Service Discovery Gateway

The Service Discovery Gateway feature enables multicast Domain Name System (mDNS) to operate across Layer 3 (L3) boundaries (different subnets). An mDNS gateway will be able to provide transport for service discovery across Layer 3 boundaries by filtering, caching and extending services from one L3 domain (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.

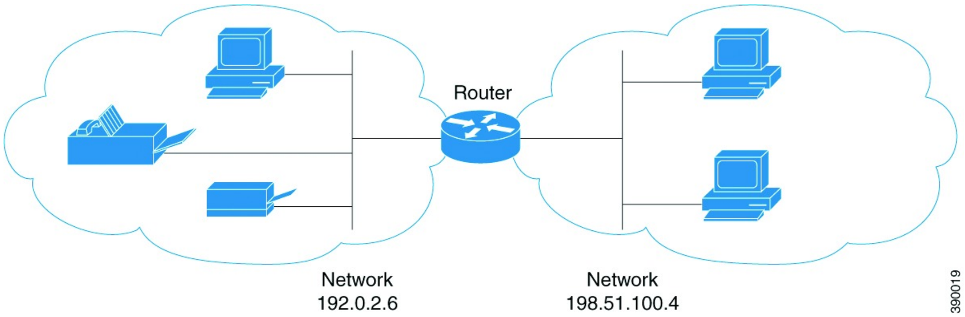
Service Announcement Redistribution

Service Extension usually 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 from a different subnet, the SDG 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 or service announcement information cannot be done globally. You can enable redistribution of service information at the interface level only.

Information About Service Discovery Gateway



You need to enable an mDNS gateway for service discovery to operate across subnets. You can enable mDNS gateway for a device or for an interface. You need to configure service routing globally before configuring at the interface level. After the device or interface is enabled, you can redistribute service discovery information across subnets. Also, you can create service policies and apply filters on either incoming service discovery information (called IN-bound filtering) or outgoing service discovery information (called OUT-bound filtering). Filters can be applied at the global level and at the interface level.

Filtering

You can filter services that you want to extend selectively. While creating a service-list, the permit or deny option must be used. The permit option allows you to permit/transport specific service-list information. The deny option allows you to deny service-list information that is available to be transported to other subnets. You need to mention a sequence number when using the permit or deny option. The same service-list name can be associated with multiple sequence numbers and each sequence number will be mapped to a rule.

Note If no filters are configured, the default action is to deny service–list information to be transported through the device or interface.

Query is another option provided while creating service–lists. You can create queries using a service–list. If you want to browse for a service, then active queries can be used. This helps to keep the records refreshed in the cache.

Service-lists of type 'query' are used for active queries. Active queries will periodically send out requests for the given service names on all interfaces configured for service routing. As services have a specific TTL (Time to Live), this can help to keep services fresh in the cache.

Note Active queries can only be used globally and cannot be used at the interface level.

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 respond to queries.

After creating a service–list and using the permit or deny option, you can filter by using match statements (commands) based on service–instance, service–type, or message–type (announcement or query).

Redistribution

Note Redistribution must be done selectively, and at the interface level only. Redistribution cannot be done globally.

Redistribution of Service Announcements is only required in specific scenarios. Generally, services like printers or Apple TV can be extended without any Service Announcement replication. 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.

How to Configure Service Discovery Gateway

Creating a Service-list, Applying a Filter for the Service-List and Configuring Parameters for the Service-List Name

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** } **OR match service-instance** {*instance-name* | **any** | **query**} **OR match service-type** *mDNS-service-type-string*
5. **exit**

DETAILED STEPS

	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.

	Command or Action	Purpose

Step 3	**service-list mdns-sd** *service-list-name* {**deny** *sequence-number* | **permit** *sequence-number* | **query**}
	Example:
	`Device(config)# service-list mdns-sd sl1 permit 3`
	Or
	`Device(config)# service-list mdns-sd sl4 query`
		Enters mdns service discovery service-list mode.
		• 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
		• Creates a service-list and associates a query for the service-list name if the **query** option is used.

Step 4	**match message-type** {**announcement** | **any** | **query** } **OR match service-instance** {*instance-name* | **any** | **query**} **OR match service-type** *mDNS-service-type-string*
	Example:
	Do one of the following:
	`Device(config-mdns-sd-sl)# match message-type announcement`
	OR
	`Device(config-mdns-sd-sl)# match service-instance servInst 1`
	OR
	`Device(config-mdns-sd-sl)# match service-type _ipp._tcp`
		Use one (or more) of the following commands.
		Configures parameters for a service-list name that is created using step 3.
		Note You cannot use the **match** command if you have used the **query** option in the previous step. The **match** command can be used only for the **permit** or **deny** option.

Step 5	**exit** **Example:** `Device(config-mdns-sd-sl)# exit`	Exits mdns service discovery service-list mode, and returns to global configuration mode.

Enabling mDNS Gateway for a Device

After enabling 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. You can set some part of the system memory for cache using the **cache-memory-max** command.

Note Steps 4 to 6 are optional and not meant to be used in any specific order.

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-query-name service-list-query-period*
7. **exit**

DETAILED STEPS

	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	**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.

Step 4	**service-policy** *service-policy-name* {**IN** | **OUT**}
	Example:
	`Device(config-mdns)# service-policy serv-pol1 IN`
		For a service-list, applies a filter on incoming service discovery information (IN-bound filtering) or outgoing service discovery information (OUT-bound filtering).
		Note Global service-policies are optional and effect all L3 interfaces. Typically, a service-policy is applied on an interface.

Step 5	**cache-memory-max** *cache-config-percentage* **Example:** `Device(config-mdns)# cache-memory-max 20`	Sets some part of the system memory (in percentage) for cache. **Note** By default, 10% of the system memory is set aside for cache. You can override the default value by using this command.
Step 6	**service-policy-query** *service-list-query-name service-list-query-period* **Example:** `Device(config-mdns)# service-policy-query sl-query1 100`	Configures service-list-query period.

	Command or Action	Purpose
Step 7	**exit** **Example:** `Device(config-mdns)# exit`	Exits multicast DNS configuration mode, and returns to global configuration mode.

Applying a Service Policy

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **service-routing mdns-sd**
4. **interface** *type number*
5. **service-policy** *service-policy-name* {**IN** | **OUT**}
6. **exit**

DETAILED STEPS

	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	**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.
Step 4	**interface** *type number* **Example:** `Device(config-mdns)# interface ethernet 0/1`	Enters Interface multicast DNS configuration mode, and enables interface configuration.

	Command or Action	Purpose

Step 5	**service-policy** *service-policy-name* {**IN** | **OUT**}
	Example:
	`Device(config-if-mdns)# service-policy serv-pol2 IN`
		For a service-list, applies a filter on incoming service discovery information (IN-bound filtering) or outgoing service discovery information (OUT-bound filtering).

Step 6	**exit** **Example:** `Device(config-if-mdns)# exit`	Exits Interface multicast DNS configuration mode, and returns to multicast DNS 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** | *name record-name* | **type record-type** [*name record-name*]]
2. **show mdns cache** [**interface** *type number* | **name** *record-name*[**type** *record-type*] | **type** *recod-type*]
3. **show mdns statistics** {**all** | **service-list***list-name* | **service-policy** {**all** | **interface** *type number*}}
4. **debug mdns** {**all error event packet verbose**}

DETAILED STEPS

Step 1 **show mdns requests** [**detail** | *name record-name* | **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 mDNS requests, including record name and record type information.

Step 2 **show mdns cache** [**interface** *type number* | **name** *record-name*[**type** *record-type*] | **type** *recod-type*]

Example:

```
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    smuchala-WS.local

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

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

This command displays mDNS cache information.

Step 3 **show mdns statistics** {**all** | **service-list***list-name* | **service-policy** {**all** | **interface** *type number*}}

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 **debug mdns** {**all error event packet verbose**}

Example:

```
Device# debug mdns
```

This command enables all mDNS debugging flows.

Configuration Examples for Service Discovery Gateway

Example: Creating a Service-List, Applying a Filter for the Service-List and Configuring Parameters for the Service-List Name

The following example shows creation of a service-list sl1. 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 sl1 permit 3
Device(config-mdns-sd-sl)# match message-type announcement
Device(config-mdns)# exit
```

Example: Enabling mDNS Gateway for a Device

The following example shows how to enable an mDNS gateway for a device. IN-bound filtering is applied on the service-list serv-pol1. 20% of system memory is made available for cache, and the service-list-query period is configured at 100 seconds.

```
Device> enable
Device# configure terminal
Device(config)# service-routing mdns-sd
Device(config-mdns)# service-policy serv-pol1 IN
Device(config-mdns)# cache-memory-max 20
Device(config-mdns)# service-policy-query sl-query1 100
Device(config-mdns)# exit
```

Example: Applying a Service Policy

```
Device> enable
Device# configure terminal
Device(config)# service-routing mdns-sd
Device(config-mdns)# interface ethernet 0/1
Device(config-if-mdns)# service-policy servpol2 IN
Device(config-if-mdns)# exit
```

Example: Creating Service Lists and Applying Service Policies

The following example shows creation of service-lists mixed, permit-most, permit-all, and deny-all. Then, a service-policy is appropriately 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
!
service-list mdns-sd mixed permit 30
 match message-type announcement
 match service-type _ipp._tcp
!
service-list mdns-sd mixed permit 40
 match message-type announcement
 match service-type _airplay._tcp
!
service-list mdns-sd mixed deny 50
!
!
service-list mdns-sd permit-most deny 10
 match service-type _sleep-proxy._udp.
!
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
 service-type _ipp._tcp
 service-type _ipps._tcp
 service-type _raop._tcp
 service-type _airplay._tcp
!
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 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 AirPlay and 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.

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
Multicast DNS Internet-Draft	Multicast DNS

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
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. 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. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	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 www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for Service Discovery Gateway

Feature Name	Releases	Feature Information
Service Discovery Gateway	15.2(1)E	The Service Discovery Gateway feature enables multicast Domain Name System (mDNS) to operate across L3 boundaries (different subnets). 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**