Configuring Local Area Bonjour

Configuring Local Area Bonjour Domain for Wired Networks

Enabling mDNS Gateway on the Device

To configure mDNS on the device, follow these steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mdns-sd gateway** **Example:** `Device(config)# mdns-sd gateway`	Enables mDNS on the device and enters mDNS gateway configuration mode. Enter the following commands in mDNS gateway configuration mode to enable the respective functionalities: • **air-print-helper**: Enables IOS devices like iPADs to discover and use older printers that support Bonjour • **cache-memory-max**: Configures the percentage memory for cache

	Command or Action	Purpose
		• **ingress-client**: Configures Ingress Client Packet Tuners • **rate-limit**: Enables rate limiting of incoming mDNS packets • **service-announcement-count**: Configures maximum advertisements • **service-announcement-timer**: Configures advertisements announce timer periodicity • **service-query-count**: Configures maximum queries • **service-query-timer**: Configures query forward timer periodicity • **service-type-enumeration**: Configures service enumeration **Note** For **cache-memory-max**, **ingress-client**, **rate-limit**, **service-announcement-count**, **service-announcement-timer**, **service-query-count**, **service-query-timer**, and **service-type-enumeration** commands, you can retain the default value of the respective parameter for general deployments. Configure a different value, if required, for a specific deployment.
Step 4	**exit** **Example:** `Device(config-mdns-sd)# exit`	Exits mDNS gateway configuration mode.

Creating Custom Service Definition

Service definition is a construct that provides an admin friendly name to one or more mDNS service types or PTR Resource Record Name. By default, few built-in service definitions are already predefined and available for admin to use. In addition to built-in service definitions, admin can also define custom service definitions.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:**	Enables privileged EXEC mode. Enter your password, if prompted.

	Command or Action	Purpose
	`Device> enable`	
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mdns-sd service-definition** *service-definition-name* **Example:** `Device(config)# mdns-sd service-definition CUSTOM1`	Configures mDNS service definition. **Note** All the created custom service definitions are added to the primary service list. Primary service list comprises of a list of custom and built-in service definitions.
Step 4	**service-type** *string* **Example:** `Device(config-mdns-ser-def)# service-type _custom1._tcp.local`	Configures mDNS service type.
Step 5	Repeat step 4 to configure more than one service type in the custom service definition.	
Step 6	**exit** **Example:** `Device(config-mdns-ser-def)# exit`	Exit mDNS service definition configuration mode.

Creating Service List

mDNS service list is a collection of service definitions. To create a service list, follow these steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mdns-sd service-list** *service-list-name* {**in** | **out**} **Example:** `Device(config)# mdns-sd service-list VLAN100-list in`	Configures mDNS service list.

	Command or Action	Purpose
Step 4	**match** *service-definition-name* [**message-type** {**any** | **announcement** | **query**}] **Example:** `Device(config-mdns-sl-in)# match PRINTER message-type announcement`	Matches the service to the message type. Here, service-definition-name refers to the names of services, such as, airplay, airserver, airtunes, and so on. **Note** To add a service, the service name must be part of the primary service list. If the mDNS service list is set to IN, the applicable command syntax is: **match** *service-definition-name* [**message-type** {**any** | **announcement** | **query**}]. If the mDNS service list is set to OFF, the applicable command syntax is: **match** *service-definition-name*.
Step 5	**exit** **Example:** `Device(config-mdns-sl-in)# exit`	Exits mDNS service list configuration mode.

Creating Service Policy

A Service Policy that is applied to an interface specifies the allowed Bonjour service announcements or the queries of specific service types that should be processed, in ingress direction or egress direction or both. For this, the service policy specifies two service-lists, one each for ingress and egress directions. In the Local Area Bonjour domain, the same service policy can be attached to one or more Bonjour client VLANs; however, different VLANs may have different service policies.

To configure service policy with service lists, follow these steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mdns-sd service-policy** *service-policy-name* **Example:**	Configures mDNS service policy.

	Command or Action	Purpose
	`Device(config)# mdns-sd service-policy mdns-policy1`	

Step 4	**service-list** *service-list-name* {**in** | **out**}
	Example:
	`Device(config-mdns-ser-pol)# service-list VLAN100-list in`
	`Device(config-mdns-ser-pol)# service-list VLAN300-list out`
		Configures service lists for IN and OUT directions.

Step 5	**exit** **Example:** `Device(config-mdns-ser-pol)# exit`	Exits mDNS service policy configuration mode.

Associating Service Policy to an Interface

To configure mDNS on the device, follow these steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *interface-name* **Example:** `Device(config)# interface Vlan 601`	Enters interface mDNS configuration mode and enables interface configuration.
Step 4	**mdns-sd gateway** **Example:** `Device(config-if)# mdns-sd gateway`	Configures mDNS gateway on the interface. Enter the following commands in the interface mDNS gateway configuration mode to enable the respective functionalities: • **active-query**: Sets the time interval for SDG agent to refresh the active status of connected Bonjour client services. The timer value ranges from 60 to 120 seconds.

	Command or Action	Purpose
		Note This configuration is mandatory only on VLANs whose Bonjour policy is configured to accept Bonjour service announcements from connected Bonjour clients. If the VLAN is configured to only accept Bonjour queries but not Bonjour service announcements, this configuration is optional. • **service-instance-suffix**(Optional) : Appends the service instance suffix to any announced service name that is forwarded to the controller. • **service-mdns-query** [**ptr** | **all**] : Configures mDNS query request message processing for the specified query types. If the **service-mdns-query** command is used without any keyword, then all Bonjour query types (PTR, SRV, and TXT) are processed by default. It is recommended to use the **service-mdns-query ptr** command. • **service-policy** *policy-name*: Attaches the specified service policy to the VLAN. Bonjour announcements, and queries received by and sent from the VLAN are governed by the policies configured in the service policy. This configuration is mandatory for all VLANs. **Note** Service policies can only be attached at interface level. • **transport** [**all** | **ipv4** | **ipv6**] (Optional): Configures BCP parameter. It is recommended to use **transport ipv4** command, except in those networks where the Bonjour clients send only IPv6 announcements and queries.
Step 5	**exit** **Example:** `Device(config-if-mdns-sd)# exit`	Exits mDNS gateway configuration mode.

Configuring Local Area Bonjour Domain for Wireless Networks

The configuration of local area Bonjour on a switch that acts as the SDG Agent in a wireless network involves the same set of procedures that are used to configure local area Bonjour on a switch that acts as the SDG Agent in a wired network.

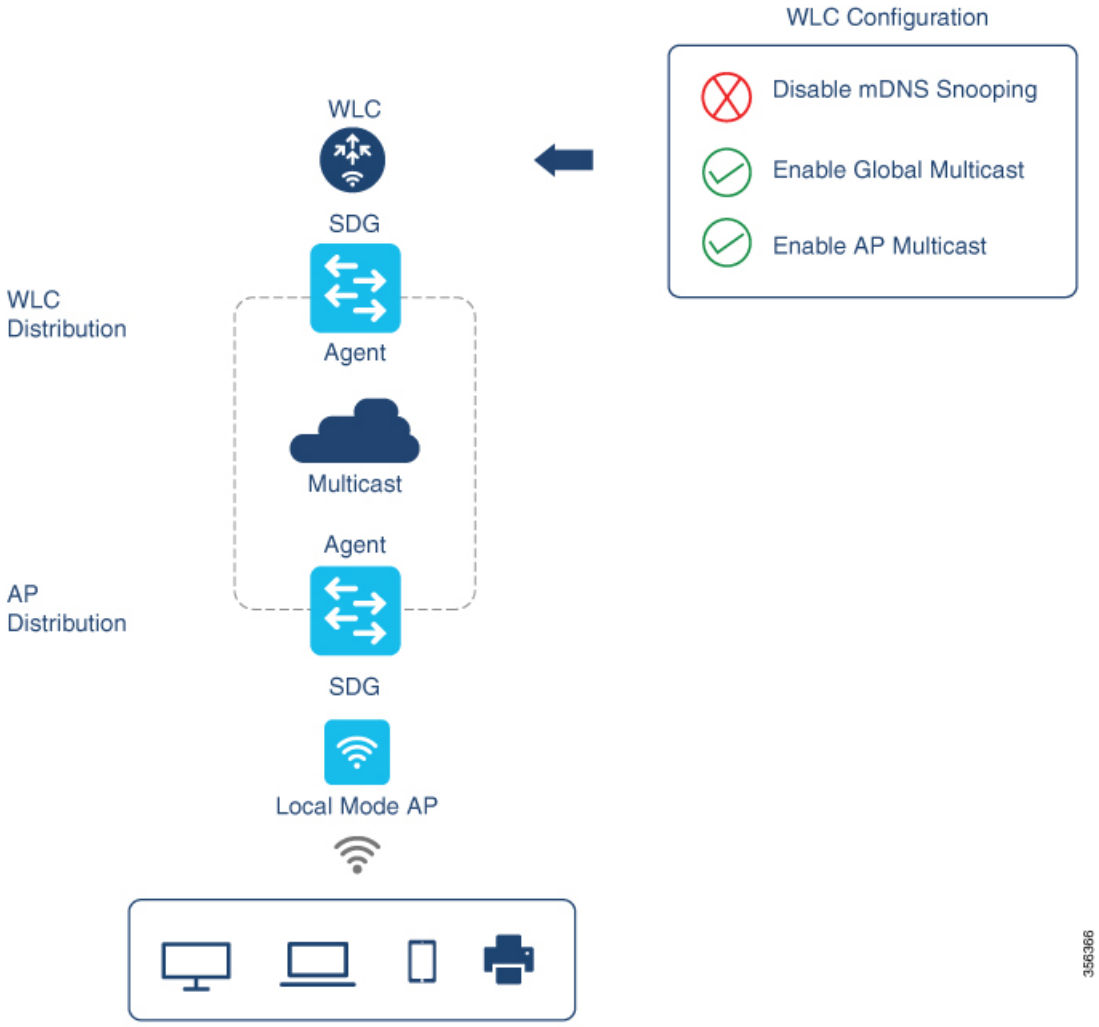
The Bonjour protocol operates on service announcements and queries. Each query or advertisement is sent to the Bonjour multicast address ipv4 224.0.0.251 (ipv6 FF02::FB). This protocol uses mDNS on UDP port 5353.

The address used by the Bonjour protocol is link-local multicast address and therefore is only forwarded to the local L2 network. As, multicast DNS is limited to an L2 domain for a client to discover a service it has to be part of the same L2 domain, This is not always possible in any large scale deployment or enterprise.

In order to address this issue, the Cisco Catalyst 9800 Series Wireless Controller acts as a Bonjour Gateway. The controller then listens for Bonjour services, caches these Bonjour advertisements (AirPlay, AirPrint, and so on) from the source or host. For example, Apple TV responds back to Bonjour clients when asked or requested for a service. This way you can have sources and clients in different subnets.

By default, the mDNS gateway is disabled on the controller. To enable mDNS gateway functionality, you must explicitly configure mDNS gateway using CLI or Web UI.

Figure below illustrates a prerequisite configuration for Wireless network to enable seamless communication between SDG-Agent switches and Wireless endpoints.



The Cisco WLC and Access Points by default prevents forwarding Layer 2 or Layer 3 Multicast frames between Wireless and Wired network infrastructure. The forwarding is supported with stateful capabilities enabled using AP Multicast. The network administrator must globally enable Multicast and configure unique Multicast Group to advertise in network. This multicast group is only required for Cisco Access-Points to enable Multicast over Multicast (MCMC) capabilities across the LAN network. The Bonjour solution does not require any Multicast requirements on Wireless Client VLAN; thus, it is optional and applicable only for other Layer 3 Multicast applications.

The core network must be configured with appropriate Multicast routing allowing AP's to join WLC Multicast Group. The Multicast configuration must be enabled on Cisco WLC management VLAN and on Cisco Access Point of their own respective distribution layer switch.

Enabling mDNS Gateway on the Device

To configure mDNS on the device, follow these steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mdns-sd gateway** **Example:** `Device(config)# mdns-sd gateway`	Enables mDNS on the device and enters mDNS gateway configuration mode. Enter the following commands in mDNS gateway configuration mode to enable the respective functionalities: • **air-print-helper**: Enables IOS devices like iPADs to discover and use older printers that support Bonjour • **cache-memory-max**: Configures the percentage memory for cache • **ingress-client**: Configures Ingress Client Packet Tuners • **rate-limit**: Enables rate limiting of incoming mDNS packets • **service-announcement-count**: Configures maximum advertisements • **service-announcement-timer**: Configures advertisements announce timer periodicity • **service-query-count**: Configures maximum queries • **service-query-timer**: Configures query forward timer periodicity • **service-type-enumeration**: Configures service enumeration

	Command or Action	Purpose
		Note For **cache-memory-max**, **ingress-client**, **rate-limit**, **service-announcement-count**, **service-announcement-timer**, **service-query-count**, **service-query-timer**, and **service-type-enumeration** commands, you can retain the default value of the respective parameter for general deployments. Configure a different value, if required, for a specific deployment.
Step 4	**exit** **Example:** `Device(config-mdns-sd)# exit`	Exits mDNS gateway configuration mode.

Creating Custom Service Definition

Service definition is a construct that provides an admin friendly name to one or more mDNS service types or PTR Resource Record Name. By default, few built-in service definitions are already predefined and available for admin to use. In addition to built-in service definitions, admin can also define custom service definitions.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mdns-sd service-definition** *service-definition-name* **Example:** `Device(config)# mdns-sd service-definition CUSTOM1`	Configures mDNS service definition. **Note** All the created custom service definitions are added to the primary service list. Primary service list comprises of a list of custom and built-in service definitions.
Step 4	**service-type** *string* **Example:** `Device(config-mdns-ser-def)# service-type _custom1._tcp.local`	Configures mDNS service type.

	Command or Action	Purpose
Step 5	Repeat step 4 to configure more than one service type in the custom service definition.	
Step 6	**exit** **Example:** `Device(config-mdns-ser-def)# exit`	Exit mDNS service definition configuration mode.

Creating Service List

mDNS service list is a collection of service definitions. To create a service list, follow these steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mdns-sd service-list** *service-list-name* {**in** | **out**} **Example:** `Device(config)# mdns-sd service-list VLAN100-list in`	Configures mDNS service list.
Step 4	**match** *service-definition-name* [**message-type** {**any** | **announcement** | **query**}] **Example:** `Device(config-mdns-sl-in)# match PRINTER message-type announcement`	Matches the service to the message type. Here, service-definition-name refers to the names of services, such as, airplay, airserver, airtunes, and so on. **Note** To add a service, the service name must be part of the primary service list. If the mDNS service list is set to IN, the applicable command syntax is: **match** *service-definition-name* [**message-type** {**any** | **announcement** | **query**}]. If the mDNS service list is set to OFF, the applicable command syntax is: **match** *service-definition-name*.

	Command or Action	Purpose
Step 5	**exit** **Example:** `Device(config-mdns-sl-in)# exit`	Exits mDNS service list configuration mode.

Creating Service Policy

A Service Policy that is applied to an interface specifies the allowed Bonjour service announcements or the queries of specific service types that should be processed, in ingress direction or egress direction or both. For this, the service policy specifies two service-lists, one each for ingress and egress directions. In the Local Area Bonjour domain, the same service policy can be attached to one or more Bonjour client VLANs; however, different VLANs may have different service policies.

To configure service policy with service lists, follow these steps:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mdns-sd service-policy** *service-policy-name* **Example:** `Device(config)# mdns-sd service-policy mdns-policy1`	Configures mDNS service policy.

Step 4	**service-list** *service-list-name* {**in** | **out**}
	Example:
	`Device(config-mdns-ser-pol)# service-list VLAN100-list in`
	`Device(config-mdns-ser-pol)# service-list VLAN300-list out`
		Configures service lists for IN and OUT directions.

Step 5	**exit** **Example:** `Device(config-mdns-ser-pol)# exit`	Exits mDNS service policy configuration mode.

Associating Service Policy with Wireless Profile Policy

A default mDNS service policy is already attached once the wireless profile policy is created. Use the following steps to override the default mDNS service policy with any of your service policy:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**wireless profile policy** *profile-policy-name* **Example:** `Device(config)# wireless profile policy default-policy-profile`	Configures wireless profile policy.
Step 4	**mdns-sd service-policy** *custom-mdns-service-policy* **Example:** `Device(config-wireless-policy)# mdns-sd service-policy custom-mdns-service-policy`	Associates an mDNS service policy with the wireless profile policy. The default mDNS service policy name is **default-mdns-service-policy**.
Step 5	**exit** **Example:** `Device(config-wireless-policy)# exit`	Exits wireless profile policy configuration mode.

Configuration Examples for Local Area Bonjour and Wide Area Bonjour

The following example shows how to create a service list for wired and wireless Local Area Bonjour, and Wide Area Bonjour:

```
Device> enable
Device# configure terminal
Device(config)# mdns-sd service-list LOCAL-AREA-SERVICES-IN IN
Device(config-mdns-sl-in)# match apple-file-share
Device(config-mdns-sl-in)# match google-chromecast
Device(config-mdns-sl-in)# match apple-windows-fileshare
Device(config-mdns-sl-in)# match airplay
Device(config-mdns-sl-in)# match airtunes
```

```
Device(config-mdns-sl-in)# exit
Device(config)# mdns-sd service-list LOCAL-AREA-SERVICES-IN OUT
Device(config-mdns-sl-in)# match airplay
Device(config-mdns-sl-in)# match airtunes
Device(config-mdns-sl-in)# match google-chromecast source-interface 101-103,200,203
Device(config-mdns-sl-in)# match apple-file-share source-interface 101
Device(config-mdns-sl-in)# match apple-airprint source-interface 101-102
Device(config-mdns-sl-in)# exit
```

The following example shows how to associate a service policy to an interface for wired and wireless Local Area Bonjour, and Wide Area Bonjour:

```
Device> enable
Device# configure terminal
Device(config)# interface Vlan101
Device(config-if)# ip address 10.151.1.14 255.255.255.240
Device(config-if)# ip helper-address 10.251.3.1
Device(config-if)# mdns-sd gateway
Device(config-if-mdns-sd)# service-policy LOCAL-AREA-POLICY
Device(config-if-mdns-sd)# active-query timer 60
Device(config-if-mdns-sd)# transport ipv4
Device(config-if-mdns-sd)# service-mdns-query ptr
Device(config-if-mdns-sd)# exit
```

Verifying Local and Wide Area Bonjour Domains

Verifying Service Discovery Gateway

The following is a sample output of the **show mdns-sd service-list** *service-list-name* {**in** | **out**} command.

```
Name    Direction  Service  Message-Type    Source
================================================================================
VLAN100-list        In        Printer      Announcement       -
          In        Airplay  Query       -
          In        CUSTOM1        Any   -
VLAN300-list  Out   Printer      Announcement     Vl200
```

The following is a sample output of the **show mdns-sd service-definition***service-definition-name* **service-type** {*custom* | *built-in*} command.

```
Service    PTR       Type
================================================================================
apple-tv        _airplay._tcp.local  Built-In
                           _raop._tcp.local
apple-file-share     _afpovertcp._tcp.local          Built-In
CUSTOM1         _custom1._tcp.local       Custom
CUSTOM2         _customA._tcp.local             Custom
                           _customA._tcp.local
```

The following is a sample output of the **show mdns-sd** *service-policy-name* **interface** *interface-name* command.

```
Name   Service-List-In   Service-List-Out
================================================
mdns-policy-1  VLAN100-list   VLAN300-list
mdns-policy-2  VLAN400-list   VLAN400-list
```

The following is a sample output of the **show mdns-sd summary** [**interface** *interface-name*] command.

```
Global mDNS Gateway
=======================================
mDNS Gateway           : Enabled
Rate Limit                    : 60 PPS (default)
AirPrint Helper            : Disabled

Interface  :  Vlan601
=======================================
mDNS Gateway             : Enabled
mDNS Service Policy      : policy1
Active Query                   : Enabled
                                        : Periodicity 60 Seconds
Transport Type               : Both IPv4 & IPv6
Service Instance Suffix  : ghalwasi
mDNS Query Type          : ALL

Interface  :  Vlan602
=======================================
mDNS Gateway             : Enabled
mDNS Service Policy      : int602
Active Query                   : Enabled
                                        : Periodicity 100 Seconds
Transport Type               : Both IPv4 & IPv6
Service Instance Suffix  : 602
mDNS Query Type          : ALL
```

Verifying Controller

The following is a sample output of the **show mdns controller summary** command.

```
Device# show mdns controller summary

Controller Summary
===================================
 Controller Name  :   DNAC-BONJOUR-CONTROLLER
 Controller IP    :   10.104.52.241
 State            :   UP
 Port             :   9991
 Interface        :   Loopback0
 Filter List      :   policy1
 Dead Time        :   00:01:00
```

The following is a sample output of the **show mdns controller export-summary** command.

```
Device# show mdns controller export-summary

Controller Export Summary
=========================
 Controller IP    :   10.104.52.241
 State            :   UP
 Filter List      :   policy1
 Count            :   100
 Delay Timer      :   30 seconds
 Export           :   300
 Drop             :   0
 Next Export      :   00:00:01
```

The following is a sample output of the **show mdns controller statistics** command.

```
Device# show mdns controller statistics

Total BCP message sent           : 47589
  Total BCP message received       : 3
  Interface WITHDRAW messages sent : 0
  Clear cache messages sent        : 0
  Total RESYNC state count         : 0
  Last successful RESYNC           : Not-Applicable

  Service Advertisements:
   IPv6 advertised                 : 0
   IPv4 advertised                 : 300
   Withdraws sent                  : 0
   Advertisements Filtered         : 0
   Total service resynced          : 0

  Service Queries:
   IPv6 queries sent               : 0
   IPv6 query responses received   : 0
   IPv4 queries sent               : 0
   IPv4 query responses received   : 0
```

The following is a sample output of the **show mdns controller detail** command.

```
Device# show mdns controller detail

Controller : DNAC-BONJOUR-CONTROLLER
 IP : 10.104.52.241, Dest Port : 9991, Src Port : 0, State : UP
 Source Interface : Loopback0, MD5 Disabled
 Hello Timer 0 sec, Dead Timer 0 sec, Next Hello 00:00:00
 Uptime 00:00:00
Service Announcement :
 Filter : policy1
 Count 100, Delay Timer 30 sec, Pending Announcement 0, Pending Withdraw
 0
 Total Export Count 300, Next Export in 00:00:16
Service Query :
```

```
 Query Suppression Disabled
 Query Count 50, Query Delay Timer 15 sec, Pending 0
 Total Query Count 0, Next Query in 00:00:01
```

Verifying Local Area Bonjour for Wired and Wireless Networks

The following is a sample output of the **show run** command.

```
mdns-sd gateway
 rate-limit 100
 service-query-count 100
 service-announcement-count 100


mdns-sd service-definition custom1
 service-type _airplay._tcp.local
 service-type _raop._tcp.local
 service-type _ipp._tcp.local
 service-type _afpovertcp._tcp.local
 service-type _nfs._tcp.local
 service-type _ssh._tcp.local
 service-type _dpap._tcp.local
 service-type _daap._tcp.local
 service-type _ichat._tcp.local
 service-type _presence._tcp.local
 service-type _http._tcp.local
 service-type _ipps._tcp.local
 service-type _printer._tcp.local
 service-type _smb._tcp.local
 service-type _ftp._tcp.local


mdns-sd service-list list1 IN
 match custom1
mdns-sd service-list list2 OUT
match custom1


mdns-sd service-policy policy1
service-list list1 IN
service-list list2 OUT


service-export mdns-sd controller APIC-EM
controller-address 99.99.99.10
controller-port 9991
controller-service-policy policy1 OUT
controller-source-interface Loopback0
```