



Service Discovery Gateway

The Service Discovery Gateway feature enables multicast Domain Name System (mDNS) to operate across Layer 3 (L3) boundaries. An mDNS gateway will be able to provide transport for service discovery across L3 boundaries by filtering, caching and extending services from one subnet to another. Prior to implementation of this feature, mDNS was limited in scope to within a subnet due to the use of link-local scoped multicast addresses. This feature enhances Bring Your Own Device (BYOD).



Caution

Extension of services should be done with proper care. Generally, only specific services should be extended. Service names should be unique in the network to avoid duplicate name conflicts.



Note

Service Discovery Gateway features have been incrementally added, in phases. For example, features added for phase three are:

- De-congestion of incoming mDNS traffic using rate limiting mechanism.
- Redistribution of messages when services are withdrawn, to improve mDNS cache efficiency and to avoid message loops.
- A filter criterion (a **match** command) for services available and learnt on a specific interface.
- Enabling and disabling of periodic browsing of services on specific interfaces; previously, services could be browsed on all interfaces of a device but not specific interfaces.

See [Feature Information for Service Discovery Gateway](#) section to check feature availability for your platform release version.

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Information About Service Discovery Gateway

Service Announcement Redistribution and Service Extension

Redistribution of announcements is the actual forwarding of announcements and query responses while service extension is the capability of proxying services between subnets. The actual replication of the service announcement can help to speed up the visibility of newly announced services and also a service's withdrawal if a service or device is turned off.

**Note**

Extension of services such as printers or Apple TV works fine without actual replication of service announcements. The Service Discovery Gateway will cache announcements, queries and their responses in the cache. If another device queries for a service, the Service Discovery Gateway will be able to provide an answer from its cache.

Enable the **redistribution mDNS-sd** command only on a per-interface basis, and only if it is actually required. You must ensure that there are no loops in the network topology corresponding to the interface for which service announcement redistribution is being enabled. A loop can lead to a broadcast storm.

Redistribution of service announcement information cannot be done globally. You can enable redistribution of service information only at the interface level.

The **withdraw-only** option

When you use this option, a service withdrawal announcement is sent to other devices when a service is removed, and the service is removed from the device's mDNS cache too. When you use the **withdraw-only** option, redistribution is only enabled for service withdrawal and not for the service announcements. For example, if the service withdrawal announcement option for a printer service is enabled, announcements about the printer service availability are not sent on other subnets. However, if the printer service is removed, withdrawal announcements will be sent to other device interfaces where the printer service is learnt.

If you do not use this option, the service will still be seen as available on other Service Discovery Gateway enabled device interfaces which have queried for this service earlier and stored in the mDNS cache. As a result, users connected to other SDG-enabled devices will not see the withdrawn service as available.

**Note**

- In scenarios when an active query is enabled, message loops are created because the original gateway relearns the service from another gateway even after the service has been withdrawn. To avoid such situations, this option was introduced.
- The **withdraw-only** option is not available for wireless devices.

The **withdraw-only** option is available on specific release versions. See [Feature Information for Service Discovery Gateway](#) section to check feature availability for your platform release version.

Extending Services Across Subnets—An Overview

You need to enable a multicast Domain Name System (mDNS) gateway to extend services across subnet boundaries. You can enable an mDNS gateway for a device or for an interface. You must enable routing of services for the device before enabling it at the interface level. After the mDNS gateway is enabled on a device or interface, you can extend services across subnet boundaries.

To extend services across subnets, you must do the following:

- 1 [Set Filter Options to Extend Services Across Subnets](#)—You can allow services such as printer services to be accessed across subnets. If printer x is available on interface 1, users on interface 2 can use printer x without configuring the printer on their local systems.
- 2 [Extend Services Across Subnets](#)—The filter created in Step 1 should be applied on the interfaces 1 and 2. Only then can users on other interfaces access the printer service.

For the sample scenario where a printer service is accessible by clients on other interfaces, you must apply these filters:

- On the interface where the printer service is available (IN filter)—You want to allow the printer service *into* the mDNS cache, so that it can be accessed by users on other subnets.
- On the interface where the printer service is available (OUT filter)—Since clients on other interfaces will access the service (printer x, for example), you should allow queries coming from the device (OUT filter, from the device's point of view).
- On each interface where clients reside (IN filter)—For clients on other interfaces (subnets) wanting to access the printer service, you must allow queries from users into the mDNS cache (IN filter).



Remember

Applying the IN filter means that you are allowing the printer service into the device mDNS cache, and other interfaces can access it. Applying the OUT filter means that you are allowing the queries out of the cache so that queries from clients on other interfaces can reach the printer interface. On other client-facing interfaces, the IN filter is applied to allow queries in.



Note

- Filters can be applied at the global level and at the interface level. Filters applied at the interface level takes precedence over the filters applied at the global level.
 - The term 'service discovery information' refers to services (printer services, etc), queries (queries for printer services, etc, from one interface to the other), announcements (printer service is removed, etc), and service-instances (a specific service—printer x, Apple TV 3, etc) that you want to extend across subnets.
-

De-congestion of Incoming mDNS Traffic Using the Rate Limiting Mechanism

Incoming mDNS packets are subjected to rate limiting by the mDNS process. The mDNS process maintains statistics, including the rate of incoming and out going messages. You can configure a rate limit value in the range 1-100 packets per second (p/s).

Set Filter Options to Extend Services Across Subnets

You can set filter options to allow services such as printer services into or out of a device or interface. You can also permit or prohibit queries, announcements, services learnt from an interface, specific service–instances, and locations. Use the **service-list mdns-sd** command to create a service-list and set filter options.

You need to create a service-list and use filter options within it. While creating a service-list, use one of the following options:

- The **permit** option permits specific services, announcements and service–instances across subnets.
- The **deny** option restricts services, announcements and service–instances from being transported across subnets.
- The **query** option is provided to browse services. For example, if you want to browse printer services periodically, then you can create a service-list with the **query** option, and add the printer service to the query. When you set a period for the query, the service entries are refreshed in the cache memory.

You must mention a sequence number when using the **permit** or **deny** option. The filtering is done sequentially, in the ascending order. The same service-list can be associated with multiple sequence numbers. Within a sequence, match statements (commands) must be used to specify what needs to be filtered. Generally, match statements are used to filter queries (for example, queries from clients to find printer and fax services), announcements (new service is added, and so on), specific service–instances, types of service such as printer services (so that the service is allowed into the cache for use), services available for a specific interface (printers and Apple TVs associated with a VLAN), and locations.



Note

A service-list by itself does not contain any services. You must specify a service type in the match statement when setting filter options to allow or prohibit services. (For example, '_ipp._tcp' is the service type for an IPP printing service running over TCP).

Sample scenario - Consider a device is in a client segment. The goal is to allow the following on the device:

- All queries from clients to the device.
- Printer services to clients on other subnets.

The following example explains how to achieve the goal:

```
!
service-list mdns-sd mixed permit 10
  match message-type query
!
service-list mdns-sd mixed permit 20
  match message-type announcement
  match service-type _ipps._tcp.local
!
```

In the above example, a service-list called 'mixed' is created and the **permit** option is used twice—to filter queries and to filter printer services and announcements. The filtering is done in the sequence given below:

- Sequence 10 - A match statement is used to filter queries.
- Sequence 20 - Match statements are used to filter announcements and printer services.

The match statement in Sequence 10 sets a filter for queries on the device, but does not specify that queries be allowed *into* the device. To allow queries from clients, the filter needs to be applied on the interface in the IN direction. The example is displayed in the [Extend Services Across Subnets](#) section.

Similarly, the match statements in Sequence 20 sets a filter for announcements and printer services on the device, but does not specify that they be allowed *into* the device. To allow announcements and printer services into the device, the filter needs to be applied on the required interfaces in the IN direction. The example is displayed in the [Extend Services Across Subnets](#) section.

**Note**

To filter services learnt for an interface, use the **match learnt-interface** command. This command was included from a specific release onwards. See the [Feature Information for Service Discovery Gateway](#) section to check its availability for your platform release version.

If neither the **permit** option nor the **deny** option is used, the default action is to disallow services from being transported to other subnets.

Browsing services periodically—Service-lists of the type **query** can be used to browse services. Such queries are called active queries. Active queries periodically send out requests for the services specified within the query on all interfaces. As services have a specific Time to Live (TTL) duration, active queries can help to keep services fresh in the cache memory.

Customizing browsing of services

- If you enable browsing of printer services globally, printer services will be periodically queried on all interfaces. If you do not want one or more interfaces to browse for the printer service, use the **disable** option on the interface. Printer services will not be browsed on the interface. The **disable** option can only be used for specific interfaces.
- You can enable browsing of services for specific interfaces too. For example, you can enable periodic browsing for printer services only on interfaces where you have printers connected.
- When you create a service-list for browsing services, ensure that you plan what services you want to include in a service-list. When the **disable** option is used on an interface, browsing of all services within the service-list will be discontinued on the interface.

**Note**

The **disable** option and the option to enable browsing of services for specific interfaces have been included from a specific release onwards. See the [Feature Information for Service Discovery Gateway](#) section to check feature availability for your platform release version.

In the following example, a service-list named 'active-query' is created and the service-list is of the type **query**. Services such as printer services are specified within the query, and these are the services that we want to extend. Typically, these services would match the services that have been configured as 'permitted' services in the IN filter.

```
!
service-list mdns-sd active-query query
  service-type _universal._sub._ipp._tcp
  service-type _ipp._tcp.local
  service-type _ipps._tcp.local
  service-type _raop._tcp.local
!
```

The purpose of an active query and a query associated with a match statement is different. When you enable an active query, services are browsed periodically. A query is used in a match statement to permit or prohibit queries (not active queries) on the interface.

**Note**

- Service-list creation can only be used globally and cannot be used at the interface level.
- You can create a new service-instance of a specific service-type using the **service-instance mdns-sd** command.
- A service end-point (such as a printer, fax, and so on) sends unsolicited announcements when a service starts up. After that, it sends unsolicited announcements whenever a network change event occurs (such as, an interface coming up or going down, and so on). The device always responds to queries.

**Remember**

Filtering only sets filter options and specifies that certain services need to be filtered. You must *apply* the filters on an interface for the services, queries, or announcements to actually be permitted or prohibited on the interface. To know about applying filters and the other available service discovery configuration options, refer the [Extend Services Across Subnets](#) section.

Extend Services Across Subnets

You must have set filter options for the device before extending services across subnets. If you have set filter options for specific services and other service discovery information to be allowed, prohibited or queried periodically, you can apply the filters for an interface.

Before applying filters, note the following:

- You must enable multicast Domain Name System (mDNS) on a device to apply filter options. You can enable mDNS using the command **service-routing mdns-sd**
- Since you might want to allow services into the device or prohibit services from being learnt on an interface, you must apply the filter in the needed direction. The options **IN** and **OUT** perform the desired actions on the interface.
- Typically, a service-policy is applied on an interface. Global service-policies are optional and affect all L3 interfaces.

Sample scenario - A device is in a client segment and the goal is to allow the following between the device interfaces:

- All queries from clients to the device.
- Printer services.

A note about filter options - Filter options have been set for the above scenario by creating a service-list called 'mixed' and adding filter options to it. (see [Set Filter Options to Extend Services Across Subnets](#) for more details). The following example explains how to apply the filters:

```
!
interface Ethernet0/0
```

```

description *** (wireless) Clients here plus some printers
ip address 172.16.33.7 255.255.255.0
service-routing mdns-sd
  service-policy mixed IN
!
interface Ethernet0/3
description *** (wireless) Clients here plus some printers
ip address 172.16.57.1 255.255.255.0
  service-routing mdns-sd
  service-policy mixed IN
!
    
```

In the above example, service-routing is enabled on the interface and the filter options in the service-policy 'mixed' are applied in the **IN** direction. In other words, all queries and printer services will be allowed into the device, from the interfaces Ethernet 0/0 and Ethernet 0/3.

Sample scenario for browsing specific services - A service-list of the type **query** (called active query) has been created. It contains services that we want to browse periodically, such as printer services (see [Set Filter Options to Extend Services Across Subnets](#) for more details about creating an active query). To enable browsing of the services in the query, you must apply the active query for the device.

```

!
service-routing mdns-sd
  service-policy-query active-query 900
!
    
```

In the above example, the period is set to 900 seconds. The services within the active query are queried on all interfaces of the device after an interval of 900 seconds.



Note

- You can enable browsing of services for specific interfaces. If browsing of services is enabled globally, you can disable browsing of services on specific interfaces.
- Services are browsed specific to a device or interface by the mDNS process. So, the IN or OUT option is not relevant for browsing of services.

You can use the following options after enabling mDNS on a device or interface.

Purpose	Use this Command Note	Global and Interface Configuration Options
For a service-list, apply a filter to allow or prohibit services.	service-policy The complete syntax is provided in the corresponding task.	Global and interface levels.
Set some part of the system memory for cache.	cache-memory-max	Global level.
Configure an active query and the query period so that specified services are queried periodically.	service-policy-query	Global and interface levels.

Designate a specific device or interface in a domain for routing mDNS announcement and query information.	designated-gateway	Global and interface levels.
Access services in the proximity of the device. Note Service policy proximity filtering functionality is only available on wireless devices and their interfaces.	service-policy-proximity	Global and interface levels.
Configure service-type enumeration period for the device.	service-type-enumeration period	Global level.
Specify an alternate source interface for outgoing mDNS packets on a device.	source-interface	Global level.
Configure the maximum rate limit of incoming mDNS packets for a device.	rate-limit	Global level.
Speed up visibility of newly announced services and withdrawal of services when a service or device is turned off.	redistribute	Interface level.

How to Configure Service Discovery Gateway

Setting Filter Options for Service Discovery

Before You Begin

Ensure that you permit a query or announcement when you set filter options. If you do not use a **permit** option and only use **deny** options, you will not be able to apply the filter.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **service-list mdns-sd** *service-list-name* {**deny** *sequence-number* | **permit** *sequence-number* | **query**}
4. **match message-type** {**announcement** | **any** | **query**}
5. **match service-instance** {*instance-name* | **any** | **query**}
6. **match service-type** *mDNS-service-type-string*
7. **match location civic** *civic-location-name*
8. **match learnt-interface** *interface number*
9. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	service-list mdns-sd <i>service-list-name</i> { deny <i>sequence-number</i> permit <i>sequence-number</i> query }	Enters mdns service discovery service-list mode. <ul style="list-style-type: none"> • Creates a service-list and applies a filter on the service-list according to the permit or deny option applied to the sequence number. Or <ul style="list-style-type: none"> • Creates a service-list and associates a query for the service-list name if the query option is used. Remember When you set filter options, ensure that you permit a query or announcement for a service-list. If you do not use a permit option and only use deny options, you will not be able to apply the filter.
Step 4	match message-type { announcement any query }	Configures parameters for a service-list based on a service announcement or query. Note You cannot use the match command if you have used the query option. The match command can be used only for the permit or deny option.

	Command or Action	Purpose
Step 5	<p>match service-instance <i>{instance-name any query}</i></p> <p>Example:</p> <pre>Device(config-mdns-sd-sl)# match service-instance printer-3</pre>	Configures parameters for a service-list based on a service-instance or query.
Step 6	<p>match service-type <i>mDNS-service-type-string</i></p> <p>Example:</p> <pre>Device(config-mdns-sd-sl)# match service-type _ipp._tcp.local</pre>	Configures parameters for a service-list based on a service-type.
Step 7	<p>match location civic <i>civic-location-name</i></p> <p>Example:</p> <pre>Device(config-mdns-sd-sl)# match location civic location3</pre>	Configures parameters for a service-list based on a civic location.
Step 8	<p>match learnt-interface <i>interface number</i></p> <p>Example:</p> <pre>Device(config-mdns-sd-sl)# match learnt-interface GigabitEthernet 1/0/1</pre>	<p>Filters services that are available on an interface and associates the filtered data to a specific service-list.</p> <p>Note For example, if a printer service on VLAN 1 is filtered under a service-list using this command, and if you apply the filters on VLAN 2, the printer will be available for use by clients in VLAN 2.</p>
Step 9	<p>exit</p> <p>Example:</p> <pre>Device(config-mdns-sd-sl)# exit</pre>	Exits mdns service discovery service-list mode, and returns to global configuration mode.

What to Do Next

Apply filters on an interface for the services, queries, or announcements to actually be permitted or prohibited on the interface.

Applying Service Discovery Filters and Configuring Service Discovery Parameters

After enabling multicast Domain Name System (mDNS) gateway for a device, you can apply filters (IN-bound filtering or OUT-bound filtering) and active queries by using **service-policy** and **service-policy-query** commands, respectively.



Note Steps 5 to 11 are mDNS Service Discovery configuration options. The steps are optional and not meant to be used in any specific order.

Before You Begin

You must set filter options for the device before applying filters.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **service-routing mdns-sd**
4. **service-policy** *service-policy-name* {IN | OUT}
5. **cache-memory-max** *cache-config-percentage*
6. **service-policy-query** *service-list-name* *query-period*
7. **designated-gateway enable** [*ttd duration*]
8. **service-policy-proximity** *service-list-name* [**limit** *number-of-services*]
9. **service-type-enumeration period** *period-value*
10. **source-interface** *type number*
11. **rate-limit in** *maximum-rate-limit*
12. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	service-routing mdns-sd Example: Device(config)# service-routing mdns-sd	Enables mDNS gateway functionality for a device and enters multicast DNS configuration (config-mdns) mode.

	Command or Action	Purpose
Step 4	<p>service-policy <i>service-policy-name</i> {IN OUT}</p> <p>Example:</p> <pre>Device(config-mdns)# service-policy s11 IN</pre>	<p>For a service-list, applies a filter on incoming service discovery information (IN-bound filtering) or outgoing service discovery information (OUT-bound filtering).</p> <p>Note Global service-policies are optional and effect all L3 interfaces. Typically, a service-policy is applied on an interface.</p>
Step 5	<p>cache-memory-max <i>cache-config-percentage</i></p> <p>Example:</p> <pre>Device(config-mdns)# cache-memory-max 20</pre>	<p>Sets some part of the system memory (in percentage) for cache.</p> <p>Note By default, 10% of the system memory is set aside for cache. You can override the default value by using this command.</p>
Step 6	<p>service-policy-query <i>service-list-name query-period</i></p> <p>Example:</p> <pre>Device(config-mdns)# service-policy-query s14 100</pre>	<p>Creates an active query and configures the service-list-query period.</p>
Step 7	<p>designated-gateway enable [<i>ttl duration</i>]</p> <p>Example:</p> <pre>Device(config-mdns)# designated-gateway enable</pre>	<p>Designates the device to route mDNS announcement and query information for the domain.</p>
Step 8	<p>service-policy-proximity <i>service-list-name</i> [limit number-of-services]</p> <p>Example:</p> <pre>Device(config-mdns)# service-policy-proximity s11 limit 10</pre>	<p>Configures service policy proximity filtering on the device.</p> <ul style="list-style-type: none"> • Service policy proximity filtering is only available for wireless clients and is based on Radio Resource Management (RRM). Wired clients and services are not affected by the limit. • The default value for the maximum number of services that can be returned is 50.
Step 9	<p>service-type-enumeration period <i>period-value</i></p> <p>Example:</p> <pre>Device(config-mdns)# service-type-enumeration period 45</pre>	<p>Configures service-type enumeration period for the device.</p>
Step 10	<p>source-interface <i>type number</i></p> <p>Example:</p> <pre>Device(config-mdns)# source-interface GigabitEthernet 1/0/1</pre>	<p>Specifies an alternate source interface for outgoing mDNS packets on a device.</p>

	Command or Action	Purpose
Step 11	rate-limit in <i>maximum-rate-limit</i> Example: Device(config-mdns)# rate-limit in 80	Configures the maximum rate limit of incoming mDNS packets for a device.
Step 12	exit Example: Device(config-mdns)# exit	Exits multicast DNS configuration mode, and returns to global configuration mode.

Applying Service Discovery Filters for an Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **service-routing mdns-sd**
5. **service-policy** *service-policy-name* {IN | OUT}
6. **service-policy-query** {*service-list-name query-period* | **disable**}
7. **redistribute mdns-sd** [**withdraw-only**]
8. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	interface <i>type number</i> Example: Device(config)# interface GigabitEthernet 1/0/1	Enters Interface multicast DNS configuration mode, and enables interface configuration.
Step 4	service-routing mdns-sd Example: Device(config-if)# service-routing mdns-sd	Enables mDNS gateway functionality for an interface and enters multicast DNS configuration (config-mdns) mode.
Step 5	service-policy <i>service-policy-name</i> {IN OUT} Example: Device(config-if-mdns-sd)# service-policy s11 IN	For a service-list, applies a filter on incoming service discovery information (IN-bound filtering) or outgoing service discovery information (OUT-bound filtering). Remember When you set filter options, ensure that you permit a query or announcement for a service-list. If you have not permitted a service, query, or announcement while setting filter options, then you will see this warning when you apply the filter: Warning: Please enable explicit service-list rule with the permit action to allow queries and responses.
Step 6	service-policy-query { <i>service-list-name</i> <i>query-period</i> disable } Example: Device(config-if-mdns-sd)# service-policy-query AQ-int 1000	Configures periodic browsing of services on an interface or stops browsing of services on an interface. Note The difference between the no form of this command and the disable option is given below: <ul style="list-style-type: none"> • no form - If you have enabled browsing of printer services for a specific interface which has a printer connected, and if the printer is removed from the interface, then you can use the no form to stop browsing printer services on the interface. • disable option - Typically, if you have enabled browsing for printer services on the device (globally configured), then printer services are periodically searched for on all the interfaces of the device. If there is an interface where there is no printer service available, you can use the disable option to disable browsing of printer services only for the interface.
Step 7	redistribute mdns-sd [withdraw-only] Example: Device(config-if-mdns-sd)# redistribute mdns-sd withdraw-only	Speeds up visibility of newly announced services and withdrawal of services when a service or device is turned off. Note When you use the withdraw-only option, redistribution is only enabled for service withdrawal and not for the service. For example, if service withdrawal announcement for a printer service is enabled, there will not be any announcement about the printer service on other subnets. However, if the printer service is removed, withdrawal announcements will be sent to other devices.

	Command or Action	Purpose
Step 8	exit Example: Device (config-if-mdns-sd) # exit	Exits Interface multicast DNS configuration mode, and returns to interface configuration mode.

Creating a Service Instance

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **service-instance mdns-sd service *instance-name* regtype *service-type* domain *name***
4. **{ipv4addr | ipv6addr} *IP-address***
5. **port *number***
6. **target-hostname *host-name***
7. **txt *text-record-name***
8. **priority *value***
9. **weight *value***
10. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	service-instance mdns-sd service <i>instance-name</i> regtype <i>service-type</i> domain <i>name</i> Example: Device (config) # service-instance mdns-sd	Creates a service-instance of a specific service type and enters multicast Domain Name System (mDNS) service discovery service-instance (config-mdns-sd-si) mode. Note In this mode, you can configure various parameters for the service-instance. The subsequent steps show how to configure service-instance parameters.

	Command or Action	Purpose
	<pre>service printer-3 regtype _ipp._tcp.local domain tcp4</pre>	
Step 4	<p>{ipv4addr ipv6addr} IP-address</p> <p>Example:</p> <pre>Device(config-mdns-sd-si)# ipv4addr 209.165.200.230 255.255.255.0</pre>	Specifies the IPv4 or IPv6 address of the port on which the service is available.
Step 5	<p>port number</p> <p>Example:</p> <pre>Device(config-mdns-sd-si)# port 9100</pre>	Specifies the port on which the service is available.
Step 6	<p>target-hostname host-name</p> <p>Example:</p> <pre>Device(config-mdns-sd-si)# target-hostname fqdn-of-printer.example.com.</pre>	Specifies the fully qualified domain name (FQDN) of the target host.
Step 7	<p>txt text-record-name</p> <p>Example:</p> <pre>Device(config-mdns-sd-si)# txt _ipp._tcp.local=printer3</pre>	<p>Specifies the text record associated with the service instance.</p> <p>Note A TXT record is a type of DNS record that provides text information to sources outside your domain. Specify the text record in the format 'service-type=service-name'. To specify multiple records, use a semicolon (;) as a separator.</p>
Step 8	<p>priority value</p> <p>Example:</p> <pre>Device(config-mdns-sd-si)# priority 3</pre>	(Optional) Specifies the priority value for the service-instance. The default priority value is zero.
Step 9	<p>weight value</p> <p>Example:</p> <pre>Device(config-mdns-sd-si)# weight 20</pre>	(Optional) Specifies the weight value for the service-instance. The default weight value is zero.
Step 10	<p>exit</p> <p>Example:</p> <pre>Device(config-mdns-sd-si)# exit</pre>	Exits multicast Domain Name System (mDNS) service discovery service-instance (config-mdns-sd-si) mode and enters global configuration mode.

Verifying and troubleshooting Service Discovery Gateway



Note The show and debug commands mentioned below are not in any specific order.

SUMMARY STEPS

1. `show mdns requests [detail | [type record-type] [name record-name]]`
2. `show mdns cache [interface type number [detail] | [name record-name] [type record-type] [detail]]`
3. `show mdns statistics {all | interface type number | service-list list-name | [cache | service-policy] {all | interface type number} | services orderby providers}`
4. `show mdns service-types [all | interface type number]`
5. `debug mdns {all | error | event | packet | verbose}`

DETAILED STEPS

Step 1 `show mdns requests [detail | [type record-type] [name record-name]]`

Example:

```
Device# show mdns requests detail
```

```
MDNS Outstanding Requests
=====
Request name   :   _ipp._tcp.local
Request type   :   PTR
Request class  :   IN
```

This command displays information for outstanding multicast Domain Name System (mDNS) requests, including record name and record type information.

Step 2 `show mdns cache [interface type number [detail] | [name record-name] [type record-type] [detail]]`

Example:

Note You can use the **detail** keyword for a specific interface, record or type. You cannot use it independently with the **show mdns cache** command.

```
Device# show mdns cache
```

```
mDNS CACHE
=====
[<NAME>]                               [<TYPE>] [<CLASS>] [<TTL>/Remaining] [Accessed]
 [If-index] [<RR Record Data>]

_services._dns-sd._udp.local           PTR      IN      4500/4496      0
  3      _ipp._tcp.local

_ipp._tcp.local                         PTR      IN      4500/4496      1
  3      printer1._ipp._tcp.local

printer1._ipp._tcp.local                SRV      IN      120/116        1      3
  0      0      5678      much-WS.local

printer1._ipp._tcp.local                TXT      IN      4500/4496      1
  3      (1)''
```

```
music-WS.local          A      IN      120/116      1      3
  192.168.183.1
```

This command displays mDNS cache information.

Step 3 `show mdns statistics {all | interface type number | service-list list-name | [cache | service-policy] {all | interface type number} | services orderby providers}`

Example:

```
Device# show mdns statistics all

mDNS Statistics
mDNS packets sent      : 0
mDNS packets received  : 31
mDNS packets dropped   : 8
mDNS cache memory in use: 64264 (bytes)
```

This command displays mDNS statistics.

Step 4 `show mdns service-types [all | interface type number]`

Example:

```
Device# show mdns service-types

mDNS SERVICES
=====
[<NAME>]          [<TTL>/Remaining] [If-name]
_ipp._tcp.local   4500/4496
```

This command displays mDNS statistics.

Step 5 `debug mdns {all | error | event | packet | verbose}`

Example:

```
Device# debug mdns all
This command enables all mDNS debugging flows.
```

Configuration Examples for Service Discovery Gateway

Example: Setting Filter Options for Service Discovery

The following example shows creation of a service-list s11. The permit option is being applied on sequence number 3 and all services with message-type announcement are filtered and available for transport across various subnets associated with the device.

```
Device> enable
Device# configure terminal
Device(config)# service-list mdns-sd s11 permit 3
Device(config-mdns-sd-s1)# match message-type announcement
Device(config-mdns-sd-s1)# exit
```

Example: Applying Service Discovery Filters and Configuring Service Discovery Parameters

```
Device> enable
Device# configure terminal
Device(config)# service-routing mdns-sd
Device(config-mdns)# service-policy serv-poll IN
Device(config-mdns)# cache-memory-max 20
Device(config-mdns)# service-policy-query sl-query1 100
Device(config-mdns)# designated-gateway enable
Device(config-mdns)# rate-limit in 80
Device(config-mdns)# exit
```

Example: Applying Service Discovery Filters for an Interface

```
Device> enable
Device# configure terminal
Device(config)# interface GigabitEthernet 0/1
Device(config-if)# service-routing mdns-sd
Device(config-if-mdns-sd)# service-policy s11 IN
Device(config-if-mdns-sd)# redistribute mdns-sd withdraw-only
Device(config-if-mdns-sd)# exit
```

Example: Setting Multiple Service Discovery Filter Options

The following example shows creation of filters using service-lists mixed, permit-most, permit-all, and deny-all. Then, the filters are applied at various interfaces, as required.

```
!
service-list mdns-sd mixed permit 10
  match message-type query
!
service-list mdns-sd mixed permit 20
  match message-type announcement
  match service-type _ipps._tcp.local
!
service-list mdns-sd mixed permit 30
  match message-type announcement
  match service-type _ipp._tcp.local
  match service-type _universal._sub._ipp._tcp
!
service-list mdns-sd mixed permit 40
  match message-type announcement
!
service-list mdns-sd mixed deny 50
!
service-list mdns-sd permit-most deny 10
  match service-type _sleep-proxy._udp.local
!
service-list mdns-sd permit-most permit 20
!
service-list mdns-sd permit-all permit 10
!
service-list mdns-sd deny-all permit 10
  match message-type query
!
service-list mdns-sd deny-all deny 20
```

```

!
service-list mdns-sd active-query query
service-type _universal._sub._ipp._tcp.local
service-type _ipp._tcp.local
service-type _ipps._tcp.local
service-type _raop._tcp.local
!
service-routing mdns-sd
service-policy-query active-query 900
!
!
interface Ethernet0/0
description *** (wireless) Clients here plus some printers or aTVs
ip address 172.16.33.7 255.255.255.0
service-routing mdns-sd
service-policy mixed IN
service-policy permit-all OUT
!
interface Ethernet0/1
description *** AppleTVs, Print Servers here
ip address 172.16.57.1 255.255.255.0
service-routing mdns-sd
service-policy permit-most IN
service-policy permit-all OUT
!
interface Ethernet0/2
description *** Clients only, we don't want to learn anything here
ip address 172.16.58.1 255.255.255.0
service-routing mdns-sd
service-policy deny-all IN
service-policy permit-all OUT
!
interface Ethernet0/3
no ip address
shutdown
!

```

In the above example, the service-lists are:

- permit-all - As the name suggests, this service-list permits all resource records, and should be used with care. This is typically applied in the OUT direction; allows the cache to respond to all requests regardless of query content or query type.
- permit-most - This allows anything in, except for sleep-proxy services. This is because extending sleep-proxy services causes an issue with devices that register with a sleep proxy across the Service Discovery Gateway. Due to split horizon, the real (sleeping) device won't be able to re-register its services when waking up again when its pointer (PTR) record is pointing to the sleep-proxy.
- deny-all - This prevents the cache from learning anything. Again incoming on a segment where only clients live. As a result, clients will be able to query for services from the cache (hence the permit 10 match query), but there is no need to learn anything from the clients.
- mixed - This is created to be used in client segments. In addition to clients (such as iPads, PCs, and so on), the occasional printer or a TV will also connect. The purpose here is to learn about those specific services but not about services the clients provide. The filter applied is IN. As a result, the following actions are applicable:
 - Allow every query IN.
 - Allow specific services in (such as printer services [IPP]).
 - Deny everything else.

In addition, to keep the service PTRs fresh in the cache an active query is configured. The active query queries for those services that we want to extend. Typically, this would match the services that have been configured

as 'permitted' services in the IN filter. The value is set to 900 seconds. The duration is enough to refresh the PTRs as they typically have a TTL of 4500 seconds.

Example: Extending Services Across Interfaces—Filtering Services per Interface or VLAN

You can filter services available in an interface or VLAN and extend the services (or prohibit the services) to clients in another interface or VLAN, using a single filter command (**match learnt-interface**).

Consider this scenario—In a university setting, the following VLANs are created:

- VLAN 100 contains Apple TVs meant for teachers. These Apple TVs must be inaccessible to students.
- VLAN 200 contains teachers' devices.
- VLAN 300 contains students' devices.
- VLAN 400 contains Apple TVs for teachers and students. These Apple TVs must be accessible to teachers and students.

Extending Apple TV service for teachers—If teachers want to access Apple TVs, then they should be able to send queries for the Apple TV service and receive the Apple TV service from the mDNS cache. A service-list **permit-all** is created to permit all services and queries into, and out of, the device. The service-list configuration is given below:

```
!
service-list mdns-sd permit-all permit 10
!
```

Since there are no restrictions for teachers accessing services on any other VLAN or interface, we can permit all services out of the mDNS cache.

```
!
Interface vlan 200
description *** Teachers' devices — Allow all queries (into the cache) and services (from
the cache).

service-routing mdns-sd
  service-policy permit-all in
  service-policy permit-all out
exit
!
```

In the above examples, these actions were taken:

- 1 The service-list **permit-all** was created to permit queries and services.
- 2 **permit-all** was applied on VLAN 200 —The **permit-all in** command allows all queries into the mDNS cache. Typically, **match** commands are specified for filtering. Since no **match** command is specified, all services or queries are permitted *into* the mDNS cache. Similarly, for the **permit-all out** statement, all services (or queries) are permitted out of the mDNS cache, in response to requests for a service.

Result—Teachers' queries for Apple TV services are allowed out of the subnet and in response, Apple TV service is allowed into the subnet.

Extending Apple TV service for students—Students must be able to send queries for Apple TV and receive responses for accessing Apple TV service. A service-list is created for filtering incoming information (queries

coming *into* the cache), and another is created for outgoing information (Apple TV service *from* the cache). The configuration example for creating the service-lists is given below:

```
service-list mdns-sd deny-all permit 10
  match message-type query
service-list mdns-sd deny-all deny 20
```

The service-list **deny-all** permits queries from students (since queries are specified within the 'permit' instruction) and prohibits all other services (since no **match** command is specified within the 'deny' instruction, other types of service information are disallowed.)

```
!
Interface vlan 300
description *** Students' devices — Allow queries from students and nothing else (into the
  cache).

  service-routing mdns-sd
    service-policy deny-all in
  exit
!
```

When the mDNS process encounters the **deny-all in** command, the commands in the service-list **deny-all** are processed sequentially, as given below:

- 1 10—Queries for Apple TV service are permitted from the students now.
- 2 20—The **deny** command ensures that, apart from queries, no other information is allowed outside the subnet.

The **restricted** service-list is created to permit Apple TV services from VLAN 400 and deny Apple TV services from VLAN 100, meant for teachers.

```
!
service-list mdns-sd restricted permit 10
  match service-type apple-tv
  match learnt-interface vlan400
!
service-list mdns-sd restricted deny 20
  match service-type apple-tv
  match learnt-interface vlan100
!
service-list mdns-sd restricted deny 30
!
```

- 1 10—Apple TV services are permitted and all services available in VLAN 400 are permitted.
- 2 20—Services available in VLAN 100 are prohibited.
- 3 30—All other services are disallowed.

Now, the service filters in the **restricted** service-list are applied onto the students' VLAN, as given below:

```
!
Interface vlan 300
description *** Students' devices — Allow Apple TV services available in VLAN 400. Prohibit
  access of Apple TVs from VLAN 100, and prohibit all other services.

  service-routing mdns-sd
    service-policy restricted out
  exit
!
```

When the mDNS process encounters the **restricted out** command, the commands in the service-list **restricted** are implemented sequentially—Queries for Apple TV services are permitted, Apple TV services from VLAN 400 are permitted for students' access and Apple TV services available in VLAN 100 are prohibited for students' access.

Example: Creating a Service Instance

```
Device> enable
Device# configure terminal
Device(config)# service-instance mdns-sd service printer-3 regtype _ipp._tcp.local domain
tcp4
Device(config-mdns-sd-si)# ipv4addr 209.165.200.230 255.255.255.0
Device(config-mdns-sd-si)# port 9100
Device(config-mdns-sd-si)# target-hostname fqdn-of-printer.example.com.
Device(config-mdns-sd-si)# txt _ipp._tcp.local=printer3
Device(config-mdns-sd-si)# priority 3
Device(config-mdns-sd-si)# weight 20
Device(config-mdns-sd-si)# exit
```



Note

When you create a service-instance, a text record is created even if you do not configure service-instance parameters.

Additional References for Service Discovery Gateway

Related Documents

Related Topic	Document Title
Master Command List	Cisco IOS Master Command List
IP Addressing Services Command Reference	Cisco IOS IP Addressing Services Command Reference
Configuring DNS	IP Addressing: DNS Configuration Guide
DNS conceptual information	“Information About DNS” section in IP Addressing: DNS Configuration Guide

Standards and RFCs

Standard/RFC	Title
RFC 6762	Multicast DNS
RFC 6763	DNS-Based Service Discovery

Standard/RFC	Title
Multicast DNS Internet-Draft	Multicast DNS Internet draft

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/support

Feature Information for Service Discovery Gateway

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [http://www.cisco.com/go/featurenavigator](#). An account on Cisco.com is not required.

Table 1: Feature Information for Service Discovery Gateway

Feature Name	Releases	Feature Information
Service Discovery Gateway	Cisco IOS XE Release 3.3SE Cisco IOS XE Release 3.6E	<p>The Service Discovery Gateway feature enables multicast Domain Name System (mDNS) to operate across L3 boundaries (different subnets).</p> <p>The following commands were introduced or modified: cache-memory-max, clear mdns cache, clear mdns statistics, debug mdns, match message-type, match service-instance, match service-type, redistribute mdns-sd, service-list mdns-sd, service-policy, service-policy-query, service-routing mdns-sd, show mdns cache, show mdns requests, show mdns statistics</p> <p>In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches</p>
Service Discovery Gateway—Phase 2	Cisco IOS XE 3.6E	<p>The Service Discovery Gateway feature was enhanced with additional filter and configuration options.</p> <p>In Cisco IOS Release Cisco IOS XE Release 3.6E, this feature is supported on the following platforms:</p> <ul style="list-style-type: none"> • Cisco Catalyst 3850 Series Switches • Cisco Catalyst 3650 Series Switches • Cisco 5760 Wireless LAN Controller <p>The following commands were introduced or modified: clear mdns cache, clear mdns service-types, clear mdns statistics, designated-gateway, match location, rate-limit, service-instance mdns-sd, service-policy-proximity, service-routing mdns-sd, service-type-enumeration, show mdns cache, show mdns statistics, source-interface</p>

Feature Name	Releases	Feature Information
Service Discovery Gateway—Phase 3	Cisco IOS XE 3.7E Cisco IOS XE Release 3.6E	<p>The Service Discovery Gateway feature was enhanced with the following features:</p> <ul style="list-style-type: none"> • De-congestion of incoming mDNS traffic using the rate limiting mechanism—The rate-limit value range was reset to 1-100 p/s. • Redistribution of service-withdrawal announcements across subnets when services are withdrawn, to improve mDNS cache efficiency and to avoid message loops—The withdraw-only option was added to the redistribute mdns-sd command. • A filter criterion for services available and learnt on a specific interface—The match learnt-interface command was added to filter services. • Enabling and disabling of periodic browsing of services on specific interfaces—The service-policy-query (interface) command was added. For existing, globally configured active queries, the disable option was added to disable browsing of services on an interface, retaining the configurations on other interfaces. <p>In Cisco IOS Release Cisco IOS XE Release 3.7E, this feature is supported on the following platforms:</p> <ul style="list-style-type: none"> • Cisco Catalyst 3850 Series Switches • Cisco 5760 Wireless LAN Controller <p>The following commands were introduced or modified: match learnt-interface, rate-limit, redistribute mdns-sd, service-policy-query (interface)</p> <p>In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches</p>