Configuring the Service Discovery Gateway

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

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/cfn. An account on Cisco.com is not required.

Restrictions for Configuring the Service Discovery Gateway

The following are restrictions for configuring the Service Discovery Gateway:

- The Service Discovery Gateway does not support topologies with multiple hops. All network segments must be connected directly to it. The Service Discovery Gateway can learn services from all connected segments to build its cache and respond to requests acting as a proxy.

Information about the Service Discovery Gateway and mDNS

mDNS

mDNS was defined to achieve zero configuration, with zero configuration being defined as providing the following features:

- Addressing—Allocating IP addresses to hosts
- Naming—Using names to refer to hosts instead of IP addresses
- Service discovery—Finding services automatically on the network

With mDNS, network users no longer have to assign IP addresses, assign host names, or type in names to access services on the network. Users only need to ask to see what network services are available, and choose from a list.

With mDNS, *addressing* is accomplished through the use of DHCP/DHCPv6 or IPv4 and IPv6 Link Local scoped addresses. The benefit of zero-configuration occurs when no infrastructure services such as DHCP or DNS are present and self-assigned link-local addressing can be used. The client can then select a random IPv4 address in the link-local range (169.254.0.0/24) or use its IPv6 link-local address (FE80::/10) for communication.

With mDNS, *naming* (name-to-address translation on a local network using mDNS) queries are sent over the local network using link-local scoped IP multicast. Because these DNS queries are sent to a multicast address (IPv4 address 224.0.0.251 or IPv6 address FF02::FB), no single DNS server with global knowledge is required to answer the queries. When a service or device sees a query for any service it is aware of, it provides a DNS response with the information from its cache.

With mDNS, *service discovery* is accomplished by browsing. An mDNS query is sent out for a given service type and domain, and any device that is aware of matching services replies with service information. The result is a list of available services for the user to choose from.

The mDNS protocol (mDNS-RFC), together with DNS Service Discovery (DNS-SD-RFC) achieves the zero-configuration addressing, naming, and service discovery.

mDNS-SD

Multicast DNS Service Discovery (mDNS-SD) uses DNS protocol semantics and multicast over well-known multicast addresses to achieve zero configuration service discovery. DNS packets are sent to and received on port 5353 using a multicast address of 224.0.0.251 and its IPv6 equivalent FF02::FB.

Because mDNS uses a link-local multicast address, its scope is limited to a single physical or logical LAN. If the networking reach needs to be extended to a distributed campus or to a wide-area environment consisting of many different networking technologies, mDNS gateway is implemented. An mDNS gateway provides a transport for mDNS packets across Layer 3 boundaries by filtering, caching, and redistributing services from one Layer 3 domain to another.

mDNS-SD Considerations for Wireless Clients

- mDNS packets can be sent out of Layer 3 interfaces that might not have an IP address.

- Packets with mDNS multicast IP and multicast MAC are sent on a multicast CAPWAP tunnel, if multicast-multicast mode is enabled. A multicast CAPWAP tunnel is a special CAPWAP tunnel used for reducing the number of copies of multicast packet that are required to be generated for each AP CAPWAP tunnel. Sending packets on the multicast CAPWAP tunnel requires the outer IP header to be destined to the multicast CAPWAP tunnel's address, which all APs are subscribed to.
- All mDNS packet handling is done at a foreign switch for roamed clients. A foreign switch is the new switch that a roamed wireless client is actually attached to, which is called the point of attachment.

Service Discovery Gateway

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

Related Topics

Configuring the Service List (CLI), on page 5
Example: Creating a Service-List, Applying a Filter and Configuring Parameters, on page 14
Enabling mDNS Gateway and Redistributing Services (CLI), on page 9
Example: Specify Alternative Source Interface for Outgoing mDNS Packets, on page 13
Example: Redistribute Service Announcements, on page 13
Example: Disable Bridging of mDNS Packets to Wireless Clients, on page 14
Example: Enabling mDNS Gateway and Redistributing Services, on page 14
Example: Global mDNS Configuration, on page 15
Example: Interface mDNS Configuration, on page 15

mDNS Gateway and Subnets

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.

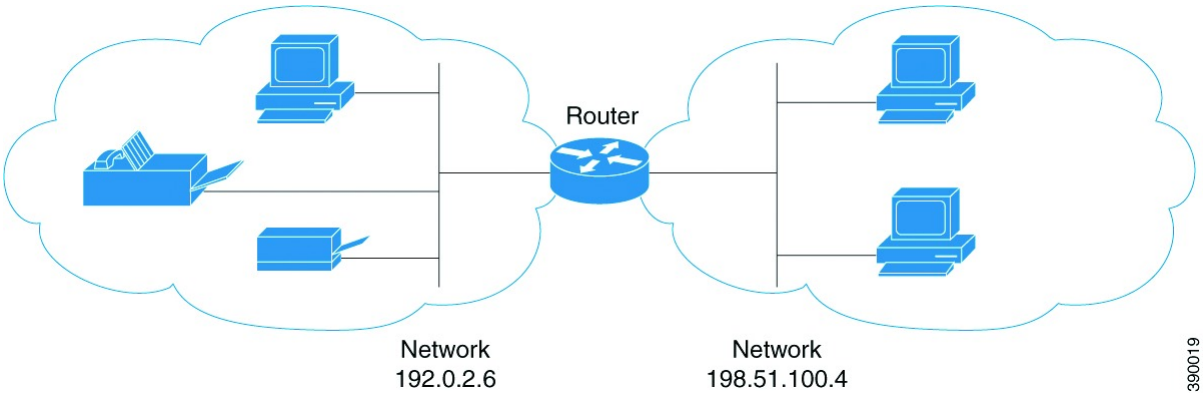
Note You need to configure service routing globally before configuring at the interface level.

After the device or interface is enabled, you can redistribute service discovery information across subnets. 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).

Note If redistribution is enabled globally, global configuration is given higher priority than interface configuration.

For example, if the mDNS gateway functionality is enabled on the router in this figure, then service information can be sent from one subnet to another and vice-versa. For example, the printer and fax service information being advertised in the network with IP address 192.0.2.6 are redistributed to the network with IP address 198.51.100.4. The printer and fax service information in the network with IP address 192.0.2.6 is learned by mDNS-enabled hosts and devices in the other network.

Figure 1: Sample Networking Scenario



Filtering

After configuring the mDNS gateway and subnets, you can filter services that you want to redistribute. While creating a service list, the **permit** or **deny** command options are used:

- The **permit** command option allows you to permit or 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 include a sequence number when using the **permit** or **deny** command 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, then the default action is to deny service list information to be transported through the device or interface.

Query is another option provided when 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 function is helpful to keep the records refreshed 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 or fax) 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). The device always respond to queries.

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

Related Topics

Configuring the Service List (CLI), on page 5
Example: Creating a Service-List, Applying a Filter and Configuring Parameters, on page 14
Enabling mDNS Gateway and Redistributing Services (CLI), on page 9
Example: Specify Alternative Source Interface for Outgoing mDNS Packets, on page 13
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How to Configure the Service Discovery Gateway

Configuring the Service List (CLI)

This procedure describes how to create a service list, apply a filter for the service list, and configure 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**}
5. **match service-instance** { *LINE* }
6. **match service-type** {*LINE* }
7. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.

Step 3	**service-list mdns-sd** *service-list-name* {**deny** *sequence-number* | **permit** *sequence-number* | **query**}
	
	Example:
	
	`Switch(config)# service-list mdns-sd sl1 permit 3`
	
	`Switch(config)# service-list mdns-sd sl4 query`
		Enters mDNS service discovery service list mode. In this mode, you can:
		• Create a service list and apply a filter on the service list according to the **permit** or **deny** option applied to the sequence number.
		• Create a service list and associate a query for the service list name if the **query** option is used.
		
		Note The sequence number sets the priority of the rule. A rule with a lower sequence number is selected first and the service announcement or query is allowed or denied accordingly. You define the sequence number as per your network requirements.

Step 4	**match message-type** {**announcement** | **any** | **query**} **Example:** `Switch(config-mdns-sd-sl)# match message-type announcement`	(Optional) Sets the message type to match. You can match the following message types: • announcement • any • query These commands configure the parameters for the service list name that is created in step 2. If the **match message-type** is an announcement, then the service list rule only allows service advertisements or announcements for the device. If the **match message-type** is a query, then only a query from the client for a certain service in the network is allowed. Multiple service maps of the same name with different sequence numbers can be created and the evaluation of the filters will be ordered on the sequence number. Service lists are an ordered sequence of individual statements, each one has a permit or deny result. Evaluation of service list consists of a list scan, in a predetermined order, and an evaluation of the criteria of each statement that matches. A list scan is stopped once the first statement match is found and an action permit/deny associated with the statement match is performed. The default action after scanning through the entire list is to deny. **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	**match service-instance** { *LINE* }	(Optional) Sets the service instance to match.

	Command or Action	Purpose
	Example: `Switch(config-mdns-sd-sl)## match service-instance servInst 1`	This command configures the parameters for the service list name that is created in step 2. **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 6	**match service-type** {*LINE* } **Example:** `Switch(config-mdns-sd-sl)# match service-type _ipp._tcp`	(Optional) Sets the value of the mDNS service type string to match. This command configures the parameters for the service list name that is created in step 2. **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 7	**end** **Example:** `Switch(config-mdns-sd-sl)# end`	Returns to privileged EXEC mode.

What to Do Next

Proceed to enable the mDNS gateway and redistribution of services.

Related Topics

Service Discovery Gateway , on page 3
Filtering, on page 4
Example: Creating a Service-List, Applying a Filter and Configuring Parameters, on page 14

Configuring Service List (GUI)

SUMMARY STEPS

1. Choose **Configuration** > **Controller** > **mDNS** > **Service List**.
2. Click **Create Service**.
3. In the **Service List Name** text box, enter the service list name.
4. From the **Service rule** drop-down list, choose from the following options:
   - **permit—**permits the service list.
   - **deny—**denies the service list.
5. In the **Sequence number** text box, enter the priority of the rule.
6. From the **Message type** drop-down list, choose the message type to match from the following options:
   - **announcement—**The service list rule allows only service advertisements or announcements for the device.
   - **query—**The service list rule allows only a query from the client for a service in the network.
   - **any—**The service list rule allows any type of message.
7. In the **Service instance** text box, enter the service instance to match.
8. In the **Custom** text box, enter the mDNS service type string to match.
9. Click **Apply**.
10. Click **Save Configuration**.

DETAILED STEPS

Step 1 Choose **Configuration** > **Controller** > **mDNS** > **Service List**.

Step 2 Click **Create Service**.
The **Service List** > **Create Service** page is displayed.

Step 3 In the **Service List Name** text box, enter the service list name.

Step 4 From the **Service rule** drop-down list, choose from the following options:

- **permit—**permits the service list.
- **deny—**denies the service list.

Step 5 In the **Sequence number** text box, enter the priority of the rule.
A rule with a lower sequence number is selected first and the service announcement or query is allowed or denied accordingly. You define the sequence number as per your network requirements.

Step 6 From the **Message type** drop-down list, choose the message type to match from the following options:

- **announcement—**The service list rule allows only service advertisements or announcements for the device.
- **query—**The service list rule allows only a query from the client for a service in the network.

• **any—**The service list rule allows any type of message.

Multiple service maps of the same name with different sequence numbers can be created and the evaluation of the filters will be ordered on the sequence number. Service lists are an ordered sequence of individual statements, each one has a permit or deny result. Evaluation of service list consists of a list scan, in a predetermined order, and an evaluation of the criteria of each statement that matches. A list scan is stopped once the first statement match is found and an action permit/deny associated with the statement match is performed. The default action after scanning through the entire list is to deny.

Step 7 In the **Service instance** text box, enter the service instance to match.

Step 8 In the **Custom** text box, enter the mDNS service type string to match.
The **Learned Service** box shows the services that are added after enabling the learned service type configured by navigating to **Configuration** > **Controller** > **mDNS** > **Global**. For example, _roap._tcp.local. The **Selected Service** box shows the learned service that you have selected for an mDNS service.

Step 9 Click **Apply**.

Step 10 Click **Save Configuration**.

What to Do Next

Proceed to enable the mDNS gateway and redistribution of services.

Enabling mDNS Gateway and Redistributing Services (CLI)

After enabling mDNS gateway for a device, you can apply filters (apply IN-bound filtering or OUT-bound filtering) and active queries by using **service-policy** and **service-policy-query** commands, respectively. You can redistribute services and service announcements using the **redistribute mdns-sd** command, and set some part of the system memory for cache using the **cache-memory-max** command.

Note By default, mDNS gateway is disabled on all interfaces.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **service-routing mdns-sd**
4. **service-policy** *service-policy-name* {**IN** | **OUT**}
5. **redistribute mdns-sd**
6. **cache-memory-max** *cache-config-percentage*
7. **service-policy-query** *service-list-query-name service-list-query-periodicity*
8. **exit**
9. **wireless multicast**
10. **no wireless mdns-bridging**
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 3	**service-routing mdns-sd** **Example:** `Switch (config)# service-routing mdns-sd`	Enables mDNS gateway functionality for a device and enters multicast DNS configuration (config-mdns) mode. **Note** This command enables the mDNS function globally. **Note** Enter the **service-routing mdns-sd source-interface** *if-name* command in either global-config or interface-config mode, to specify an alternate source interface for outgoing mDNS packets, so its IP address can be used when there is none configured on the outgoing interface.
Step 4	**service-policy** *service-policy-name* {**IN** | **OUT**} **Example:** `Switch (config-mdns)# service-policy serv-pol1 IN`	(Optional) For a service list, applies a filter on incoming service discovery information (IN-bound filtering) or outgoing service discovery information (OUT-bound filtering).
Step 5	**redistribute mdns-sd** **Example:** `Switch (config-mdns)# redistribute mdns-sd`	(Optional) Redistributes services or service announcements across subnets. **Note** If redistribution is enabled globally, global configuration is given higher priority than interface configuration.
Step 6	**cache-memory-max** *cache-config-percentage* **Example:** `Switch (config-mdns)# cache-memory-max 20`	(Optional) Sets some part of the system memory (in percentage) for cache. **Note** By default, 10 percent of the system memory is set aside for cache. You can override the default value by using this command.
Step 7	**service-policy-query** *service-list-query-name service-list-query-periodicity*	(Optional) Configures service list-query periodicity.

	Command or Action	Purpose
	Example: `Switch (config-mdns)# service-policy-query sl-query1 100`	
Step 8	**exit** **Example:** `Switch (config-mdns)#exit`	(Optional) Returns to global configuration mode.
Step 9	**wireless multicast** **Example:** `Switch (config)# wireless multicast`	(Optional) Enables wireless Ethernet multicast support.
Step 10	**no wireless mdns-bridging** **Example:** `Switch (config)# no wireless mdns-bridging`	(Optional) Disables bridging of mDNS packets to wireless clients.
Step 11	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode.

Related Topics

Service Discovery Gateway , on page 3
Filtering, on page 4
Example: Specify Alternative Source Interface for Outgoing mDNS Packets, on page 13
Example: Redistribute Service Announcements, on page 13
Example: Disable Bridging of mDNS Packets to Wireless Clients, on page 14
Example: Enabling mDNS Gateway and Redistributing Services, on page 14
Example: Global mDNS Configuration, on page 15
Example: Interface mDNS Configuration, on page 15

Enabling Multicast DNS Gateway (GUI)

SUMMARY STEPS

1. Choose **Configuration** > **Controller** > **mDNS** > **Global**.
2. Select the **mDNS gateway** check box.
3. From the **Learn Service** drop-down list, choose from the following options:
   - **Enable—** Allows the switch to learn all the announced services. It is used to learn services by enabling all announcement/queries by using Service Policy IN of type GUI-permit-all and in Service Policy OUT of type GUI-deny-all.
   - **Disable—** Denies all the traffics IN and OUT. It is used to deny services by disabling all announcement/queries by using Service Policy IN of type GUI-deny-all and in Service Policy OUT of type GUI-deny-all.
   - **Custom—** You can set your own IN and OUT policy. It allows you to define a custom service list.
4. Click **Apply**.
5. Click **Save Configuration**.

DETAILED STEPS

Step 1 Choose **Configuration** > **Controller** > **mDNS** > **Global**.
The **Global Service Rules** page is displayed.

Step 2 Select the **mDNS gateway** check box.

Step 3 From the **Learn Service** drop-down list, choose from the following options:

- **Enable—** Allows the switch to learn all the announced services. It is used to learn services by enabling all announcement/queries by using Service Policy IN of type GUI-permit-all and in Service Policy OUT of type GUI-deny-all.
- **Disable—** Denies all the traffics IN and OUT. It is used to deny services by disabling all announcement/queries by using Service Policy IN of type GUI-deny-all and in Service Policy OUT of type GUI-deny-all.
- **Custom—** You can set your own IN and OUT policy. It allows you to define a custom service list.

Step 4 Click **Apply**.

Step 5 Click **Save Configuration**.

Monitoring Service Discovery Gateway

Table 1: Monitoring Service Discovery Gateway

Command	Purpose
show mdns requests [**detail** | **name** *record-name*| **type** *record-type* [**name** *record-name*]]	This command displays information for outstanding mDNS requests, including record name and record type information.
show mdns cache [**interface** *type number* | **name** *record-name* [**type** *record-type*]| **type** *record-type*]	This command displays mDNS cache information.
show mdns statistics {**all** | **service-list** *list-name* | **service-policy** {**all** | **interface** *type number* }}	This command displays mDNS statistics.

Configuration Examples

Example: Specify Alternative Source Interface for Outgoing mDNS Packets

The following example displays how to specify an alternate source interface for outgoing mDNS packets, so its IP address can be used when there is none configured on the outgoing interface.

```
Switch(config)# service-routing mdns-sd
Switch(config-mdns)# source-interface if-name
```

Related Topics

Enabling mDNS Gateway and Redistributing Services (CLI), on page 9
Service Discovery Gateway , on page 3
Filtering, on page 4

Example: Redistribute Service Announcements

The following example displays how to redistribute service announcements received on one interface over all the interfaces or over a specific interface.

```
Switch(config)# service-routing mdns-sd
Switch(config-mdns)# Redistribute mdns-sd if-name
```

Related Topics

Enabling mDNS Gateway and Redistributing Services (CLI), on page 9
Service Discovery Gateway , on page 3

Filtering, on page 4

Example: Disable Bridging of mDNS Packets to Wireless Clients

The following example displays how to disable bridging of mDNS packets to wireless clients.

```
Switch(config)# wireless multicast
Switch(config)# no wireless mdns-bridging
```

Related Topics

Enabling mDNS Gateway and Redistributing Services (CLI), on page 9
Service Discovery Gateway , on page 3
Filtering, on page 4

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

The following example shows the creation of a service-list sl1. The **permit** command 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.

```
Switch# configure terminal
Switch(config)# service-list mdns-sd sl1 permit 3
Switch(config-mdns-sd-sl)#match message-type announcement
Switch(config-mdns)# exit
```

Related Topics

Configuring the Service List (CLI), on page 5
Service Discovery Gateway , on page 3
Filtering, on page 4

Example: Enabling mDNS Gateway and Redistributing Services

The following example shows how to enable an mDNS gateway for a device and enable redistribution of services across subnets. IN-bound filtering is applied on the service-list serv-pol1. Twenty percent of system memory is made available for cache and service-list-query periodicity is configured at 100 seconds.

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

Related Topics

Enabling mDNS Gateway and Redistributing Services (CLI), on page 9

Service Discovery Gateway , on page 3
Filtering, on page 4

Example: Global mDNS Configuration

The following example displays how to globally configure mDNS.

```
Switch# configure terminal
Switch(config)# service-list mdns-sd mypermit-all permit 10
Switch(config-mdns-sd-s1)# exit
Switch(config)# service-list mdns-sd querier query
Switch(config-mdns-sd-s1)# service-type _dns._udp
Switch(config-mdns-sd-s1)# end
Switch# configure terminal
Switch(config)# service-routing mdns-sd
Switch(config-mdns)# service-policy mypermit-all IN
Switch(config-mdns)# service-policy mypermit-all OUT
```

Related Topics

Enabling mDNS Gateway and Redistributing Services (CLI), on page 9
Service Discovery Gateway , on page 3
Filtering, on page 4

Example: Interface mDNS Configuration

The following example displays how to configure mDNS for an interface.

```
Switch(config)#interface Vlan136
Switch(config-if)# description *** Mgmt VLAN ***
Switch(config-if)# ip address 9.7.136.10 255.255.255.0
Switch(config-if)# ip helper-address 9.1.0.100
Switch(config-if)# service-routing mdns-sd
Switch(config-if-mdns-sd)#  service-policy mypermit-all IN
Switch(config-if-mdns-sd)# service-policy mypermit-all OUT
Switch(config-if-mdns-sd)#  service-policy-query querier 60
```

Related Topics

Enabling mDNS Gateway and Redistributing Services (CLI), on page 9
Service Discovery Gateway , on page 3
Filtering, on page 4

Where to Go Next for Configuring Services Discovery Gateway

You can configure the following:

- IGMP
- Wireless Multicast

- PIM
- SSM
- IP Multicast Routing

Additional References

Related Documents

Related Topic	Document Title
Configuring DNS	*IP Addressing: DNS Configuration Guide, Cisco IOS XE Release 3SE*
DNS conceptual information	'Information About DNS' section in *IP Addressing: DNS Configuration Guide, Cisco IOS XE Release 3SE*
Platform-independent configuration information	*IP Addressing: DNS Configuration Guide, Cisco IOS XE Release 3SE*

Error Message Decoder

Description	Link
To help you research and resolve system error messages in this release, use the Error Message Decoder tool.	https://www.cisco.com/cgi-bin/Support/Errordecoder/index.cgi

Standards and RFCs

Standard/RFC	Title
RFC 6763	*DNS-Based Service Discovery*
Multicast DNS Internet-Draft	Multicast

MIBs

MIB	MIBs Link
All supported MIBs for this release.	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 History and Information for Services Discovery Gateway

Release	Modification
Cisco IOS XE 3.3SE	This feature was introduced.