Understand mDNS on Catalyst 9800 Wireless Controller

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Introduction

This document describes how to configure the multicast Domain Name Services (mDNS) Gateway feature on Catalyst 9800 Wireless Controllers.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- mDNS Bonjour Protocol
- Catalyst 9800 Wireless Controller

Components Used

The information in this document is based on these software and hardware versions:

- C9800-CL-K9 version 16.12.1s
- WS-C3560CX-12PC-S
- C9117AXI-A
- Chromecast NC2-6A5-D
- MacbookPro 10.14.5

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Background Information

This document also explains how this special multicast traffic known as mDNS (or Bonjour) is handled by C9800 controllers.

mDNS Bridging

In the C9800 Architecture, mDNS (Bonjour Protocol) Bridging refers to the forwarding of Bonjour TTL=1 protocol packets within the same L2 broadcast domain. By default, the dataplane enables mDNS bridging functionality for packets received on both wired ports and wireless interfaces for each WLAN. This means that mDNS Bridging works without any specific configuration, and even Global mDNS does not need to be enabled.

However, if necessary, you can disable mDNS Bridging per WLAN by changing the mDNS mode in the WLAN settings. When Access Point (AP) Control and Provisioning of Wireless Access Points (CAPWAP) Multicast-Multicast mode is enabled, the C9800 bridges each mDNS packet to the AP multicast group configured on the controller. This ensures that wireless clients can receive the packets.

If CAPWAP Multicast-Multicast mode is not enabled, the C9800 creates a copy of each mDNS packet received and bridges it individually to every single AP via a CAPWAP unicast tunnel. In both scenarios, the C9800 also bridges the mDNS packets into the wired network at the VLAN of the client that originated the mDNS packet.

Configure

Configure Multicast Mode in Your C9800 Controller

Step 1. Navigate to **Configuration > Services > multicast**.

Step 2. Enable **Global Wireless Multicast** Mode.

Step 3. Set AP CAPWAP Multicast to **Multicast**.

Step 4. Assign Multicast IP in **AP CAPWAP IPv4 Multicast group Address** (range 224.0.0.0 to 239.255.255.255).

Step 5. AP CAPWAP IPv6 Multicast group Address is optional.

Step 6. Enable **Wireless mDNS Bridging**.

Step 7. Enable **IGMP Snooping**.

Configure Multicast Routing with PIM Sparse-dense Mode on a Layer 3 Switch

Step 1. Enable **Multicast routing** and **igmp snooping**.

```
Switch# config t
Switch(config)# ip multicast-routing
Switch(config)# interface vlan <vlan-id>
Switch(config-if)# ip igmp snooping
Switch(config)# end
```

Step 2. Enable **PIM** on the VLAN interfaces where you want to route multicast traffic.

```
Switch> enable
Switch# config t
Switch(config)# interface vlan <vlan-id>
Switch(config-if)# ip pim sparse-dense-mode
Switch(config-if)# end
```

Verify

Use this section in order to confirm that your configuration works properly.

C9800 Commands

C9800# show wireless multicast
C9800# show ap multicast mom

Layer3 Switch Commands

```
Switch# show ip pim interface
```

mDNS can work in C9800 without requiring any special configuration, as long as the devices involved in the mDNS handshake (such as a client and Chromecast) are on the same subnet. However, it is recommended to filter mDNS traffic using an mDNS Gateway, as explained in the next section.

mDNS Gateway

The mDNS Gateway feature introduced on AireOS Wireless Controllers is also supported on Catalyst 9800 Wireless Controllers from 16.11.1. This feature is disabled by default and you can enable/disable it per WLAN after you enable it globally.

The mDNS Gateway feature works the same way as in previous AireOS Wireless Controller, the C9800 listens for Bonjour services (mDNS advertisements and queries) on wired and wireless interfaces, caches these Bonjour services (AirPlay, AirPrint, Googlecast, and so on) advertised from each source/host in an internal database and is able to bridge those mDNS packets between different broadcast domains while it filters unneeded services and avoids their multicast flow in the network. This way you can have the sources and clients of such services in different subnets, and also control mDNS traffic in your network.

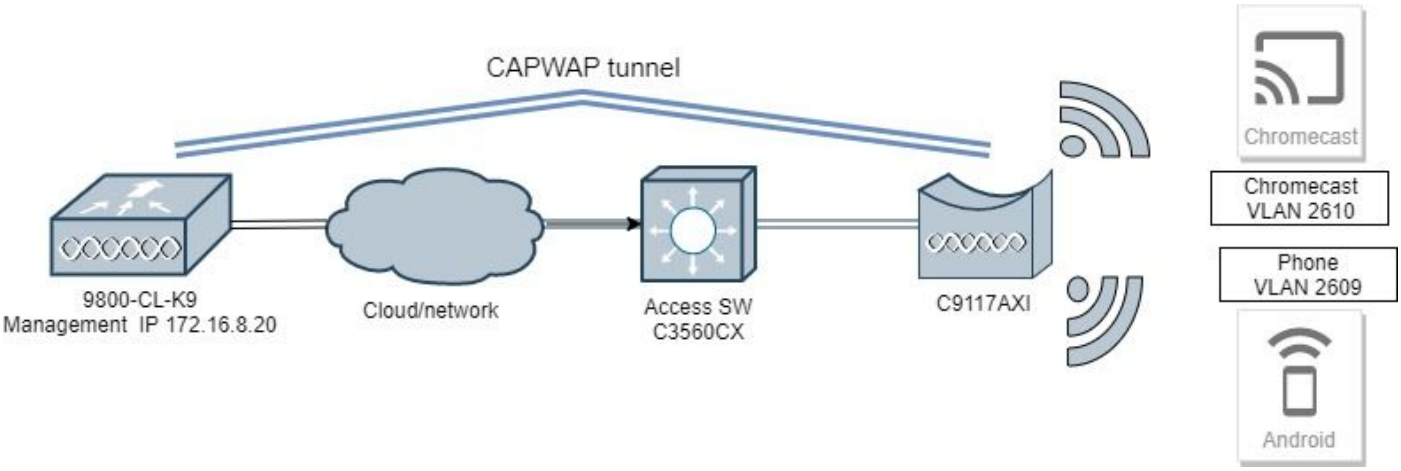
The C9800 that acts as mDNS Gateway replies to mDNS queries from clients (for cached services) sourcing these mDNS responses with the use of its IP address for the VLAN assigned to the client that asks for the service. This is why all VLANs on the C9800 controller where there are clients that require mDNS/Bonjour services must have a valid IP address configured at the Switched Virtual Interface (SVI).

For more information about the Bonjour/mDNS Gateway feature, refer to AireOS Wireless LAN Controller Bonjour Phase III Deployment Guide.

Configure

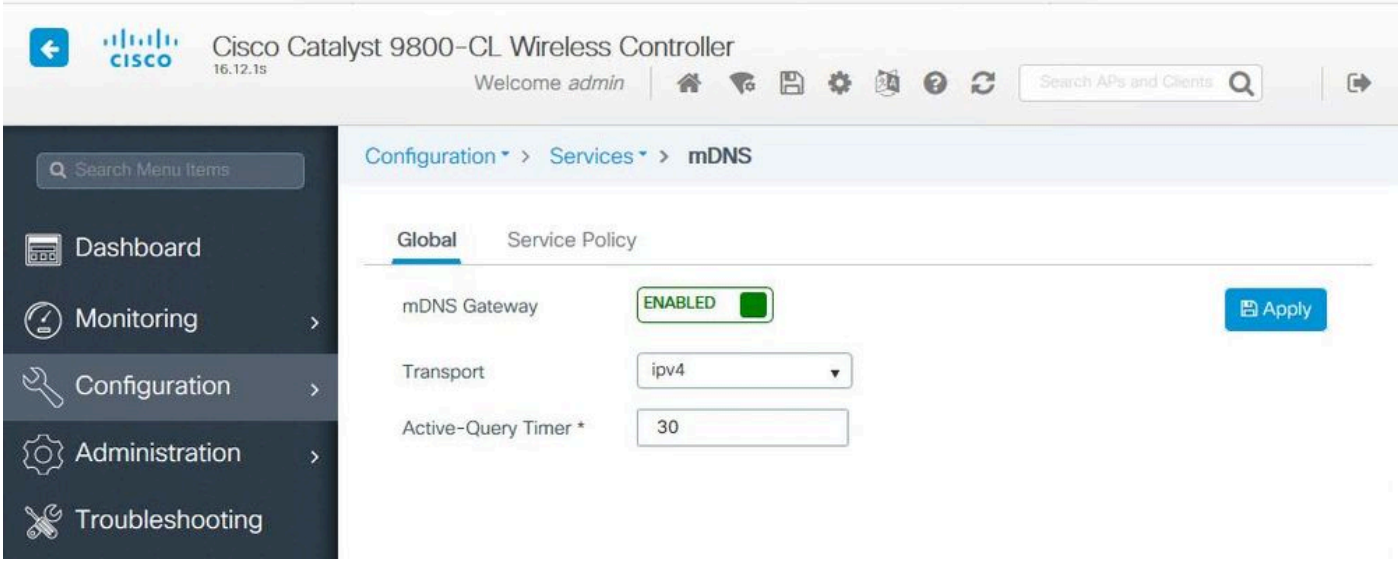
Network Diagram

This is the diagram of the example setup. The purpose is to allow wireless clients to use mDNS services from a different subnet, which requires mDNS Gateway as shown in the image.



Configure mDNS Gateway via Graphical User Interface

Step 1. In order to enable mDNS Gateway globally, navigate to **Configuration > Services > mDNS**. Under **Global**, switch to **Enable mDNS Gateway** and select **Apply** as shown in the image.



Step 2 (Optional). Configure a custom mDNS Service List for a custom Service Policy. If you want to use default mDNS Service List and Service Policy, move to Step 5.

Under **Configuration > Services > mDNS**, in the **Service Policy** tab, configure new Service Lists as required. C9800 has predefined common services used by most wireless devices. If you do not need a special (not available) service, you can create a List with predefined available Services, but if needed, you can also add new services (with Service Definition).

You need both, a Service List for Incoming (IN) direction and a Service List for Outgoing (OUT) direction (so required services are filtered when coming into the C9800 and when going out from it; hence, both lists are supposed to have the same services).

1. Define a Service List Name for IN services.

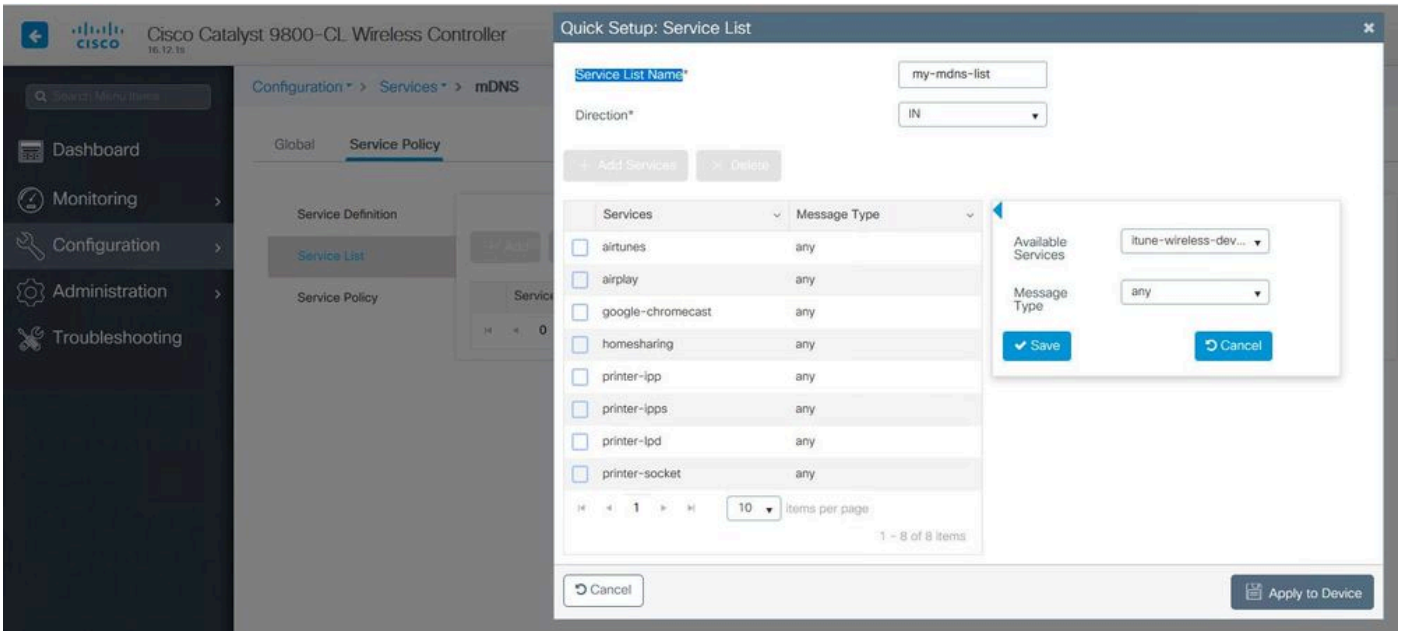
2. Choose **IN** direction.

3. Choose **Add Services**.

4. Available Services drop-down list is displayed. Choose the desired **Service** and **Message Type any**.

5. Repeat steps to add more services as required.

6. Choose **Apply to Device** as shown in the image.



1. Define a Service List Name for **OUT** services.

2. Choose **OUT** direction.

3. Move **Available Services** into the **Assigned Services** list.

5. Repeat steps to add more services as required.

6. Choose **Apply to Device** as shown in the image.



Tip: Upon migration task from previous AireOS WLC, you can build your new list based on AireOS default mDNS list.

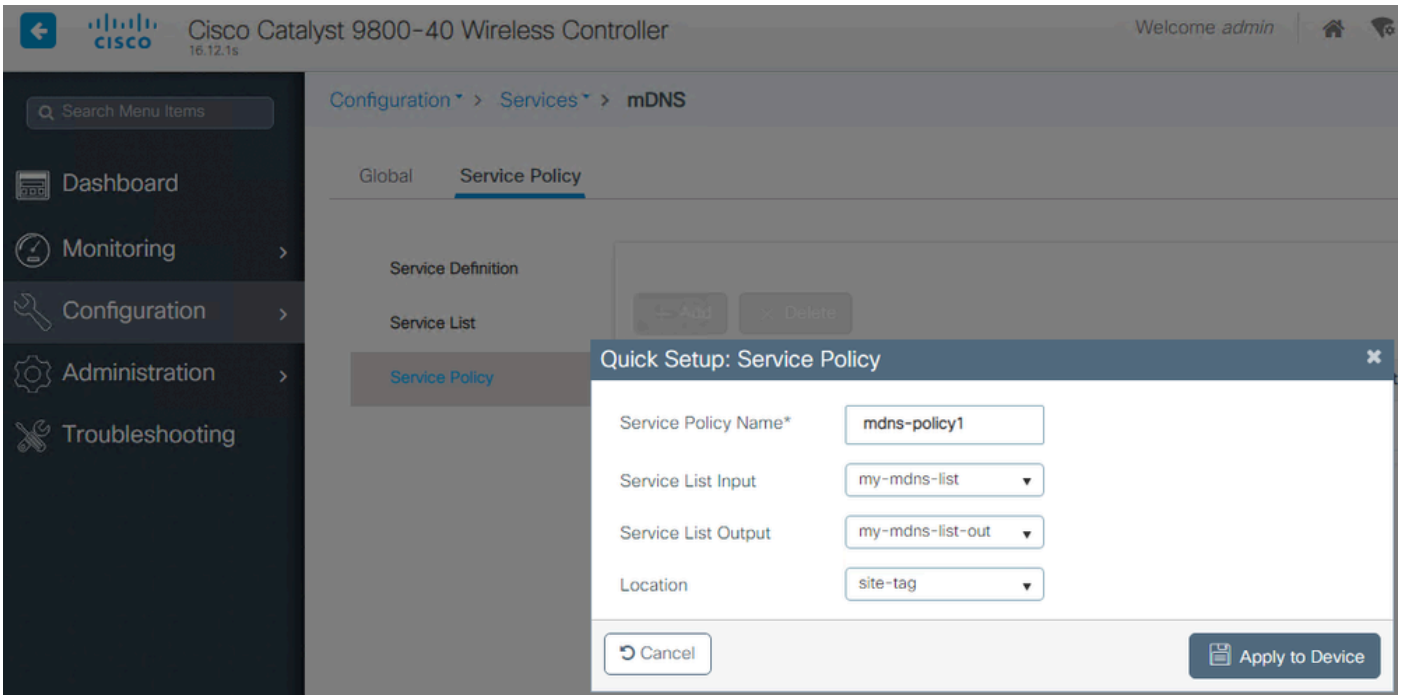
Step 3 (Optional). If you use a custom Service List (Step 2.), you need to define a custom mDNS Service Policy to be used with those customized Service Lists. Navigate to **Configuration > Services > mDNS > Service Policy**. Choose **Service Policy** and perform the next steps:

1. Define a **Service Policy Name**.

2. Add your custom Service List IN to **Service List Input**.

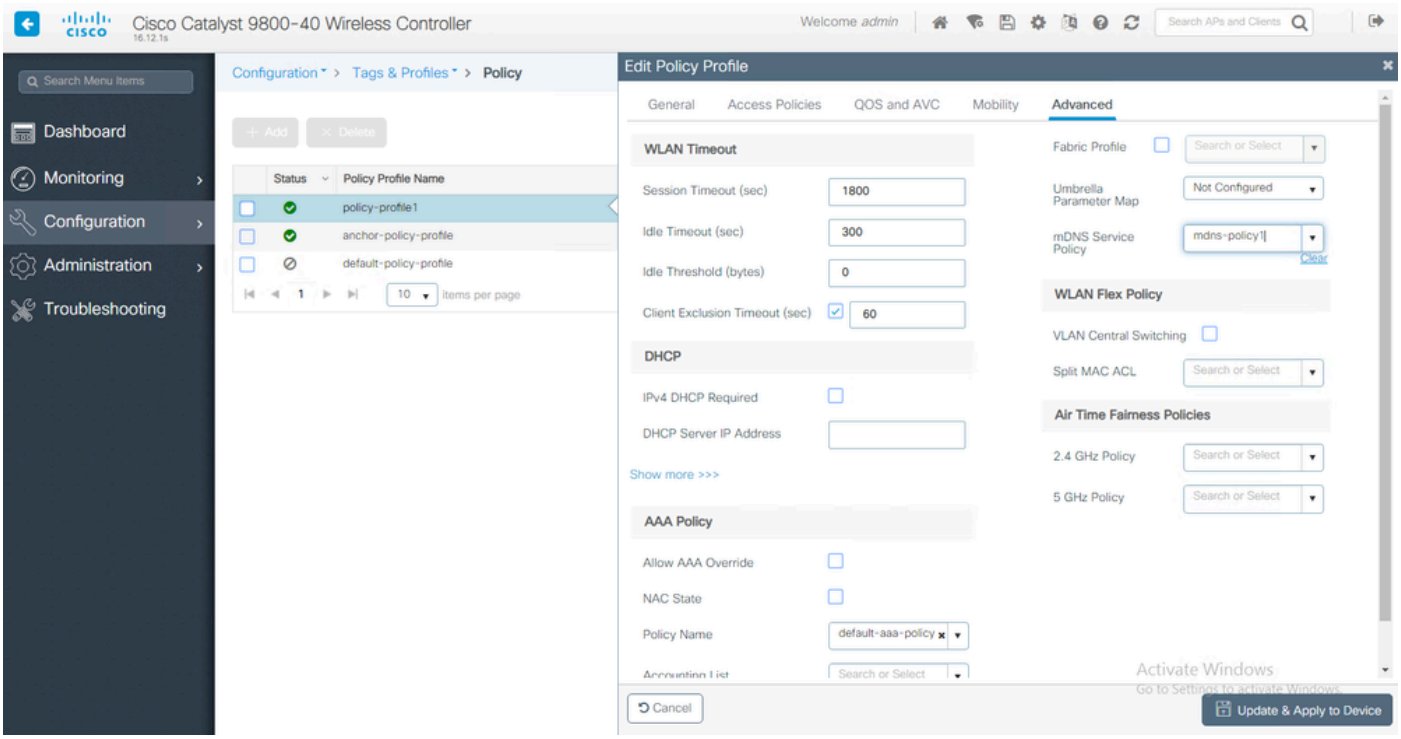
3. Add your custom Service List OUT to **Service List Output**.

4. Under **Location**, choose **site-tag**, **Location Specific Services (LSS)**, or your preferred available option. In this example, **site-tag** is used as shown in the image.

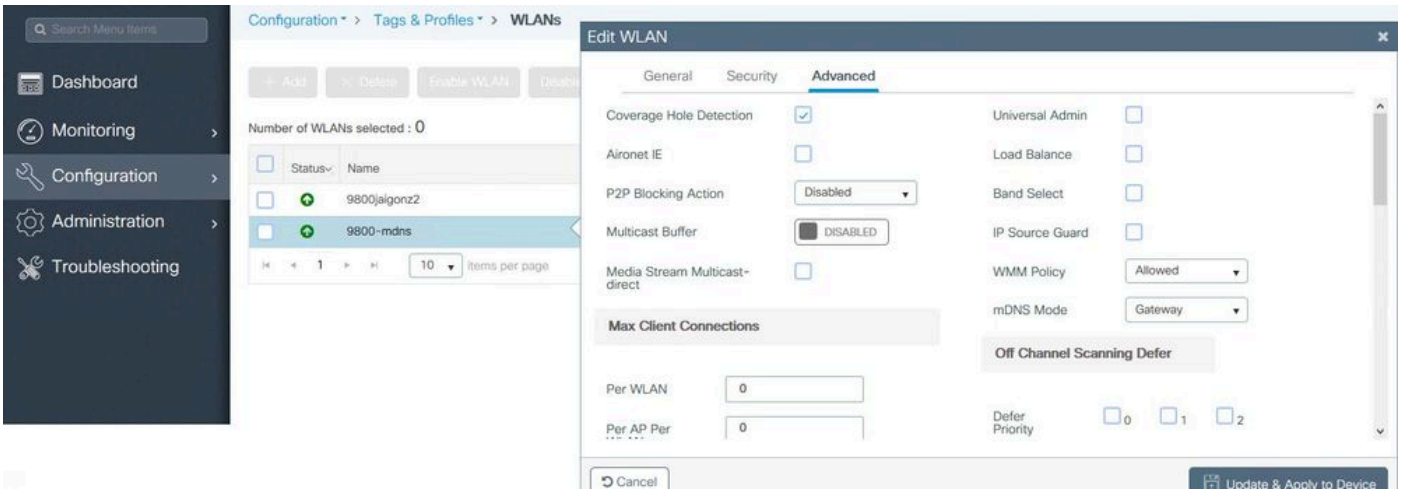


Step 4. (Optional). Passing the mDNS Service Policy to a Policy Profile.

Navigate to **Configuration > Tags & Profiles > Policy > Policy Profile Name > Advanced** and choose from the **mDNS Service Policy** drop-down list, the custom **mDNS Service Policy** previously created (in this example, mdns-policy1), and then choose **Update** and **Apply to Device** as shown in the image.



Step 5. Navigate to **Configuration > Tags & Profiles > WLANs > WLAN > Advanced** and choose **Gateway** on mDNS mode drop-down list and then **Update** and **Apply to Device**. The default mode is Bridging (you can use Drop to disable/drop mDNS services on the WLAN) as shown in the image.



If a custom Service Policy is not used, the WLAN uses the default-mdns-service-policy assigned to the Policy Profile, which uses the mDNS default-service-list. You can verify the list of default services with the use of this command:

```
C9800#show running-config mdns-sd default-service-list
============================================================================
                mDNS Default Service List
============================================================================
Service Name                                                      PTR Name
============================================================================
airtunes                        :                          _raop._tcp.local

airplay                         :                       _airplay._tcp.local

homesharing                     :                  _home-sharing._tcp.local

google-chromecast               :                    _googlecast._tcp.local

printer-ipp                     :                           _ipp._tcp.local

printer-ipps                    :                          _ipps._tcp.local

printer-lpd                     :                       _printer._tcp.local

printer-socket                  :                _pdl-datastream._tcp.local

itune-wireless-devicesharing2 :                 _apple-mobdev2._tcp.local
```

Configure mDNS Gateway via Command Line Interface

Step 1. Enable **mDNS** globally with the use of these commands:

```
C9800#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
C9800(config)#mdns-sd gateway
C9800(config-mdns-sd)#transport both
C9800(config-mdns-sd)#active-query timer 30
C9800(config-mdns-sd)#exit
C9800(config)#
```

Step 2 (optional). Configure a custom **Service List** for **IN services**, and add the different **services** required from the available list:

```
C9800(config)#mdns-sd service-list my-mdns-list IN
C9800(config-mdns-sl-in)#match ?
  airplay                          airplay
  airserver                        airserver
  airtunes                         airtunes
  amazon-fire-tv                   amazon-fire-tv
  apple-airprint                   apple-airprint
  apple-continuity                 apple-continuity
  apple-file-share                 apple-file-share
  apple-homekit                    apple-homekit
  apple-itunes-library             apple-itunes-library
  apple-itunes-music               apple-itunes-music
  apple-itunes-photo               apple-itunes-photo
  apple-keynote                    apple-keynote
  apple-rdp                        apple-rdp
  apple-remote-events              apple-remote-events
  apple-remote-login               apple-remote-login
  apple-screen-share               apple-screen-share
  apple-timecapsule                apple-timecapsule
  apple-timecapsule-mgmt           apple-timecapsule-mgmt
  apple-windows-fileshare          apple-windows-fileshare
  fax                              fax
  google-chromecast                google-chromecast
  homesharing                      homesharing
  itune-wireless-devicesharing2    itune-wireless-devicesharing2
  multifunction-printer            multifunction-printer
  phillips-hue-lights              phillips-hue-lights
  printer-ipp                      printer-ipp
  printer-ipps                     printer-ipps
  printer-lpd                      printer-lpd
  printer-socket                   printer-socket
  roku                             roku
  scanner                          scanner
  spotify                          spotify
  web-server                       web-server
  workstation                      workstation

C9800(config-mdns-sl-in)#match airtunes message-type any
C9800(config-mdns-sl-in)#exit
```

Configure a custom **Service List** for **OUT services**, and add the different **services** required from the available list:

```
C9800(config)#mdns-sd service-list my-mdns-list-out OUT
C9800(config-mdns-sl-out)#match ?
airplay airplay
airserver airserver
airtunes airtunes
amazon-fire-tv amazon-fire-tv
apple-airprint apple-airprint
apple-continuity apple-continuity
apple-file-share apple-file-share
```

```
apple-homekit apple-homekit
apple-itunes-library apple-itunes-library
apple-itunes-music apple-itunes-music
apple-itunes-photo apple-itunes-photo
apple-keynote apple-keynote
apple-rdp apple-rdp
apple-remote-events apple-remote-events
apple-remote-login apple-remote-login
apple-screen-share apple-screen-share
apple-timecapsule apple-timecapsule
apple-timecapsule-mgmt apple-timecapsule-mgmt
apple-windows-fileshare apple-windows-fileshare
fax fax
google-chromecast google-chromecast
homesharing homesharing
itune-wireless-devicesharing2 itune-wireless-devicesharing2
multifunction-printer multifunction-printer
phillips-hue-lights phillips-hue-lights
printer-ipp printer-ipp
printer-ipps printer-ipps
printer-lpd printer-lpd
printer-socket printer-socket
roku roku
scanner scanner
spotify spotify
web-server web-server
workstation workstation

C9800(config-mdns-sl-out)#match airplay
C9800(config-mdns-sl-out)#exit
```

Step 3 (optional). Create a **mDNS Service Policy** with the use of these commands:

```
C9800(config)#mdns-sd service-policy mdns-policy1
C9800(config-mdns-ser-pol)#location site-tag
C9800(config-mdns-ser-pol)#service-list my-mdns-list IN
C9800(config-mdns-ser-pol)#service-list my-mdns-list-out OUT
C9800(config-mdns-ser-pol)#exit
C9800(config)#
```

Step 4 (optional). Add the **mDNS Service Policy** to the Policy Profile with the use of these commands:

```
C9800(config)#wireless profile policy my-policy-profile
C9800(config-wireless-policy)#mdns-sd service-policy mdns-policy1
Warning! Ensure mDNS service policy is configured globally.
C9800(config-wireless-policy)#exit
```

Step 5. Enable **mDNS Gateway** in the WLAN with the use of these commands:

```
C9800(config)#wlan 9800-mdns
```

```
C9800(config-wlan)#shut
C9800(config-wlan)#mdns-sd gateway
Warning! Ensure global mDNS gateway is configured.
C9800(config-wlan)#no shut
C9800(config-wlan)#exit
```

Anchor-Foreign Scenario

When you implement the mDNS Gateway feature in a mobility Anchor WLAN, where both the Foreign and Anchor WLCs are C9800 and the wireless clients obtain their IP address from VLAN(s) in the Anchor controller, this is the behavior and the required setup:

- The Anchor controller is the one that acts as the mDNS Gateway, caching the services from all the devices connected to that Anchor WLAN and the respective VLAN, and responds for queries to those services cached.
- When it responds to queries, the C9800 Anchor controller can source responses and use its SVI IP address of the VLAN assigned to the client that asks for the service. Hence, all client VLANs requiring mDNS Services must have an IP address at the SVI in the Anchor.
- mDNS Gateway must be globally enabled on both the Foreign and Anchor WLCs.
- Both the Foreign and Anchor controllers can use the same mDNS Service Policy with same services (default or custom), which can be assigned to the Policy Profile linked to this Anchor WLAN. All these configuration settings are the same steps already covered in this document.
- The only configuration difference for a mobility Anchor WLAN setup is this. Navigate to **WLAN > Advanced** settings, the mDNS Mode, in the Foreign C9800 must be Bridging and in the Anchor C9800 it must be Gateway.

Verify

Use this section in order to confirm that your configuration works properly.

Use commands:

```
C9800#show mdns-sd summary
mDNS Gateway: Enabled
Active Query: Enabled
  Periodicity (in minutes): 30
Transport Type: Both IPv4 and IPv6
```

Review if WLC is actually caching mDNS services and which ones (in a mobility Anchor WLAN, this cache can be checked on the Anchor controller), by listing the mDNS cached services with this command, where you can see the source MAC address of the device that offers the service and even its IP address, along with other mDNS details:

```
C9800#show mdns-sd cache
------------------------------------------------------------ PTR Records ------------------------------
RECORD-NAME                                 TTL      TYPE  ID    CLIENT-MAC       RR-RECORD-DATA
-------------------------------------------------------------------------------------------------------
_googlecast._tcp.local                      4500     WLAN  2     48d6.d50c.a620   Chromecast-Ultra-6
```

```
------------------------------------------------------------ SRV Records ------------------------------
RECORD-NAME                                  TTL      TYPE  ID    CLIENT-MAC       RR-RECORD-DATA
-------------------------------------------------------------------------------------------------------
Chromecast-Ultra-687f65f66d478b2c787eac8bc7c9  4500     WLAN  2     48d6.d50c.a620   0 0 8009 687f65f6-

------------------------------------------------------------ A/AAAA Records ---------------------------
RECORD-NAME                                  TTL      TYPE  ID    CLIENT-MAC       RR-RECORD-DATA
-------------------------------------------------------------------------------------------------------
687f65f6-6d47-8b2c-787e-ac8bc7c9efad.local     4500     WLAN  2     48d6.d50c.a620   172.16.9.11

------------------------------------------------------------ TXT Records ------------------------------
RECORD-NAME                                  TTL      TYPE  ID    CLIENT-MAC       RR-RECORD-DATA
-------------------------------------------------------------------------------------------------------
Chromecast-Ultra-687f65f66d478b2c787eac8bc7c9  4500     WLAN  2     48d6.d50c.a620   [172]'id=687f65f66

C9800#
```

Troubleshoot

This section provides information you can use in order to troubleshoot your configuration.

If you need to check more details about all the exchanges that happen on the C9800, queries, caching behavior, responses, drops, errors, and more, gather these traces at the C9800 while you recreate the issue (connect the device that offers the service and the client asks for the service, let them try to discover the services required):

1. Run this command at C9800: **set platform software trace wncd <0-7> chassis active R0 mdns debug**
2. Reproduce the issue.
3. Finally, run this command to gather the traces enabled: **show platform software trace message wncd <0-7> chassis active R0**

Related Information

- Troubleshoot and Understand mDNS Gateway on Wireless LAN Controller (WLC)
- Technical Support & Documentation - Cisco Systems