

Cisco Catalyst 3850 and 3650 Series Platforms: Service Discovery Gateway

Cisco IOS 3.3.4 SE Release



Contents

Preface	3
1. Introduction	4
2. Deployment Scenarios	5
2.1 MDNS on One Node	5
2.2 MDNS across Multiple Nodes	7
3. Configuration	8
3.1 Example of Configuring for Multiple-Node Deployment	8
3.2 CLI Configuration Commands	11
4. Useful Commands	12
5. Key Points	14
6. Appendix	15
6.1 Common Service Names	15
6.2 Advanced SDG Features	15
6.3 Platform Support	16

Preface

This document provides an overview of the Cisco® Service Discovery Gateway (SDG) functionality and shows how the Cisco SDG feature functions, as well as how it can be practically deployed in an enterprise bring-your-own-device (BYOD) context to manage various services. To this end, step-by-step configuration guidance and verification commands are presented for the Cisco Catalyst® 3850 and 3650 Series Switches (with the Cisco IOS® 3.3.4 SE release).

1. Introduction

Bonjour is Apple's zero-configuration (Zeroconf) protocol for advertising, discovering, and connecting to network services, such as file sharing, print sharing, media sharing, etc. It is supported on both Mac OS X devices (such as laptops and desktops), as well as on Apple iOS devices (such as iPhones and iPads). Zeroconf is designed to make network configuration easier for users. It was originally designed for home network use and uses Multicast Domain Name Services (mDNS) through link-local multicasting to share network services. While this approach works well in most networks, a limitation of link-local multicasting is that these network services can be shared within only a single Layer 2 domain (such as a VLAN or WLAN). In a BYOD enterprise scenario, different WLANs and VLANs are used for different classes of devices, including corporate devices, employee devices, personal devices, and guest devices (as well as quarantine WLANs for unapproved devices). As such, basic operations, such as printing to a wired printer from a wireless LAN, may not be natively supported.

To address this limitation and to facilitate user demand for BYOD devices in the enterprise, Cisco has developed the Service Discovery Gateway (SDG) feature. With SDG, we can extend service discovery beyond the link-local scope by implementing a proxy and redistribution component. This feature solves the Layer 2 domain limitation by allowing the Cisco Wireless LAN Controller (WLC) to snoop, cache, and respond by proxy- to various service requests that may reside on different Layer 2 domains. These services are added to a cache and whenever a device asks for a service, the switch looks up that service in its cache and, when it finds a match, it responds in a proxy-like fashion. Additionally, this technology has the capability to apply service filters so that these responses can be selectively controlled by administrative policies so that only certain services are permitted in specific Layer 2 domains.

The SDG is a Cisco networkwide solution of implementing the Zeroconf while overcoming the challenges of service discovery in Zeroconf. SDG allows the service information to propagate over Layer 3 boundaries so that devices in one Layer 2 domain can discover services in a different Layer 2 domain altogether.

Multicast Domain Name System (mDNS) is primarily a protocol used in implementing the service discovery. All DNS service discovery messages are typically transported through mDNS. It is defined in RFC 6762 Multicast DNS.

Tech Tip: Bonjour is the specific implementation of Apple technology that deals with service discovery using the Zeroconf as the underlying technology

For example, consider if you enable IP-based print services. Each printer needs a unique IP address, whether statically assigned or dynamically assigned (by a DHCP server). Because dynamically assigned addresses can change, most printers are manually configured with a static address so that computers on the network can reach them using the same address every time. In this case, each client device must know the statically configured IP address of the printer, or printers, to use these. To make the process more user friendly, network administrators can configure DNS records so that clients can access printers by name rather than by specific IP addresses. Even so, the clients must know the specific DNS name of each printer they are trying to access. Thus, the seemingly minor task of enabling IP-based printing can require significant client and server configuration. As such, this level of configuration is not practical in such a setting.

Consider the same example in a network running Zeroconf. Zeroconf lets you connect a printer to your network without assigning it a specific IP address or manually entering that address in each computer. With Zeroconf networking, nearby computers can discover its existence and automatically determine the printer's IP address. If that address is a dynamically assigned an address that changes, they can automatically discover the new address in the future. Notice that while Zeroconf is predominantly associated with Apple products, it is not limited to them. Almost every printer with network connectivity supports Zeroconf by default, facilitating initial discovery and configuration, and ease of use in daily operation. Zeroconf functionality is not limited to printing and includes file-sharing services, remote desktop services, full screen mirroring, and various iTunes services including music and video streaming. Zeroconf is available on multiple endpoint devices, such as smartphones, tablets, PCs, Macs, cameras, displays, audio-visual (AV) receivers, speakers, storage appliances, wireless routers, etc. It's also available on various operating systems such as Windows, Mac OS, Linux, Android, and iOS.

The Cisco Service Discovery Gateway services benefit not only users (who no longer need to assign IP addresses or host names to access network services), but also applications (applications can use DNS service discovery [DNS-SD] to automatically detect required services or to interact with other applications to allow for automatic connection, communication, and data exchange, all without any user configuration).

This document provides an overview of the Cisco Service Discovery Gateway and mDNS protocol. It also discusses how it can be practically deployed in an enterprise BYOD context. To this end, step-by-step configuration guidance and verification commands are presented for the Cisco Catalyst 3850 and 3650 Series Switches (with the Cisco IOS 3.3.4 SE release).

2. Deployment Scenarios

The following describes mDNS deployment scenarios on one node and multiple nodes.

2.1 MDNS on One Node

In this section we describe the various combinations that can arise when deploying the mDNS protocol on one Cisco Catalyst 3850 (controller) node. Given that the mDNS addresses are in the multicast address range, we see some differences in behavior when wireless multicast is enabled or disabled. Tables 1, 2, and 3 describe in detail the mDNS behavior for the following deployment scenarios (Figure 1) for wireless endpoints:

Case 1: Wireless client and Apple TV are connected on the same WLAN (and hence same client VLAN).

Case 2: Wireless client and Apple TV are connected on different WLANs having the same client VLAN.

Case 3: Wireless client and Apple TV are connected on different WLANs having different client VLAN IDs.

These scenarios are described in more detail in the following topology diagram. Notice that services similar to airplay exhibit similar behavior. For the purpose of this document we consider airplay as one such service when interacting with Apple TV.

Figure 1. Three Scenarios with a Wireless Client and Apple TV

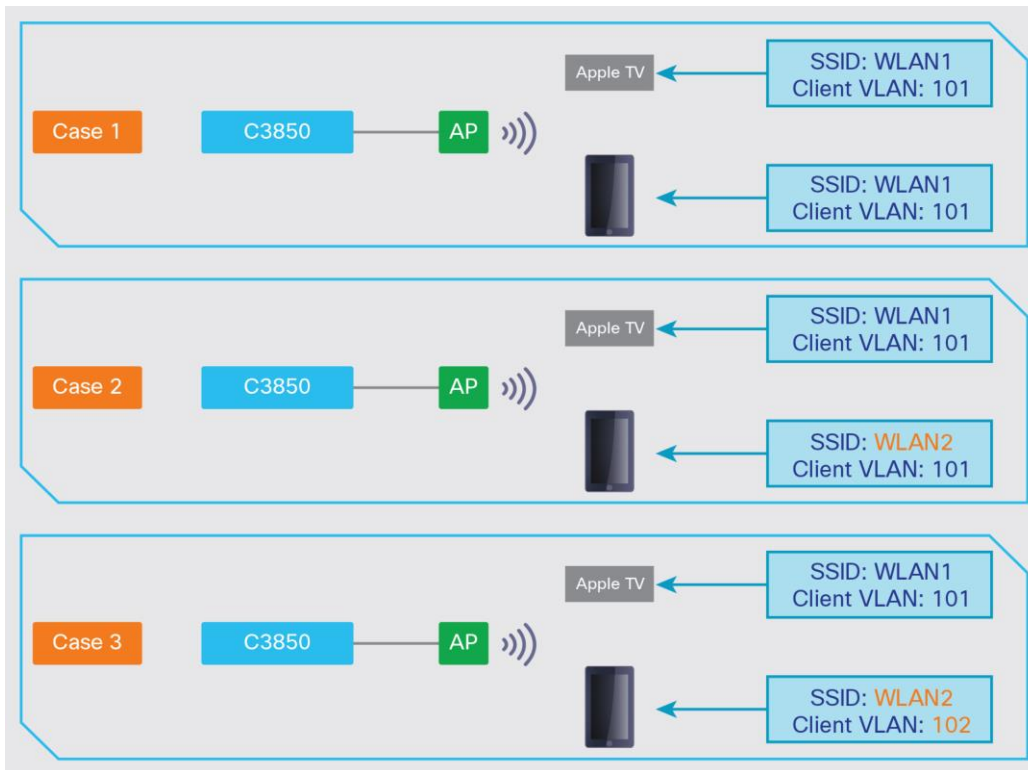


Table 1. Client and Apple TV on Same WLAN (No Active Query)

Wireless Multicast (Enabled Yes/No)	mDNS Bridging (Enabled Yes/No)	mDNS Enable (Enabled Yes/No)	Airplay Service Visibility on Client (Yes/No)
No	No	No	No
No	No	Yes	Yes
Yes	Yes	No	Yes
Yes	No	No	No
Yes	Yes	Yes	Yes

Table 2. Client and Apple TV on Different WLAN (Same Client VLAN/No Active Query)

Wireless Multicast (Enabled Yes/No)	mDNS Bridging (Enabled Yes/No)	mDNS Enable (Enabled Yes/No)	Airplay Service Visibility on Client (Yes/No)
No	No	No	No
No	No	Yes	Yes
Yes	Yes	No	Yes
Yes	No	No	No
Yes	Yes	Yes	Yes

Table 3. Client and Apple TV on Different WLAN (Different Client VLAN/No Active Query)

Wireless Multicast (Enabled Yes/No)	mDNS Bridging (Enabled Yes/No)	mDNS Enable (Enabled Yes/No)	Airplay Service Visibility on Client (Yes/No)
No	No	No	No
No	No	Yes	Yes
Yes	Yes	No	No
Yes	No	No	No
Yes	Yes	Yes	Yes

As shown in these tables, with wireless multicast enabled on the switch, wireless clients on the same client VLAN are able to discover services even when mDNS configuration is not enabled. To disable this behavior, the **no wireless mdns-bridging** configuration needs to be added on the switch. When the wireless client and Apple TV are on different client VLANs, services can be discovered on the client only when mDNS is enabled on the switch.

For more information about the **wireless mdns-bridging** configuration, see section 3.0, “Configuration.”

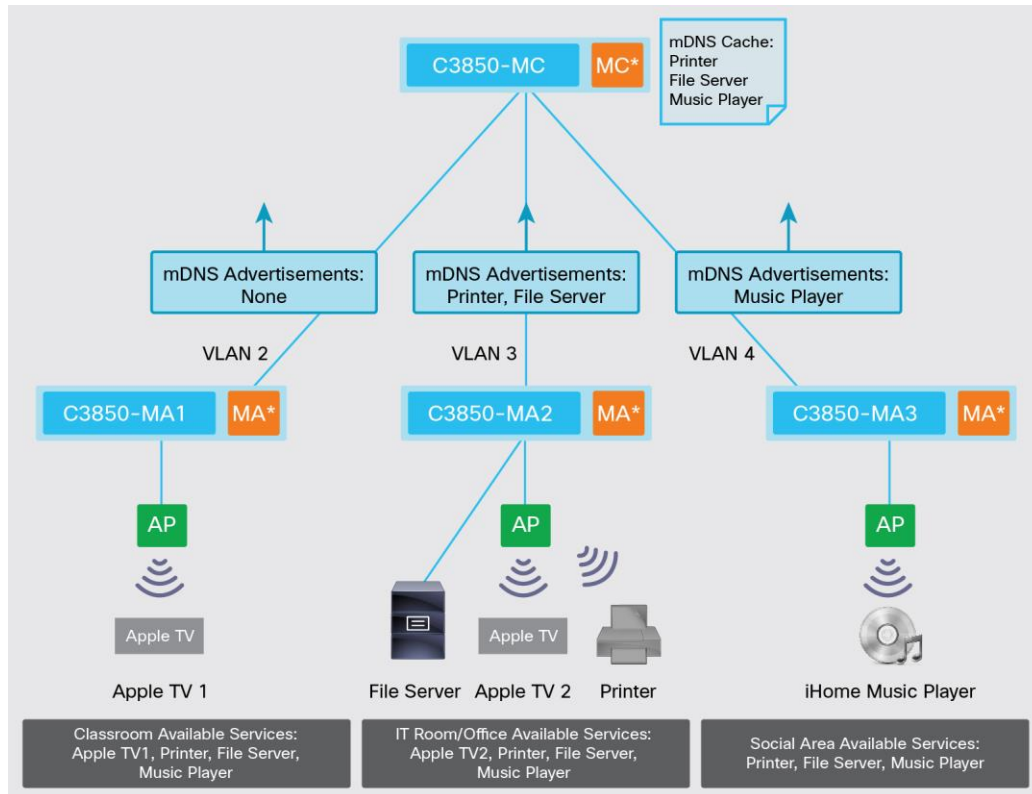
2.2 MDNS across Multiple Nodes

In this section we describe the Cisco SDG as a service in a converged access deployment model for a multinode scenario consisting of a Cisco Catalyst 3850 Series Switch in the distribution layer and three Cisco Catalyst 3850 Series Switches in the access layer. A typical Cisco Catalyst 3850 and Catalyst 3650 Series Switches converged access deployment model consists of one Cisco Catalyst 3850 or Catalyst 3650 Switch as Mobility Controller and the remainder of the switches acting as mobility agents. In the following (Figure 2) shows the C850-MC acting as the mobility controller in the distribution layer is the Layer 3 termination for the Layer 3 subnets spanning across the VLANs connected to the Cisco access switches C3850-MA1, C3850-MA2, and C3850-MA3. Notice that in this design the Cisco C3850-MA1, C3850-MA2, and C3850-MA3 switches are pure layer-2 domains and the layer-3 termination is at the Cisco C3850-MC switch. This C3850-MC switch is responsible for maintaining the mDNS cache for all services that it learns across multiple VLANs. It is also responsible for filtering the services and enforcing the service policies. As a practical example, consider three different areas in a school environment: a classroom (C3850-MA1), an IT room (C3850-MA2), and a social area (C3850-MA3). Each of these 3850 nodes has mDNS enabled with various types of end devices connected to them.

For our deployment example, consider the following rules:

- The Apple TV1 device in the classroom does not need to be advertised outside the classroom. The AppleTV1 services do not need to be available in other rooms.
- The printer and the file server in the IT room area do need to have their services advertised to the other nodes in the network. The Apple-TV2 device located in this area needs to remain local to this area.
- The music player in the social area does need to be advertised to all other nodes in the school network.

Figure 2. SDG Deployment Scenario



The switch configuration required for this deployment scenario is explained in the following section.

3. Configuration

Following is a configuration example for multiple node deployments and a description of the command line interface (CLI) commands used for configuration.

3.1 Example of Configuring for Multiple-Node Deployment

Based on the previous topology, the entire necessary mDNS configuration is applied only on the Cisco 3850-MC node, which acts as a termination point for all other access switches. This switch is responsible for maintain the mDNS cache for all services that it learns across multiple VLANs. It is responsible for filtering the services and enforcing the service advertisement policies. Because the Cisco access switches C3850-MA1, C3850-MA2, and C3850-MA3 have Layer 2 VLAN domains that extend and terminate at the Cisco C3850-MC switch, the only configuration specific to mDNS that is needed is to enable **wireless multicast** and **wireless mDNS bridging**. For the sake of keeping the configuration relevant only to mDNS, this document assumes that the network is already provisioned for wireless and any other network related tasks that are mandatory.

C3850-MA1 Node, C3850-MA2 Node, C3850-MA3 Node

```
# Enable Wireless Multicast and mDNS Bridging
wireless multicast
!
```


C3850-MC Node

```
# Define Service-list to deny all the advertisements from C3850-MA1 classroom and
permit only the announcements and queries types of mDNS Services
service-list mdns-sd 3850-MA1-PERMIT-LIST1 permit 10
  match message-type query
!
service-list mdns-sd 3850-MA1-PERMIT-LIST1 deny 20
!
# # Define Service-list to permit specific services from C3850-MA2 IT Room/Office
service-list mdns-sd 3850-MA2-PERMIT-LIST2 permit 10
  match message-type query
!
service-list mdns-sd 3850-MA2-PERMIT-LIST2 permit 20
  match message-type announcement
  match service-type _smb._tcp.local
!
service-list mdns-sd 3850-MA2-PERMIT-LIST2 permit 30
  match message-type announcement
  match service-type _afpovertcp._tcp.local
!
service-list mdns-sd 3850-MA2-PERMIT-LIST2 permit 40
  match message-type announcement
  match service-type _printer._tcp.local
!
service-list mdns-sd 3850-MA2-PERMIT-LIST2 permit 50
  match message-type announcement
  match service-type _ipp._tcp.local
!

service-list mdns-sd 3850-MA2-PERMIT-LIST2 deny 60
!
# # Define Service-list to permit specific services from C3850-MA3 Social Lounge
room
service-list mdns-sd 3850-MA3-PERMIT-LIST3 permit 10
  match message-type query
!
service-list mdns-sd 3850-MA3-PERMIT-LIST3 permit 20
  match message-type announcement
  match service-type _raop._tcp.local
!
service-list mdns-sd 3850-MA3-PERMIT-LIST3 deny 30
!
# # Define Service-list to permit all kinds of services, announcements etc. Can
be used for outgoing responses.
service-list mdns-sd PERMIT-ALL permit 10
```

```
!
# Active Query service list for periodically polling interesting services in the
network
service-list mdns-sd ACTIVE-QUERY1 query
  service-type _printer._tcp.local
  service-type _ipp._tcp.local
  service-type _afpovertcp._tcp.local
  service-type _smb._tcp.local
  service-type _raop._tcp.local
!

# Enable the mDNS
# Policy to periodically query for services, every 900 seconds
service-routing mdns-sd
  service-policy-query ACTIVE-QUERY1 900
!

# Enable Wireless Multicast and mDNS Bridging
#We're only permitting specific services into the cache and ignore the rest using
the filters defined above (IN). We are not restricting any responses from the
cache (OUT)

interface Vlan2
  description Connecting the C3850-MA1 VLAN
  ip address 2.1.1.1 255.255.255.0
  service-routing mdns-sd
  service-policy 3850-MA1-PERMIT-LIST1 IN
  service-policy PERMIT-ALL OUT
!
interface Vlan3
  description Connecting the C3850-MA2 VLAN
  ip address 3.1.1.1 255.255.255.0
  service-routing mdns-sd
  service-policy 3850-MA2-PERMIT-LIST2 IN
  service-policy PERMIT-ALL OUT
!
interface Vlan4
  description Connecting the C3850-MA3 VLAN
  ip address 4.1.1.1 255.255.255.0
  service-routing mdns-sd
  service-policy 3850-MA2-PERMIT-LIST3 IN
  service-policy PERMIT-ALL OUT
!
```

Notice that the statement **service-list mdns-sd 3850-MA2-PERMIT-LIST2 deny 60** at the end of the service list implicitly denies the remainder of the services by default. However, if you want to explicitly block certain advertisements, then configuring an explicit **deny** can do it. For example, if the **airplay** service from Apple TV2 needs to be explicitly denied, configure it as follows:

```
## The following configuration snippet is intended to show the usage and is
redundant/optional in the above configuration example.
service-list mdns-sd 3850-MA2-PERMIT-LIST2 deny 55
  match message-type announcement
  match service-type _airplay._tcp
```

3.2 CLI Configuration Commands

This section gives a brief description of the CLI configuration commands used in this guide.

1. To enable the mDNS functionality, issue the following command in the global configuration:

```
service-routing mdns-sd
```

2. To apply a filter for incoming or outgoing mDNS services, issue the following command in the global configuration or interface configuration mode as applicable:

```
service-policy <service-list> <in/out>
```

3. To redistribute the newly discovered services over to the adjoining switch issue the following command at the interface level. This redistributes the services only to the next-hop switch connected on that interface.

Note: The **redistribute** command is not available in global configuration mode. For more information about the use of redistribute commands, see the recommendations for redistribution in section 5, “Key Points.”

```
service-routing mdns-sd
  redistribute mdns-sd
```

4. The active query feature of the SDG refreshes cache content before it times out due to transistor-transistor logic (TTL) expiring. To enable periodic scanning for existing services on the network, issue the **service-policy-query** command. Because periodic announcements of services is not required by the RFC, PTR records can time out and thus the cache does not respond without a valid PTR record. With this active query in place, a query is sent for a given service type and domain as defined in the service-list. Any device that is aware of matching services replies with service information. This helps to keep the records refreshed without expiring in the mDNS cache. A service-list is associated with the query to provide more flexibility to choose either all services or interested services to scan for:

```
service-routing mdns-sd
  service-policy-query <service-list> <timer seconds>
```

Tech Tip: A good value on a typical implementation is 900s (assuming a PTR TTL of 4,500 seconds).

5. When **wireless multicast** is issued, **wireless mdns bridging** is enabled by default. Similarly, **no wireless multicast** disables **wireless mdns bridging** by default. To enable wireless multicast but disable bridging of mDNS packets to wireless clients, issue the following command in global-configuration:

```
wireless multicast
no wireless mdns-bridging
```

6. The following command needs to be used to define mDNS filters. Filters are like access control lists (ACLs) for mDNS. The following command defines the service types, message types, or instances that are learned or redistributed:

```
service-list mdns-sd <name> {permit|deny} <sequence_number>
match message-type {query|announcement|any}
match service-instance <instance-name>
match service-type <DNS service type string>
```

4. Useful Commands

1. The **show mdns cache** command displays the mDNS cache information for the switch. This output can be filtered based on the interface, record name, and/or the record type:

```
show mdns cache [ interface <number> | name <record-name> [ type <record-type>] |
type <record-type>]
```

```
3850-MC# show mdns cache
```

```

                                     mDNS CACHE
=====
[<NAME>]                               [<TYPE>][<CLASS>]
[<TTL>/Remaining] [Accessed] [If-name] [Mac Address] [<RR Record Data>]

_afpovertcp._tcp.local                 PTR    IN    4500/4230    0
  V13    6476.ba99.51ba    FileServer._afpovertcp._tcp.local

_smb._tcp.local                         PTR    IN    4500/4230    9
  V13    6476.ba99.51ba    FileServer._smb._tcp.local

FileServer._afpovertcp._tcp.local      TXT    IN    4500/4230    9
  V13    6476.ba99.51ba    (1)''

FileServer._smb._tcp.local             TXT    IN    4500/4230    9
  V13    6476.ba99.51ba    (1)''

_raop._tcp.local                       PTR    IN    4500/4452    4
  V14    c8d5.fee6.b8f1    C8D5FEE6B8F1@iHome iw3 E6B8F1._raop._tcp.local

C8D5FEE6B8F1@iHome iw3 E6B8F1._raop._tcp.local  SRV    IN    120/72    4
  V14    c8d5.fee6.b8f1    0    0    1024    iHome-iW3-E6B8F1.local

iHome-iW3-E6B8F1.local                 A      IN    120/72    4
  V14    c8d5.fee6.b8f1    4.1.1.14

C8D5FEE6B8F1@iHome iw3 E6B8F1._raop._tcp.local  TXT    IN    4500/4452
  4      V14    c8d5.fee6.b8f1
  (123)'txtvers=1''ch=2''cn=0,1''et=0,4''sv=false''da=true''sr=44100''ss=16''pw=
false'~
```

```

_printer._tcp.local PTR IN 4500/4499 1
V13 ac18.266e.c562 EPSON XP-810 Series-6EC562-02._printer._tcp.local

_smb._tcp.local PTR IN 4500/4499 1
V13 ac18.266e.c562 EPSON XP-810 Series-6EC562-02._smb._tcp.local

EPSON XP-810 Series-6EC562-02._printer._tcp.local SRV IN 120/119 1
V13 ac18.266e.c562 0 0 515 EPSON6EC562.local

EPSON XP-810 Series-6EC562-02._smb._tcp.local SRV IN 120/119 1
V13 ac18.266e.c562 0 0 445 EPSON6EC562.local

EPSON6EC562.local A IN 120/119 1
V13 ac18.266e.c562 3.1.1.60

EPSON XP-810 Series-6EC562-02._printer._tcp.local TXT IN 4500/4499 1
V13 ac18.266e.c562 (201)'txtvers=1''priority=50''ty=EPSON XP-810
Series''usb_MFG=EPSON''usb_MDL=XP~''

EPSON XP-810 Series-6EC562-02._smb._tcp.local TXT IN 4500/4499 1
V13 ac18.266e.c562 (1)''

_universal._sub._ipp._tcp.local PTR IN 4500/4499 1
V13 ac18.266e.c562 EPSON XP-810 Series-6EC562-02._ipp._tcp.local

_ipp._tcp.local PTR IN 4500/4499 1
V13 ac18.266e.c562 EPSON XP-810 Series-6EC562-02._ipp._tcp.local

EPSON XP-810 Series-6EC562-02._ipp._tcp.local TXT IN 4500/4499
1 V13 ac18.266e.c562 (441)'txtvers=1''priority=30''ty=EPSON XP-
810 Series''usb_MFG=EPSON''usb_MDL=XP~''

EPSON XP-810 Series-6EC562-02._ipp._tcp.local SRV IN 120/119
1 V13 ac18.266e.c562 0 0 631 EPSON6EC562.local

```

2. You can also query for a specific service type.

```
show mdns cache name <service name>
```

```
3850-MC#show mdns cache name _raop._tcp.local
```

```

mDNS CACHE
=====
[<NAME>] [<TYPE>] [<CLASS>]
[<TTL>/Remaining] [Accessed] [If-name] [Mac Address] [<RR Record Data>]

_raop._tcp.local PTR IN 4500/4452 4
V14 c8d5.fee6.b8f1 C8D5FEE6B8F1@iHome iW3 E6B8F1._raop._tcp.local

```

3. The following command clears the mDNS cache information from the switch:

```
clear mdns cache
```

4. The following command checks the packet statistics.

```
show mdns statistics all
```

```
show mdns statistics <service list name>
```

```
3850-MC#show mdns statistics all
mDNS Statistics
mDNS packets sent           : 108113
mDNS packets received      : 6485
mDNS packets dropped       : 174
mDNS packets dropped via Rate Limit : 0
mDNS cache memory in use: 65544(bytes)
```

```
3850-MC#show mdns statistics service-list 3850-MA2-PERMIT-LIST2
service-list mdns-sd 3850-MA2-PERMIT-LIST2 [matched 4814]
    permit 10 [matched 1729]
    permit 20 [matched 592]
    permit 30 [matched 89]
    permit 40 [matched 70]
    permit 50 [matched 68]
    deny 60 [matched 2177]
```

5. Key Points

When you're implementing SDG functionality on the Cisco Catalyst 3850 platform with the Cisco IOS XE 3.3.4 SE release, remember these keys points:

- The simplest configuration for SDG includes a **PERMIT-ALL** service filter, which is applied globally in the service discovery configuration for in- and outgoing services. However, such a configuration should be avoided in production networks. The recommendation is to define filters and be specific about which services are extended to other segments.
- The active query feature should be used whenever the service list needs to be refreshed.
- Any mDNS filters configured on the interface level takes precedence over the filters configured globally.
- mDNS is not single sign-on (SSO) aware, and there is no cache synchronization in this release across active-standby. The active query feature is one of the ways services are re-learned after SSO. The expectation is that only a subset of services are permitted in a deployment by configuring an IN-OUT service list and applying for filtering. The same set of service types must be configured as active query to be relearned on SSO.
- By default, mDNS gateway functionality is disabled on all interfaces.
- The first permit used in this document with **match message-type query** is mandatory for incoming filters. Otherwise, SDG does not work. This requirement corresponds with the following console message, which is displayed on an SDG enabled router: "Warning: Please enable explicit service list rule with permit action to allow queries and responses."

Following are recommendations specific to the redistribution of mDNS services:

- The best practice is to **not** turn on redistribution of service announcements. Turning on redistribution is not required to extend services across subnets. Using the **active query** command is sufficient most times to extend the services across the subnets. Improper use of redistribution can cause multicast storms in the network and should be enabled only if needed. The control for specific filters is set to OUT.
- On the Cisco Catalyst 3850 access switch, **redistribute mDNS** should be enabled only on the required interfaces and/or VLANs.
- Enabling the redistribution of mDNS services at the global level is **not** supported. It can be enabled only at the interface level. This example implementation prevents looping of mDNS service announcements.
- The redistribute mDNS configuration does not redistribute the existing services from the mdns cache. It redistributes any newly learnt or relearned services.

6. Appendix

This appendix describes information about common service names, advanced SDG features, and the switching platforms that support SDG.

6.1 Common Service Names

Table 4 shows the most commonly used service instance names and the description for each of those.

Table 4. Common Service Names

Service	Description
printer	Spooler (more commonly known as LPR printing or LPD printing)
raop	Remote Audio Output Protocol (RAOP) for Apple AirTunes
ipp	Internet Printing Protocol
Afpovertcp	Apple file sharing
smb	Server message block over TCP/IP
rtsp	Real Time Streaming Protocol (RTSP)
daap	Digital Audio Access Protocol (DAAP) for Apple iTunes
sleep-proxy	Sleep proxy server
home-sharing	Apple iTunes home sharing
appletv	Apple TV
ftp	File Transfer Protocol (FTP)
sftp-ssh	Secure File Transfer Protocol (SFTP) over Secure Shell (SSH)
rfb	Remote Frame Buffer (RFB), which can be used for screen sharing or Virtual Network Computing (VNC).

6.2 Advanced SDG Features

It is to be noted that this deployment guide explains only the most common and simplistic use case of deploying SDG. There are, however, more advanced SDG features that are available and out of the scope of this document. The following are the list of the advanced features that are available in the 03.0.6.00SE release of Cisco IOS Software.

Table 5. Advanced SDG Features and their Release of Cisco IOS Software

Feature	Release of Cisco IOS Software
Proximity Awareness	03.06.00SE
Civic Location Based Service	03.06.00SE
mDNS Service Enumeration	03.06.00SE
mDNS Designated Gateway	03.06.00SE
HA Awareness - HSRP/VRRP	03.06.00SE
mDNS Static Service definition and announcement	03.06.00SE

6.3 Platform Support

SDG functionality is supported on the following platforms.

Table 6. SDG Functionality in Cisco IOS Software

Platform	First Release Support for Cisco IOS Software
Cisco Catalyst 6500 Series	15.1(2)SY
Cisco Catalyst 4500 Series	3.5.0E
Cisco Catalyst 3850 Series	3.3.0SE
Cisco Catalyst 3650 Series	3.3.0SE



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at www.cisco.com/go/offices.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: www.cisco.com/go/trademarks. Third party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)