EOBC0, changed state to up
May 10 18:16:38.798: %LINEPROTO-5-UPDOWN: Line protocol on Interface LIIN0, changed state to up
May 10 18:16:39.786: %LINK-3-UPDOWN: Interface Null0, changed state to up
May 10 18:16:39.786: %LINK-3-UPDOWN: Interface TenGigabitEthernet0/0/0, changed state to up
May 10 18:16:39.787: %LINK-3-UPDOWN: Interface Vlan1, changed state to up
May 10 18:16:39.788: %LINK-3-UPDOWN: Interface Vlan112, changed state to up
May 10 18:16:40.787: %LINEPROTO-5-UPDOWN: Line protocol on Interface Null0, changed state to up
May 10 18:16:40.787: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet0/0/0, changed state to up
May 10 18:16:40.787: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up
May 10 18:16:40.787: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan112, changed state to up
WLC#
May 10 18:16:49.798: %LINK-3-UPDOWN: Interface GigabitEthernet0, changed state to up
May 10 18:16:50.799: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0, changed state to up
WLC#show ap sum
WLC#show ap summary
Number of APs: 1

AP Name                            Slots    AP Model  Ethernet MAC    Radio MAC       Location              Country     IP Address
State
--------------------------------------------------------------------------------------------------------------------------------
----------------------------------------
AP005D.735C.B544                     3      3802I     005d.735c.b544  b4de.31d0.5800  default location      US          172.20.226.186
Registered

WLC#show wireless client summary
Number of Local Clients: 1

MAC Address    AP Name                          WLAN  State             Protocol Method     Role
------------------------------------------------------------------------------------------------
e8b2.ac94.757e AP005D.735C.B544                 1     Run               11ac     None       Local

Number of Excluded Clients: 0
```

# Verifying AP and Client SSO State Sync

On successful switchover of the standby wireless controller as active, all access points and clients connected to the previously active wireless controller must remain connected to the new Active controller.

This can be verified by executing the commands:

- **show ap uptime** : Verifies that the uptime of the access point after the switchover is not reset.
- **show wireless client summary**: Displays the clients connected to the new Active controller.

```
WLC#show ap uptime
Number of APs: 1

AP Name                          Ethernet MAC    Radio MAC      AP Up Time                                            Association Up Time
------------------------------------------------------------------------------------------------------------------------------------------------
--
AP005D.735C.B544                 005d.735c.b544  b4de.31d0.5800  1 day 0 hour 47 minutes 22 seconds                   1 day 0 hour 45 minutes 33 s
econds

WLC#
```

```
WLC#show wireless client summary
Number of Local Clients: 1

MAC Address     AP Name                          WLAN  State                Protocol Method     Role
-------------------------------------------------------------------------------------------------------
e8b2.ac94.757e AP005D.735C.B544                  1     Run                  11ac     None       Local

Number of Excluded Clients: 0
```

## SSO Failover Time Metrics

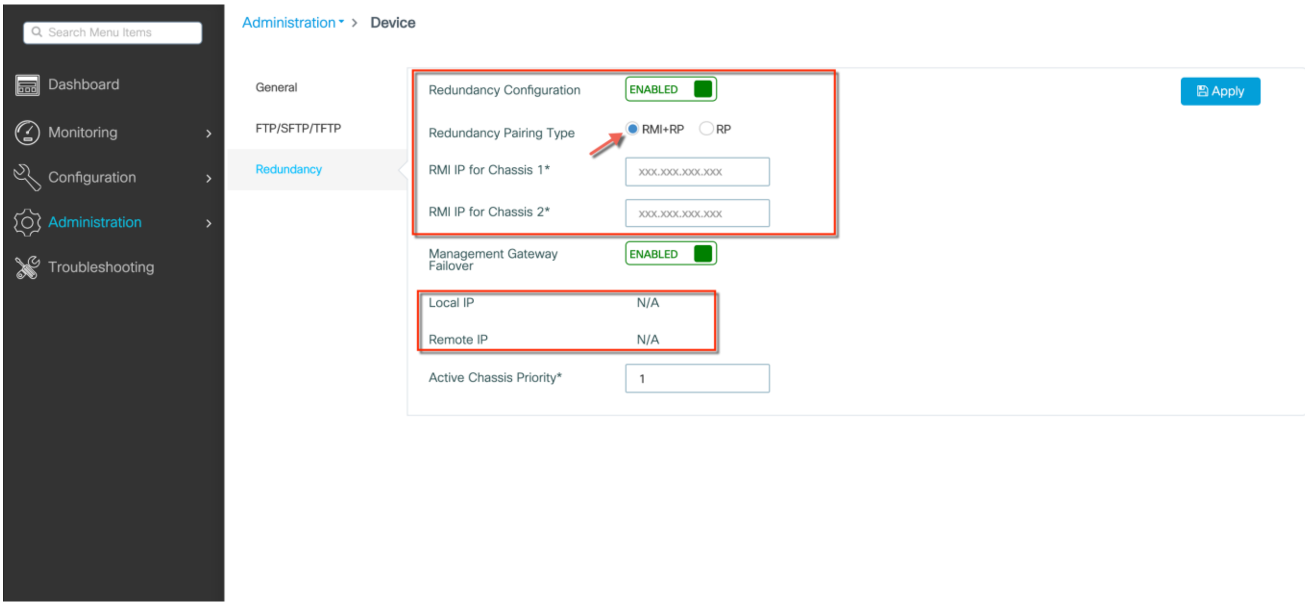
| **Metrics** | **Time** |
| --- | --- |
| Failure Detection | In the order of 50 ms. - TBD |
| Reconciliation Time (Standby becoming Active) | In the order of 1020 ms. - TBD |

## Redundancy Management Interface

With a single RP link between the SSO pair, if the heartbeat on RP fails, there is no way find out if the failure is limited to the link or if the other controller has failed. Redundancy Port (RP link) that handles state sync traffic between the active and the standby is a single point of failure.

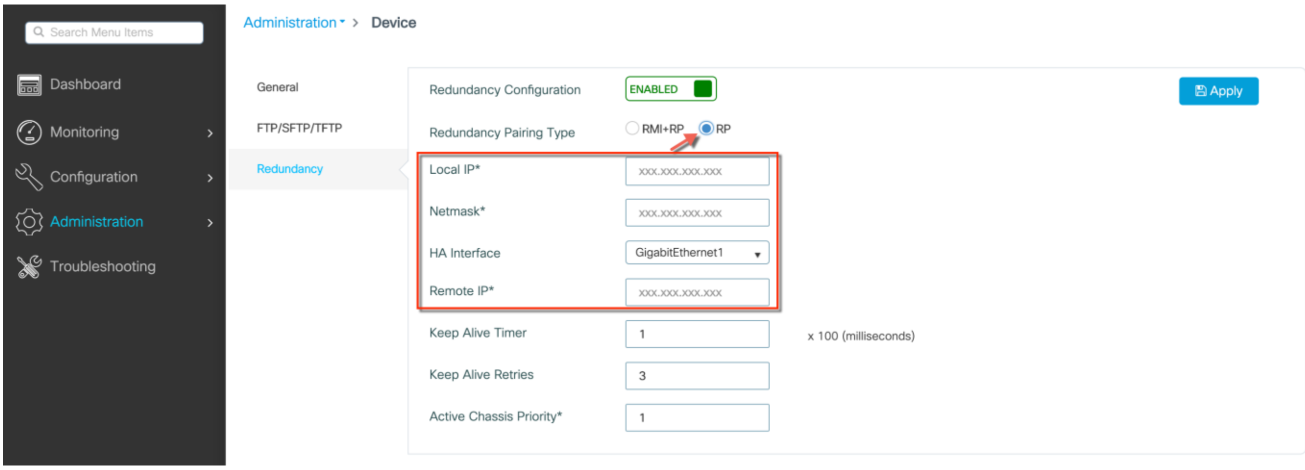
Release 17.1 introduces the Redundancy Management Interface (RMI) as a secondary link between the active and the standby controllers. This release also introduces the support for default gateway check which is done using the redundancy management interface.

## Redundancy Management Interface Configuration using WebUI




- RMI IP for chassis 1 and 2 is same across both active and standby controllers
- RP IP configuration for chassis 1 and 2 auto-generated as 169.254.x.x where x.x. is from the RMI IP
- The netmask for RMI is picked up from the netmask configured on the Wireless Management VLAN.

For backward compatibility, RP based SSO configuration will also be supported, but keep in mind that this will not support default gateway check and hence is not preferred.




## Redundancy Management Interface Configuration using CLI

Until 17.1, only RP-based SSO configuration was supported, i.e., chassis redundancy ha-interface <RP interface> local-ip <local IP> <local IP subnet> remote-ip <remote IP>.

17.1 and beyond, the user can use either RMI+RP or RP-based configuration. Once an HA pair is formed using RMI+RP configuration, the exec CLI for RP-based method of clearing and forming the HA pair shall not be allowed.

**Note**: Chassis re-number needs to be configured while bringing up HA with RMI from scratch using RMI in 17.x release.

By default, chassis number is 1. IP addresses of RP ports are derived from RMI. If the chassis number is the same on both controllers, local RP port IP derivation will be same and discovery will fail. This will result in Active-Active case.

To avoid this scenario, execute the following CLI:

```
WLC#chassis 1 renumber ?
  <1-2>  Renumber local chassis id assignment

WLC(config)# redun-management interface <VLAN> chassis 1 address <RMI IP of chassis 1>
chassis 2 address <RMI IP of chassis 2>
```

Configuration example:

On WLC 1:

```
WLC(config)# redun-management interface Vlan112 chassis 1 address 172.20.226.148 chassis 2
address 172.20.226.149
```

On WLC 2: (Same CLI)

```
WLC(config)# redun-management interface Vlan112 chassis 1 address 172.20.226.148 chassis 2
address 172.20.226.149
```

Chassis numbers identify the individual controllers and must be configured before configuring the RMI IPs. It is mandatory to execute the same CLI on both controllers before forming the pair. The RMI IP configuration triggers HA pairing and forms the SSO pair. There is no IPv6 Support on RMI or Gateway IP.

## Verifying RMI and RP configuration

```
WLC-9800#show chassis rmi
Sep 20 21:26:13.024: %SYS-5-CONFIG_I: Configured from console by console
Chassis/Stack Mac Address : 00a3.8e23.8760 - Local Mac Address
Mac persistency wait time: Indefinite
Local Redundancy Port Type: Twisted Pair
                                                 H/W   Current
Chassis#   Role    Mac Address     Priority Version  State      IP          RMI-IP
------------------------------------------------------------------------------------
 1       Standby  00a3.8e23.8760     2       V02      Ready  169.254.226.149 172.20.226.149
*2       Active   00a3.8e23.8900     1       V02      Ready  169.254.226.148 172.20.226.148


WLC-9800#show romvar
ROMMON variables:
 SWITCH_NUMBER = 1
 LICENSE_BOOT_LEVEL =
…
 RANDOM_NUM = 842430634
 SWITCH_PRIORITY = 1
 RMI_INTERFACE_NAME = Vlan112
 RMI_CHASSIS_LOCAL_IP = 172.20.226.148
 RMI_CHASSIS_REMOTE_IP = 172.20.226.149
 CHASSIS_HA_LOCAL_IP = 169.254.226.148
 CHASSIS_HA_REMOTE_IP = 169.254.226.149
 CHASSIS_HA_LOCAL_MASK = 255.255.255.0
```

## RMI and RP pairing combinations

### Upgrade and HA Pairing with no previous HA config

The user shall be presented with an option to choose the existing mechanism (exec RP-based CLIs) or the RMI IP based mechanism.

If the user chooses the exec CLI based method, the RP IPs shall be configured as it happens till 16.12.

When the RMI configuration is done, it shall:

Generate the RP IPs with IPs derived from the RMI IPs and will also be used for setting RMI IPs and pair the Controllers (while pairing only standby reloads in hardware platforms. Both active and standby reload in case of 9800-CL VM). Exec RP-based CLIs are blocked in this case.

Option 1: RMI Based Configuration (Preferred)

1. Upgrade to 17.1 and connect the RPs
2. Configure RMI+RP
3. RP IPs are derived from the RMI IPs
4. RP-based exec commands are blocked
5. ROMMON RP and RMI variables are set

Option 2: RP Based Configuration

1. Upgrade to 17.1 and connect RPs
2. Configure RP via GUI/CLI
3. RP-based configuration sets the local and remote IP
4. ROMMON RP Variables are set to the local and remote IP

## Upgrade already Paired controllers

If the controllers are already in an HA pair, the existing exec RP CLIs can be continued to be used.

Those who would like to migrate to the RMI based HA pairing (preferred) can enable RMI.

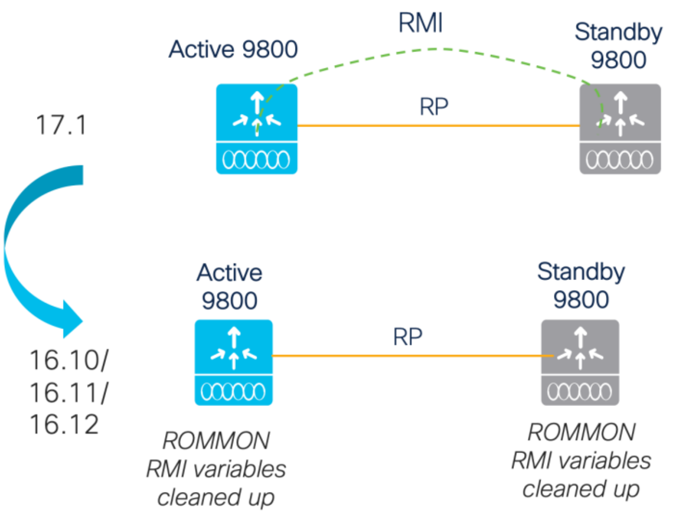
This will overwrite the RP IPs with RMI derived IPs. The HA pair will not be immediately disturbed, but the controllers will pick up the new IP when they reload next.

RMI feature mandates a reload for the feature to take effect.

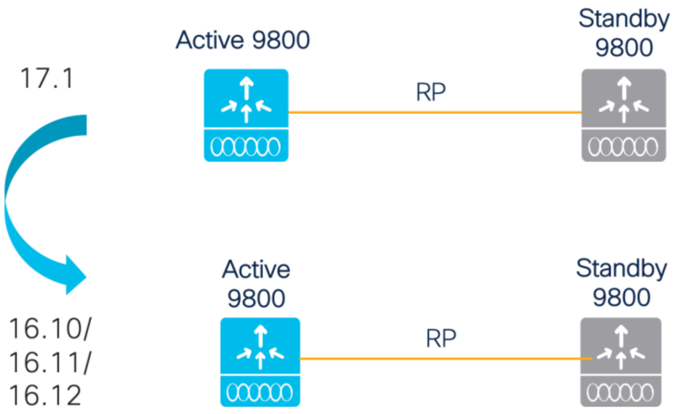
When the controllers reload, they would come up as a pair with the new RMI-derived-RP-IPs. Exec RP-based CLIs will be blocked

## Downgrade

If RMI based configuration was used, after downgrade the system will fall back to the RP-based configuration



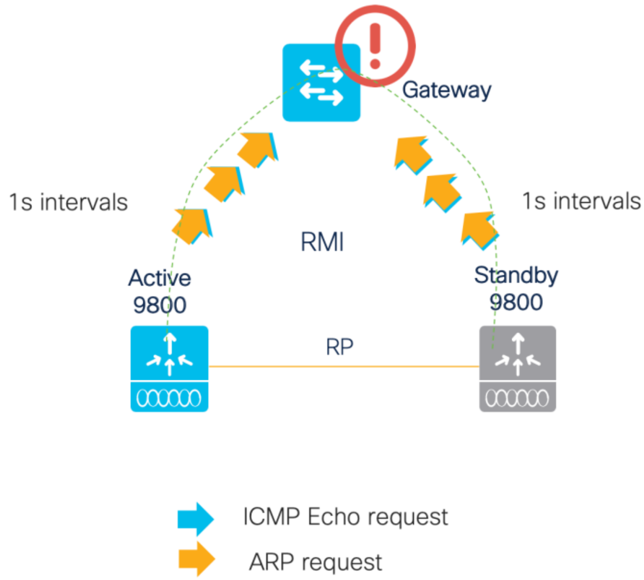

If RP based configuration was used, after downgrade the system will continue to use RP-based configuration




## Default Gateway Check

Default Gateway check is done by periodically sending Internet Control Message Protocol (ICMP) ping to the gateway. Both the active and the standby controllers use the RMI IP as the source IP. These messages are sent at 1 second interval. If there are 8 consecutive failures in reaching the gateway, the controller will declare the gateway as non-reachable.

After 4 ICMP Echo requests fail to get ICMP Echo responses, ARP requests are attempted. If there is no response for 8 seconds (4 ICMP Echo Requests followed by 4 ARP Requests), the gateway is assumed to be non-reachable. Currently, this feature supports IPv4 only.




The Catalyst 9800 Wireless controller has two recovery states to prevent an active-active scenario.

Recovery mode logically means a state where the controller does not have all "resources" available to provide the service. Currently, RP, RMI and Gateway are the resources. Ports will be in admin down in recovery mode, so no traffic goes through.

- Standby-Recovery: If Gateway goes down, standby goes to standby-recovery mode. Standby means, its state is up to date with the active. But since it does not have the other resource (Gateway) it goes to Standby-

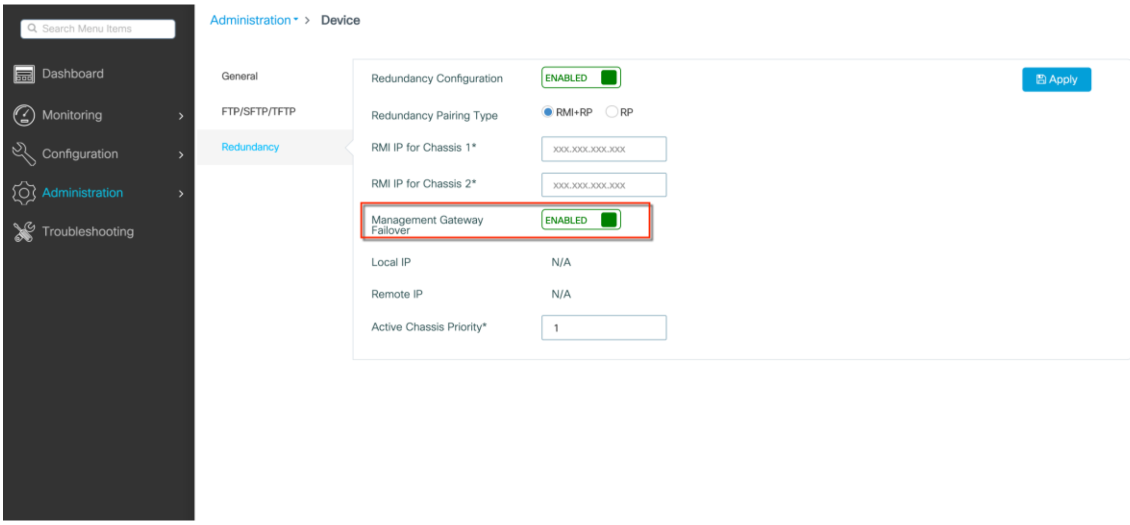
Recovery. The standby shall not be in a position to take over the active functionality when it is in standby-recovery mode. Standby-Recovery will go back to Standby without a reload, once it detects that the Gateway reachability is restored.

- Active-Recovery is when the RP goes down. Active-Recovery does not have its internal state in sync with the Active. Active-Recovery will reload when the RP link comes up so that it can come up as Standby with bulk sync.

Switchover history will show switchover reason as Gateway down in the event of a switchover triggered as a result of the gateway going down.

## Default Gateway Check WebUI Configuration

The default gateway check option can be configured under Administration > Device > Redundancy > Management Gateway Failover




## Default Gateway Check CLI Configuration

The following CLIs need to be configured for the gateway check functionality to be enabled and to specify the default gateway IP used by this feature

```
WLC-9800(config)#management gateway-failover enable
WLC-9800#ip default-gateway <IP>
```

To verify if gateway check is enabled, use the CLI show redundancy state

```
WLC-9800#show redundancy states
       my state = 13 -ACTIVE
     peer state = 8  -STANDBY HOT
           Mode = Duplex
           Unit = Primary
        Unit ID = 2
Redundancy Mode (Operational) = sso
Redundancy Mode (Configured)  = sso
Redundancy State              = sso
…
Gateway Monitoring = Enabled
```

# System and Network Fault Handling

If the standby controller crashes, it shall reboot and come up as standby. Bulk sync will follow and the standby will become hot. If the active controller crashes, the standby becomes active. The new active shall assume the role of master and try to detect a dual active.

These matrices provide a clear picture of what condition the WLC Switchover will trigger:

| **System Issues** | | | | |
|---|---|---|---|---|
| **Trigger** | **RP Link Status** | **Peer Reachability through RMI** | **Switchover** | **Result** |
| Critical Process crash | Up | Reachable | Yes | Switchover happens |
| Forced switchover | Up | Reachable | Yes | Switchover happens |
| Critical Process crash | Up | Unreachable | Yes | Switchover happens |
| Forced switchover | Up | Unreachable | Yes | Switchover happens |
| Critical Process crash | Down | Reachable | No | No action, one controller will be in recovery mode already. |
| Forced switchover | Down | Reachable | N/A | No action, one controller will be in recovery mode already. |
| Critical Process crash | Down | Unreachable | No | Double fault – as mentioned in Network Error handling |
| Forced switchover | Down | Unreachable | N/A | Double fault – as mentioned in Network Error handling |

| RP Link | Peer reachability through RMI | Gateway From Active | Gateway from Standby | Switchover | Result |
|---|---|---|---|---|---|
| Up | Up | Reachable | Reachable | No | No action |
| Up | Up | Reachable | Unreachable | No | No Action. Standby is not ready for SSO in this state as it does not have gateway reachability. The standby shall be shown to be in standby-recovery mode. If the RP goes down, standby (in recovery mode) shall become active. |

| | | | | | |
|---|---|---|---|---|---|
| Up | Up | Unreachable | Reachable | Yes | Gateway reachability message is exchanged over the RMI + RP links. Active shall reboot so that standby becomes active. |
| Up | Up | Unreachable | Unreachable | No | With this, when the active SVI goes down, so will the standby SVI. A switchover is then triggered. If the new active discovers its gateway to be reachable, the system shall stabilise in Active - Standby Recovery. Otherwise, switchovers will happen in a ping-pong fashion. |
| Up | Down | Reachable | Reachable | No | No Action |
| Up | Down | Reachable | Unreachable | No | Standby is not ready for SSO in this state as it does not have gateway reachability. Standby will go to recovery mode as LMP messages are exchanged over the RP link also. |
| Up | Down | Unreachable | Reachable | Yes | Gateway reachability message is exchanged over RP link also. Active shall reboot so that standby becomes active. |
| Up | Down | Unreachable | Unreachable | No | With this, when the active SVI goes down, so will the standby SVI. A switchover is then triggered. If the new active discovers its gateway to be reachable, the system shall stabilise in Active - Standby Recovery. Otherwise, switchovers will happen in a ping-pong fashion. |
| Down | Up | Reachable | Reachable | Yes | Standby will become active with (old) active going to active-recovery. Config mode is disabled in active-recovery mode. All interfaces will be ADMIN DOWN with the wireless management interface having RMI IP. The controller in Active Recovery will reload to become standby when the RP link comes UP. |

| | | | | | |
|---|---|---|---|---|---|
| Down | Up | Reachable | Unreachable | Yes | Same as above |
| Down | Up | Unreachable | Reachable | Yes | Same as above |
| Down | Up | Unreachable | Unreachable | Yes | Same as above |
| Down | Down | Reachable | Reachable | Yes | Double fault – this may result in a network conflict as there will be 2 active controllers. Standby becomes active. Old active also exists. Role negotiation has to happen once the connectivity is restored and keep the active that came up last |
| Down | Down | Reachable | Unreachable | Yes | Same as above |
| Down | Down | Unreachable | Reachable | Yes | Same as Above |
| Down | Down | Unreachable | Unreachable | Yes | Same as Above |

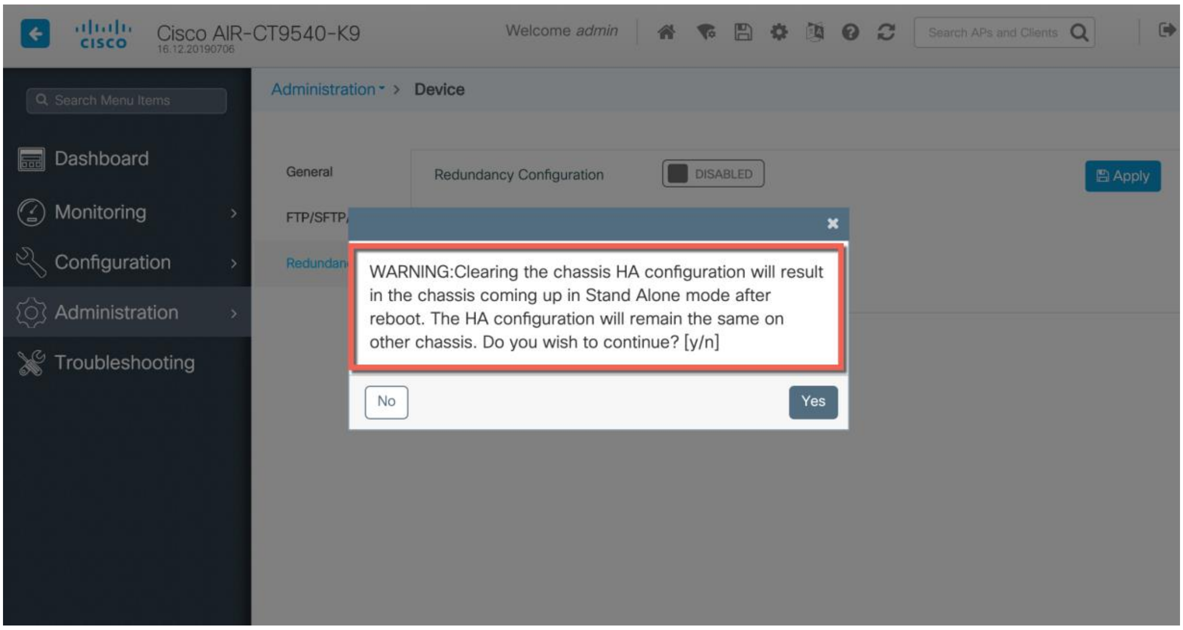
## HA Unpairing Behavior

In release 16.10 and 16.11, when disjoining an HA pair by issuing the command 'clear chassis redundancy', the standby controller reboots and comes up with exactly the same configuration as the active controller, causing duplicate IP address error leading to the following messages:

```
WLC#sh log | i DUP
Mar 21 21:53:46.307 CET: %IP-4-DUPADDR: Duplicate address 120.0.0.1 on Vlan120, sourced by
d4c9.3ccc.f98b
Mar 21 21:54:16.947 CET: %IP-4-DUPADDR: Duplicate address 172.18.50.60 on
GigabitEthernet0, sourced by d4c9.3ccc.f981
```

The solution implemented in 16.12 and 17.1 is that after HA unpairing, the standby controller startup config and HA config will be cleared and standby will go to Day 0.

Before the command is executed, the user is prompted with the following warning on the active controller:




The same is seen on the CLI as well.

```
WLC#clear chassis redundancy
WARNING: Clearing the chassis HA configuration will result in both the chassis move into
Stand Alone mode. This involves reloading the standby chassis after clearing its HA
configuration and startup configuration which results in standby chassis coming up as a
totally clean after reboot. Do you wish to continue? [y/n]? [yes]:
*Apr  3 23:42:22.985: received clear chassis.. ha_supported:1yes
WLC#
*Apr  3 23:42:25.042: clearing peer startup config
*Apr  3 23:42:25.042: chkpt send: sent msg type 2 to peer..
*Apr  3 23:42:25.043: chkpt send: sent msg type 1 to peer..
*Apr  3 23:42:25.043: Clearing HA configurations
*Apr  3 23:42:26.183:  Successfully sent Set chassis mode msg for chassis 1.chasfs file
updated
*Apr  3 23:42:26.359: %IOSXE_REDUNDANCY-6-PEER_LOST: Active detected chassis 2 is no
longer standby
```

On the standby controller, the following messages indicate that the configuration is being cleared:

```
WLC-stby#
*Apr  3 23:40:40.537: mcprp_handle_spa_oir_tsm_event: subslot 0/0 event=2
*Apr  3 23:40:40.537:     spa_oir_tsm subslot 0/0 TSM: during state ready, got event
3(ready)
*Apr  3 23:40:40.537: @@@ spa_oir_tsm subslot 0/0 TSM: ready -> ready
*Apr  3 23:42:25.041: Removing the startup config file on standby
*Apr  3 23:42:26.466: Calling HA configs clear on standby
*Apr  3 23:42:26.466: Clearing HA configurations
*Apr  3 23:42:27.499:  Successfully sent Set chassis mode msg for chassis 2.chasfs file
updated
```

Note: To unpair the SSO pair when using RMI based config, use the "no" version of the RMI configuration followed command by reload:

```
WLC(config)# no redun-management interface <VLAN> chassis 1 address <RMI IP of chassis 1>
chassis 2 address <RMI IP of chassis 2>
```

# LACP, PAGP support in SSO Pair

LACP protocol (IEEE 802.3ad) aggregates physical Ethernet interfaces by exchanging the Link Aggregation Control Protocol Data Units (LACPDUs) between two devices.

LACP, PAGP support is needed on SSO pair in order to have the ability to detect and monitor the link/connectivity failures on the standby controller and to have seamless transfer of client data traffic upon switchover (SSO). Prior to 17.1 only LAG mode ON was supported in SSO mode. With 17.1 both LACP (active and passive) and PAGP will be supported in SSO mode.

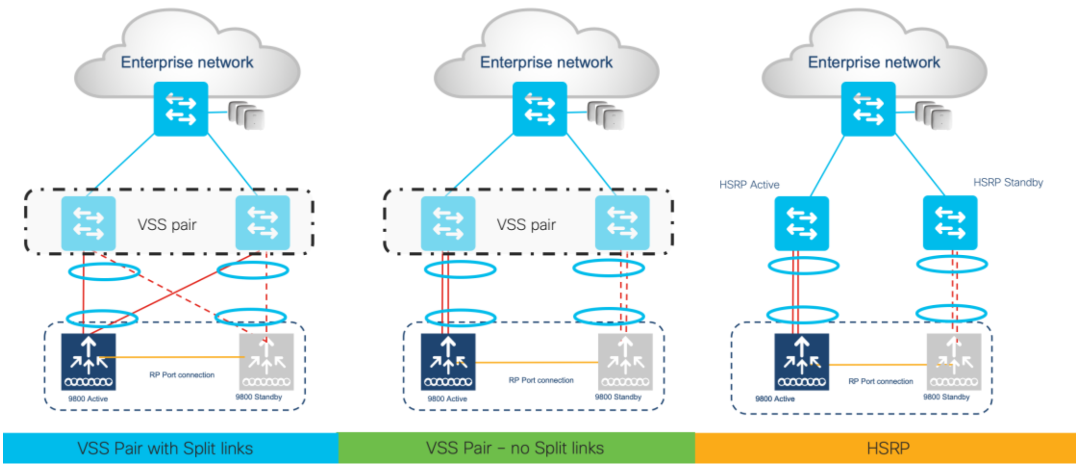
This feature is supported on Cisco Catalyst 9800-L, Cisco Catalyst 9800-40and Cisco Catalyst 9800-80 (including module ports).

Note: To unpair the SSO pair when using RMI based config, use the “no” version of the RMI configuration followed command by reload:

```
WLC(config)# no redun-management interface <VLAN> chassis 1 address <RMI IP of chassis 1>
chassis 2 address <RMI IP of chassis 2>
```

## Supported LACP, PAGP topologies

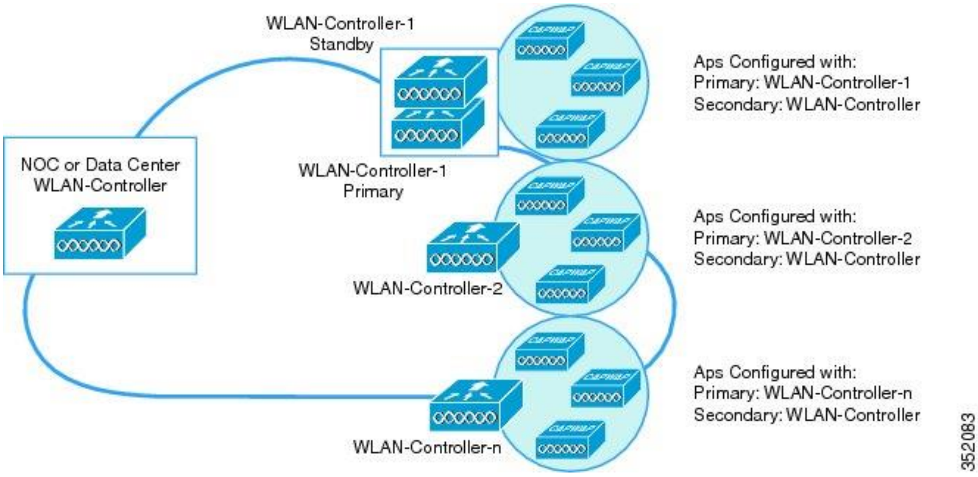
The following topologies are supported with SSO and LACP/PAGP




The following are not supported with LACP, PAGP topologies:

- Auto-LAG is not supported.
- C9800-CL and EWC on AP is not supported.
- L3 port-channel is not supported.

# N+1 with SSO Hybrid deployment




A hybrid topology of SSO redundant pair and N+1 primary, secondary and tertiary model is supported as shown above. The secondary controller at the DR site can be a Catalyst C9800-L, C9800-40 C9800-80 or C9800-CL Wireless controller. Access points failing back from Catalyst 9800 Wireless controller to CUWN controllers will re-download the code before joining the CUWN wireless controller and vice versa.