Cisco DNA Service For Bonjour Configuration Guide, Cisco Nexus 9000 Series NX-OS, Release 10.6(x)

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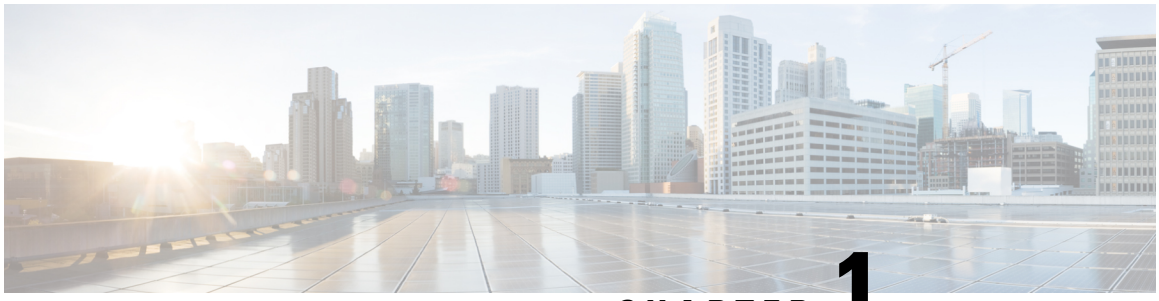


CHAPTER 1

New and Changed Information

- New and Changed Information, on page 1

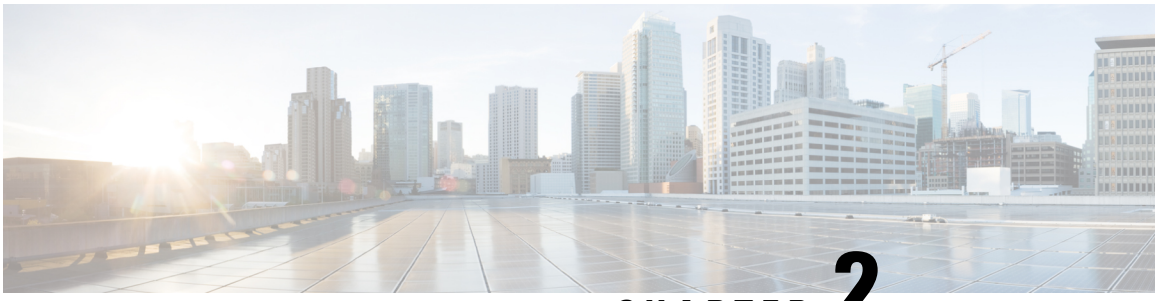
New and Changed Information

This table summarizes the new and changed features for the *Cisco DNA Service For Bonjour Configuration Guide, Cisco Nexus 9000 Series NX-OS, Release 10.6(1)F* and where they are documented.

Table 1: New and Changed Features

Feature	Description	Changed in Release	Where Documented
NA	No new features added for this release.	10.6(1)F	NA

New and Changed Information



CHAPTER 2

Cisco DNA Service for Bonjour Solution Overview

- About Cisco DNA Service for Bonjour Solution, on page 3
- Solution Components, on page 4
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About Cisco DNA Service for Bonjour Solution

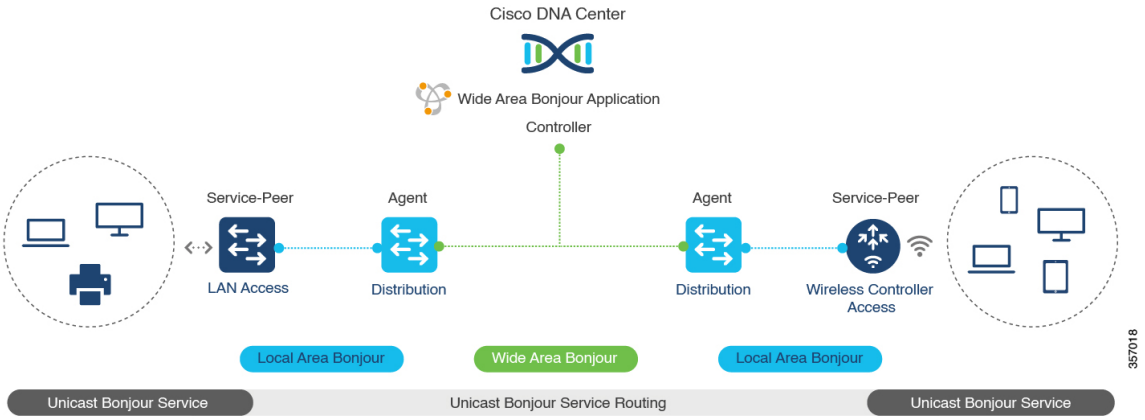
The Apple Bonjour protocol is a zero-configuration solution that simplifies network configuration and enables communication between connected devices, services, and applications. Using Bonjour, you can discover and use shared services with minimal intervention and configuration. Bonjour is designed for single Layer 2 domains that are ideal for small, flat, single-domain setups, such as home networks. The Cisco DNA Service for Bonjour solution eliminates the single Layer 2 domain constraint and expands the scope to enterprise-grade traditional wired and wireless networks, including overlay networks such as Cisco Software-Defined Access (SD-Access) and industry-standard BGP EVPN with VXLAN. The Cisco Catalyst 9000 series LAN switches and wireless LAN controllers follow the industry standard, RFC 6762-based multicast DNS (mDNS) specification to support interoperability with various compatible wired and wireless consumer products in enterprise networks.

The Cisco Wide Area Bonjour application is a software-defined, controller-based solution that enables devices to advertise and discover Bonjour services across Layer 2 domains, making these services applicable to a wide variety of wired and wireless enterprise networks. The Cisco Wide Area Bonjour application also addresses problems relating to security, policy enforcement, and services administration on a large scale. The new distributed architecture is designed to eliminate mDNS flood boundaries and transition to unicast-based service routing, providing policy enforcement points and enabling the management of Bonjour services. With the Cisco Wide Area Bonjour application, you can seamlessly introduce new services into the existing enterprise environment without modifying the existing network design or configuration.

The enhanced intuitive GUI provides you with centralized access control and monitoring capabilities, combined with the scalability and performance required for large-scale Bonjour services deployments for various supporting enterprise network types.

The following figure illustrates how the Cisco Wide Area Bonjour application operates across two integrated domain networks with end-to-end unicast-based service routing.

Figure 1: Cisco Wide Area Bonjour Solution



- **Local-Area Service Discovery Gateway Domain - Multicast DNS Mode**: The classic Layer 2 multicast flood-n-learn-based deployment model. The service provider and receiver can discover and browse within the common VLAN or broadcast domain without any security and location-based policy enforcement. The Cisco Catalyst switches at the Layer 3 boundary function as the Service Discovery Gateway (SDG) to discover and distribute services between local wired or wireless VLANs based on applied policies. The inter-VLAN service routing at a single gateway is known as Local Area Bonjour.
- **Local Area Service Discovery Gateway Domain - Unicast Mode**: The new enhanced Layer 2 unicast policy-based deployment model. The new mDNS service discovery and distribution using Layer 2 unicast address enables flood-free LAN and wireless networks. Cisco Catalyst switches and Cisco Catalyst 9800 series wireless LAN controllers in Layer 2 mode introduce a new service-peer role, replacing classic flood-n-learn, for new unicast-based service routing support in the network. The service-peer switch and wireless LAN controller also replace mDNS flood-n-learn with unicast-based communication with any RFC 6762 mDNS-compatible wired and wireless endpoints.
- **Wide-Area Service Discovery Gateway Domain**: The Wide Area Bonjour domain is a controller-based solution. The Bonjour gateway role and responsibilities of Cisco Catalyst switches are extended from a single SDG switch to an SDG agent, enabling Wide Area Bonjour service routing beyond a single IP gateway. The network-wide distributed SDG agent devices establish a lightweight, stateful, and reliable communication channel with a centralized Cisco DNA Center controller running the Cisco Wide Area Bonjour application. Service routing between the SDG agents and the controller operates over regular IP networks using TCP port 9991. The SDG agents route locally discovered services based on the export policy.

Solution Components

The Cisco DNA Service for Bonjour solution is an end-to-end solution that includes the following key components and system roles to enable unicast-based service routing across the local area and Wide Area Bonjour domain:

- **Cisco Service peer**: A Cisco Catalyst switch and Catalyst Wireless LAN Controller (WLC) in Layer 2 access function in service peer mode to support unicast-based communication with local attached endpoints and export service information to the upstream Cisco SDG agent in the distribution layer.

- **Cisco SDG agent**: A Cisco Catalyst switch functions as an SDG agent and communicates with the Bonjour service endpoints in Layer 3 access mode. At the distribution layer, the SDG agent aggregates information from the downstream Cisco service peer switch and WLC, and exports information to the central Cisco DNA controller.
- **Cisco DNA controller**: The Cisco DNA controller builds the Wide Area Bonjour domain with network-wide and distributed trusted SDG agents using a secure communication channel for centralized services management and controlled service routing.
- **Endpoints**: A Bonjour endpoint is any device that advertises or queries Bonjour services conforming to RFC 6762. The Bonjour endpoints can be in either LANs or WLANs. The Cisco Wide Area Bonjour application is designed to integrate with RFC 6762-compliant Bonjour services, including AirPlay, Google Chrome cast, AirPrint, and so on.

Supported Platforms

See the Nexus Switch Platform Support Matrix to know from which Cisco NX-OS releases various Cisco Nexus 9000 and 3000 switches support a selected feature.

Supported Network Design

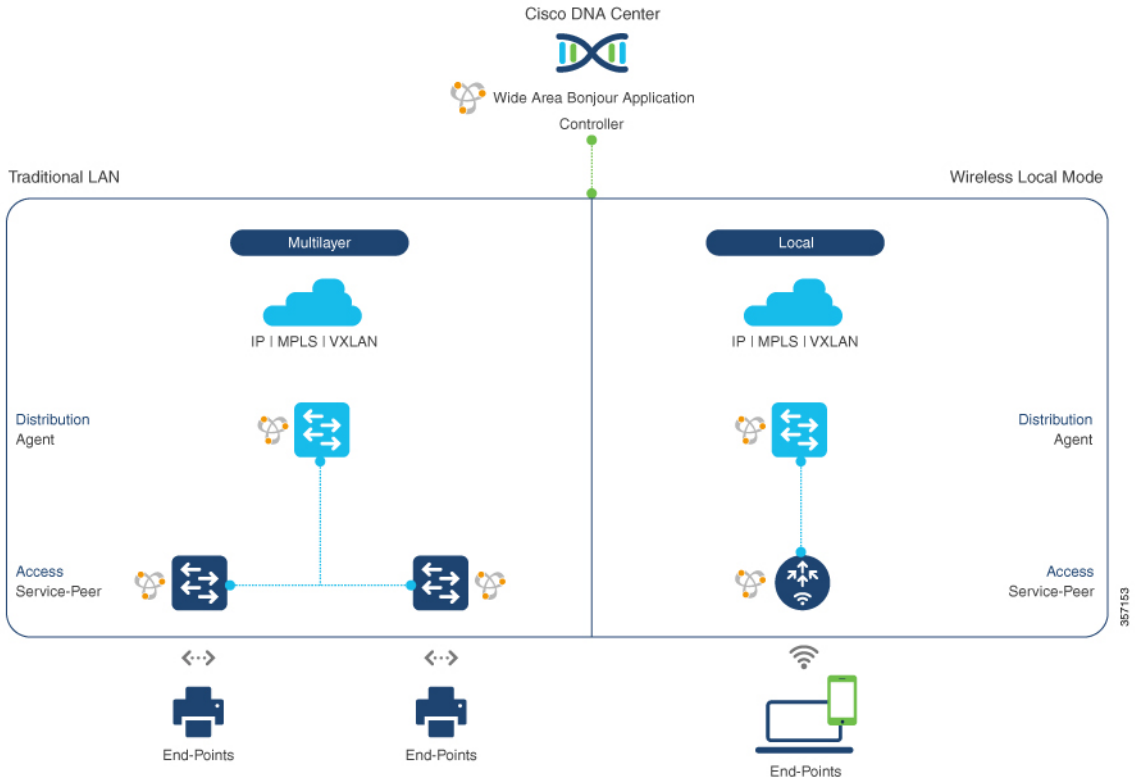
The Cisco DNA Service for Bonjour supports a broad range of enterprise-grade networks. The end-to-end unicast-based Bonjour service routing is supported on traditional, Cisco SD-Access, and BGP EVPN-enabled wired and wireless networks.

Traditional Wired and Wireless Networks

Traditional networks are classic wired and wireless modes deployed in enterprise networks. Cisco DNA Service for Bonjour supports a broad range of network designs to enable end-to-end service routing.

The following figure illustrates traditional LAN network designs that are commonly deployed in an enterprise.

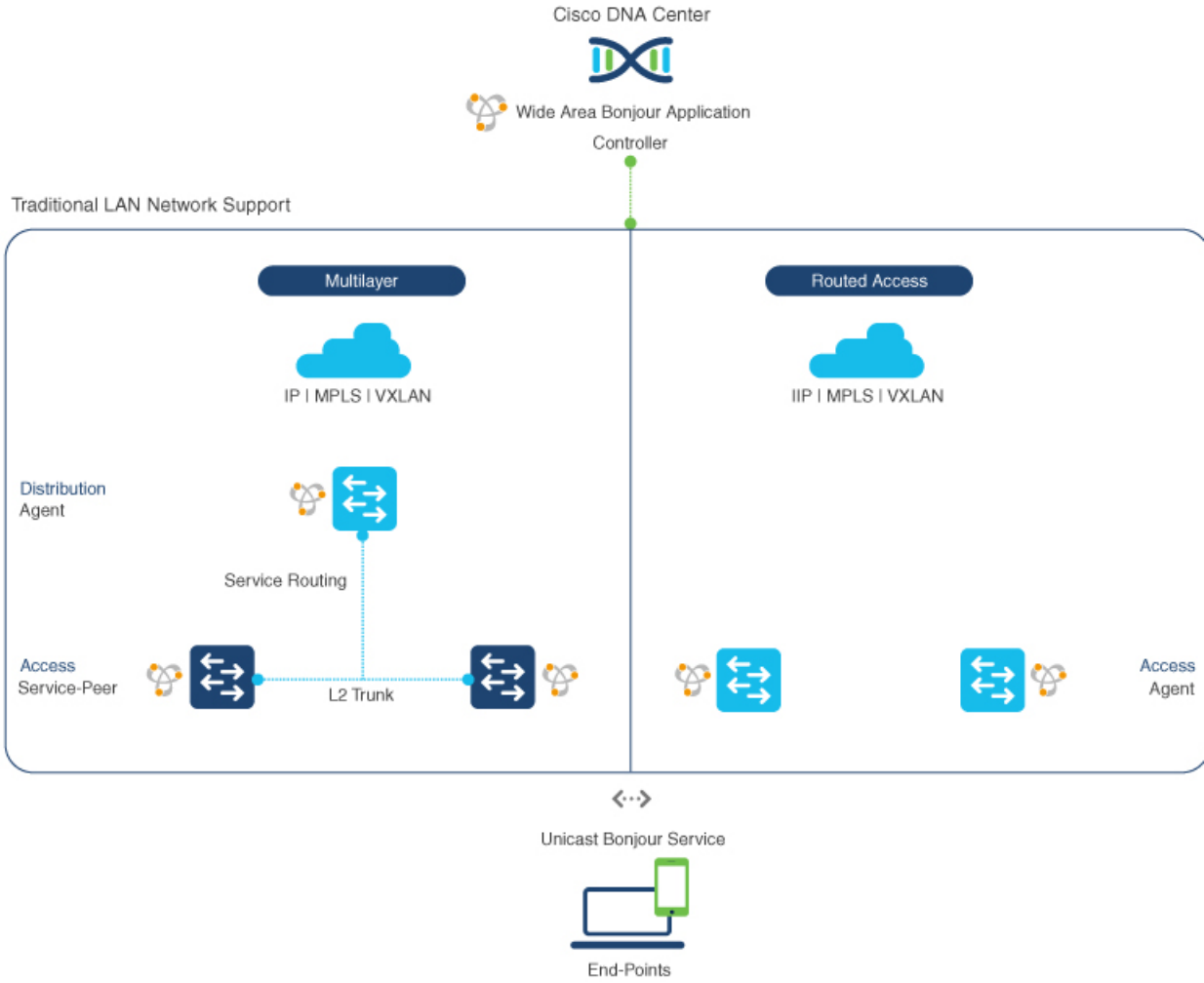
Figure 2: Enterprise Traditional LAN Network Design



Wired Networks

The following figure shows the supported LAN network designs that are commonly deployed in an enterprise.

Figure 3: Enterprise Multilayer and Routed Access Network Design



The SDG agent that provides Bonjour gateway functions is typically an IP gateway for wired endpoints that could reside in the distribution layer in multilayer network designs, or in the access layer in routed access network designs:

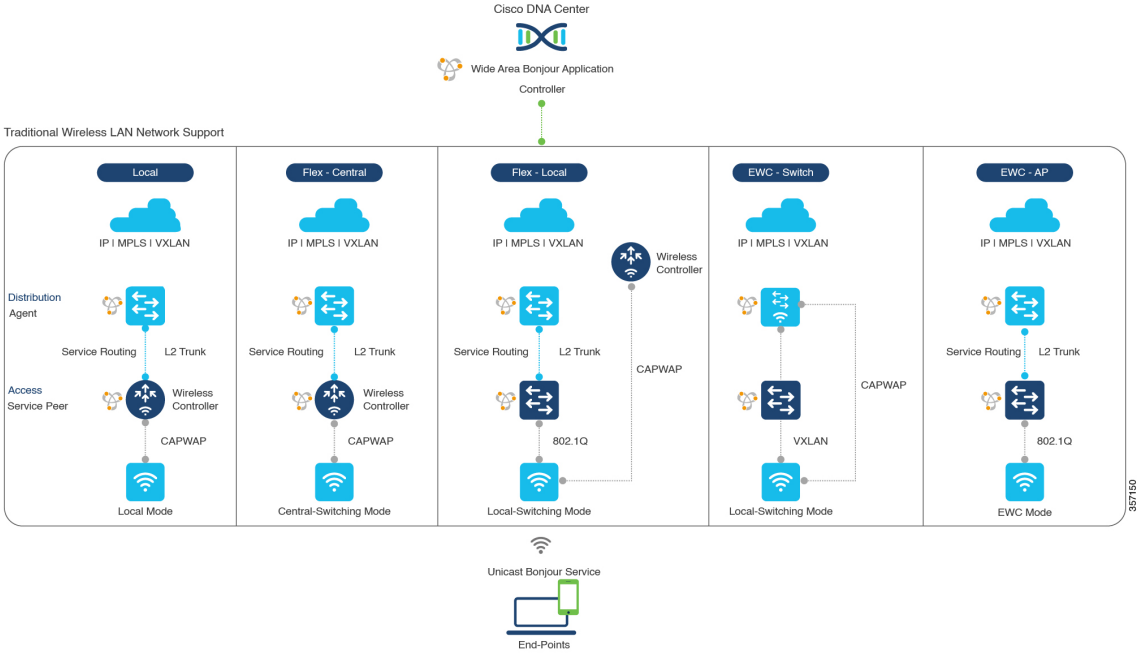
- **Multilayer LAN**: In this deployment mode, the Layer 2 access switch provides the first-hop Bonjour gateway function to locally attached wired endpoints. The Bonjour services and global discovery request are routed to the distribution layer systems that act as the IP gateway or SDG agent. There's no additional configuration or new requirement to modify the existing Layer 2 trunk settings between the access and distribution layers of the Cisco Catalyst switches. The policy-based service routing between the Layer 2 service-peer switches is performed by the SDG agent. The policy-based service routing between the SDG agents is performed by the Cisco DNA Center controller.
- **Routed Access**: In this deployment mode, the first-hop switch is an IP gateway boundary and, therefore, it must also perform the SDG agent role. The policy-based service routing between the SDG agents is performed by the Cisco DNA Center controller.

Wireless Networks

The Cisco DNA Service for Bonjour also supports various wireless LAN network designs that are commonly deployed in an enterprise. The Cisco Catalyst 9800 Series Wireless LAN Controller (WLC) can be deployed in a service-peer role supporting the mDNS gateway and paired with an upstream gateway switch for end-to-end service routing.

The following figure shows the supported wireless LAN network designs that are commonly deployed in an enterprise.

Figure 4: Enterprise Traditional Wireless LAN Network Design



The Cisco DNA Service for Bonjour supports the following modes for wireless LAN networks:

- **Local Mode**: In this central switching wireless deployment mode, the Bonjour traffic is encapsulated within the CAPWAP tunnel from the Cisco access points to the centrally deployed Cisco Wireless LAN Controller. The Cisco access points are configured to be in local mode (central switching also allows the access point to be configured in FlexConnect mode). With central switching, the Cisco Catalyst 9800 Series Wireless LAN Controller provides the mDNS gateway function of Bonjour services in the service-peer role. The WLC can discover and distribute services to local wireless users and perform unicast service routing over a wireless management interface to the Cisco Catalyst switch in the distribution layer, which acts as the IP gateway and the SDG agent. There's no additional configuration or requirement to modify the existing Layer 2 trunk settings between the Cisco Wireless LAN Controller and the distribution layer of the Cisco Catalyst switch. The Cisco Wireless LAN Controller must be configured with Global Multicast and AP Multicast in Multicast mode. Unless the access point joins the wireless LAN controller-announced multicast group, communication to and from Bonjour endpoints is not enabled for the wireless user group.

- **FlexConnect**: In FlexConnect local switching mode, both wired and wireless users share the same gateway in the access layer. The Layer 2 access switch provides the policy-based mDNS gateway function to locally attached wired and wireless users. The Cisco Catalyst switches in the distribution layer function as SDG agents for the LAN and wireless LAN user groups.

- **Embedded Wireless Controller - Switch**: The Cisco Embedded Wireless Controller solution enables the lightweight integrated wireless LAN controller function within the Cisco Catalyst 9300 series switch. The Cisco Catalyst switches in the distribution layer function as SDG agents to the LAN and wireless LAN user groups. The SDG agent in the distribution layer provides unicast service routing across all wireless access point and Layer 2 service-peer switches without any mDNS flooding. The embedded Cisco Wireless LAN Controller switch must be configured with Global Multicast and AP Multicast in Multicast mode and mDNS must be set in bridging mode.
- **Embedded Wireless Controller - Access Point**: The Cisco Embedded Wireless Controller solution enables the lightweight integrated wireless LAN controller function within the Cisco access points configured in the primary role. The wireless users share the same Bonjour gateway in the access layer as the wired endpoints. The Cisco Catalyst switches in the access layer function as service peers to the LAN and wireless LAN user groups. The SDG agent in the distribution layer provides unicast service routing across all Layer 2 service-peer switches in the Layer 2 network block without any mDNS flooding. AP multicast is required for Embedded Wireless mode AP, and mDNS must be set in bridging mode.

Note The Cisco AireOS-based WLC can be deployed as an mDNS pass-through network device between the wireless endpoints. The upstream SDG agent provides consistent Bonjour gateway functions for wireless endpoints, as for wired networks. In general, the IP gateway of wireless clients is also a Bonjour gateway. However, the placement of the SDG agent may vary depending on the wireless LAN deployment mode.

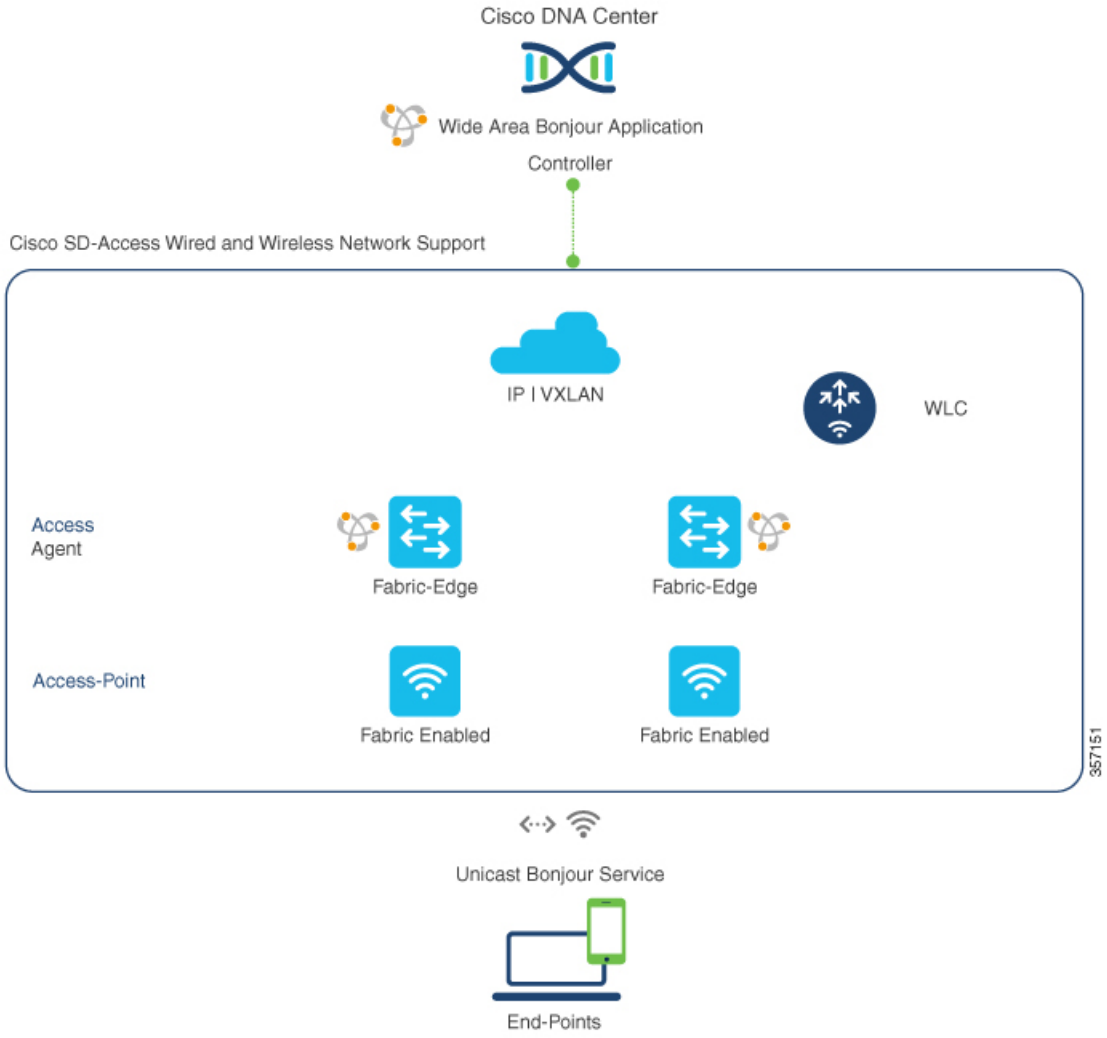
Cisco SD-Access Wired and Wireless Networks

Cisco SD-Access-enabled wired and wireless networks support Cisco DNA Service for Bonjour. From Cisco IOS-XE Release 17.4.1, the VRF-aware Wide Area Bonjour service routing provides secure and segmented mDNS service discovery and distribution management for fabric-enabled wired and wireless networks. The VRF-aware Wide Area Bonjour service routing eliminates the need for Layer 2 flooding. The Layer 3 Fabric Edge switch in the access layer must be configured as the SDG agent and paired with the central Cisco DNA Center for end-to-end service routing. Wide Area Bonjour policies must be aligned with the SD-Access network policies for virtual networks and SGT policies, if any.

Fabric-Enabled Wired and Wireless Networks

The following figure shows Cisco SD-Access-enabled wired and wireless networks without extending the Layer 2 network boundaries.

Figure 5: Cisco SD-Access Network Design



The Cisco DNA Service for Bonjour for SD-Access-enabled wired and wireless networks uses two logical components:

- **SDG agent**: The Layer 3 Fabric Edge switch in the access layer network is configured as the SDG agent. The VRF-aware mDNS gateway and Wide Area Bonjour service routing configuration is added only after SD-Access is configured.
- **Cisco DNA controller**: The Cisco Wide Area Bonjour application on Cisco DNA Center acts as the controller that supports policy and location-based service discovery and distribution between network-wide distributed Fabric Edge switches.

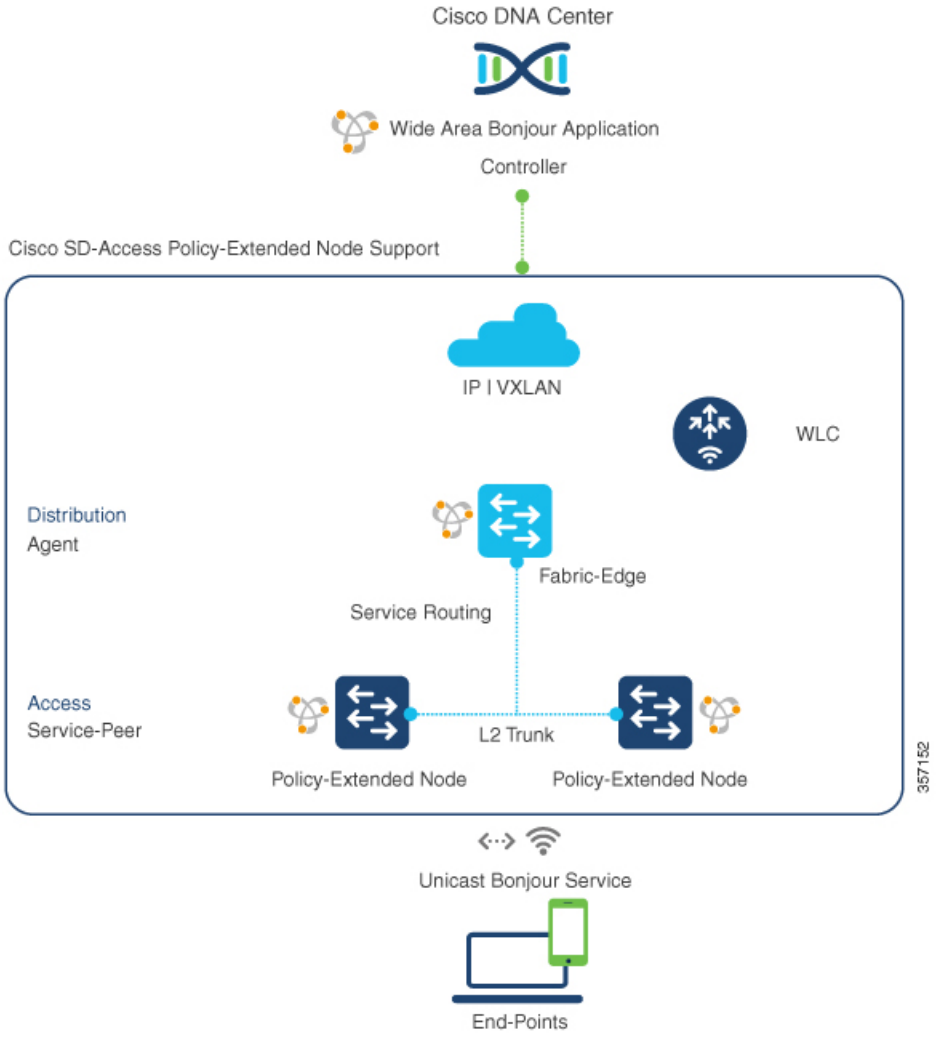
The Wide Area Bonjour communication between the SDG agent and the controller takes place through the network underlay. The SDG agent forwards the endpoint announcements or queries to the controller through the fabric underlay based on policies. After discovering a service, a Bonjour-enabled application establishes direct unicast communication between endpoints through the fabric overlay. This communication is subject to configured overlay IP routing and SGT policies, if any.

The Cisco Wireless LAN Controller must be configured with Global Multicast and AP Multicast in Multicast mode. The network administrator must enable IP Multicast in the underlay and ensure all fabric-enabled Cisco wireless access points have successfully joined the multicast group. The mDNS snooping configuration on the Cisco Wireless LAN Controller is ineffective and must remain in disabled mode.

Fabric-Enabled Policy Extended Node

The security policy can be extended to Cisco Catalyst 9000 Series Switches at Layer 2 access with the Policy Extended Node (PEN) function in a Cisco SD-Access fabric network. The network security and mDNS service policy can be combined at the Layer 2 access PEN switch in a service-peer role combined with Fabric Edge supporting SDG agent mode in Layer 2/3 distribution layer for Wide Area Bonjour service routing with Cisco DNA Center.

Figure 6: Fabric-Enabled Policy Extended Node

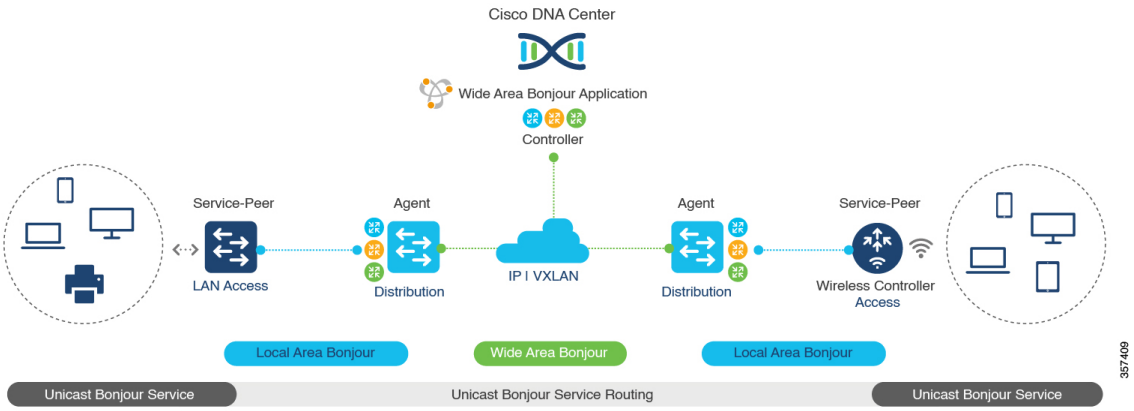


BGP EVPN Networks

The BGP EVPN-based enterprise network provides a flexible Layer 3 segmentation and Layer 2 extension overlay network. From Cisco IOS-XE Release 17.4.1, the VRF-aware Wide Area Bonjour service routing provides secure and segmented mDNS service discovery and distribution management for all common VXLAN overlay deployment models. The VRF-aware Wide Area Bonjour service routing eliminates mDNS flooding over Layer 2 extended EVPN VXLAN networks (symmetric and asymmetric integrated routing and bridging (IRB)) and service reachability challenges for Layer 3 segmented EVPN VXLAN networks in the fabric.

The following figure shows the BGP EVPN leaf switch in Layer 3 access mode, supporting overlay Bonjour service routing for a BGP EVPN-enabled wired and wireless enterprise network over various types of Layer 2 networks and Layer 3 segmented VRF-enabled networks.

Figure 7: Overlay Bonjour Service for a BGP EVPN-Enabled Enterprise Network

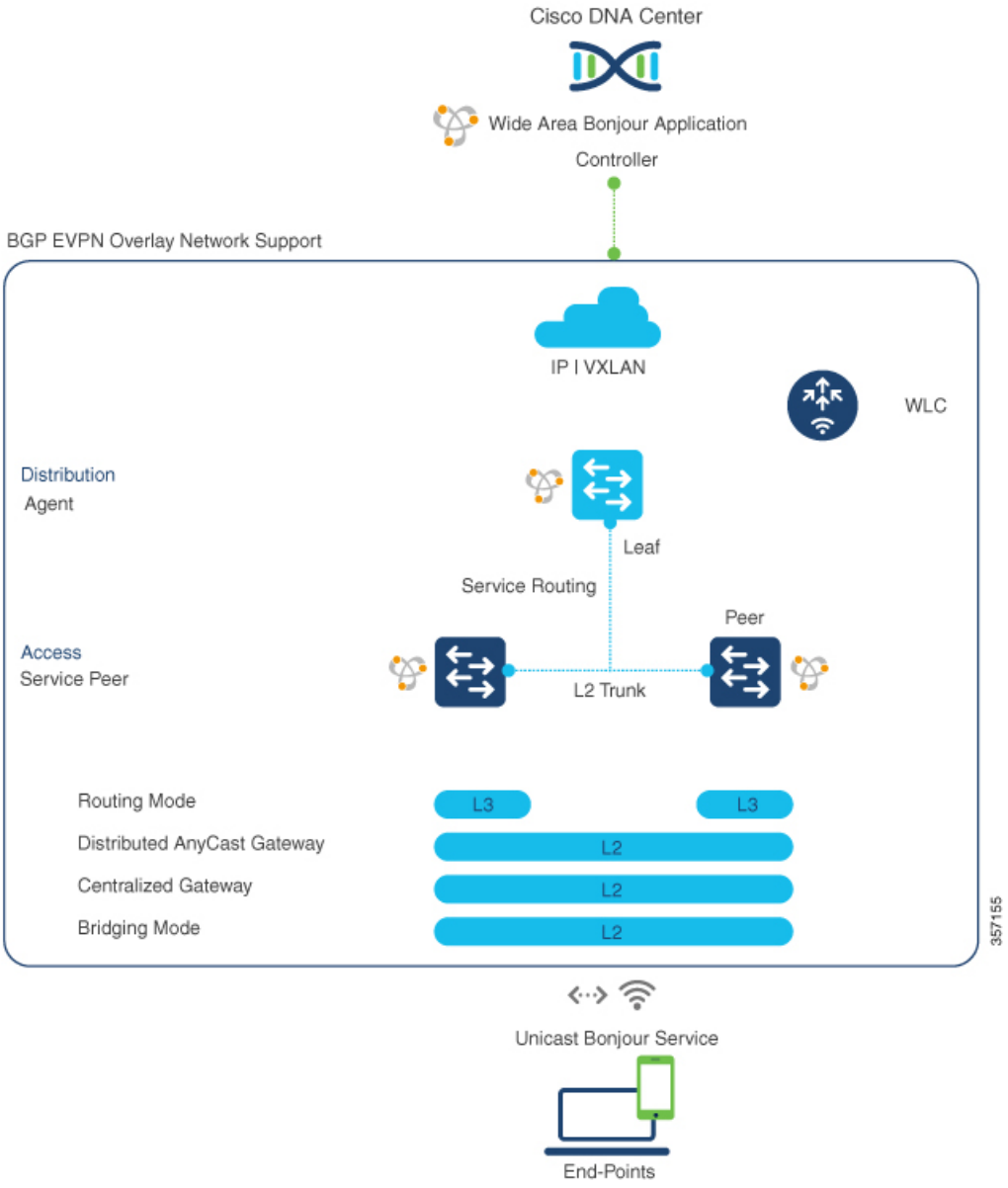


Cisco DNA Service for Bonjour supports Wide Area Bonjour service routing for BGP EVPN networks extended with Layer 2 service-peer network devices, such as a Cisco Catalyst switch or 9800 series WLC. The BGP EVPN leaf device in the distribution layer supports the SDG agent role for overlay service routing.

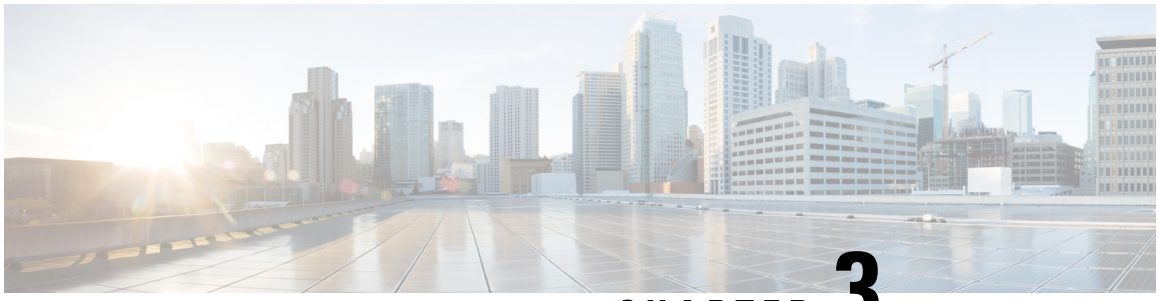
The Cisco DNA Service for Bonjour solution for BGP EVPN networks enables policy-based end-to-end service routing for virtual network environments. The solution helps to protect enterprise network scale and performance by eliminating the Layer 2 mDNS flood over the VXLAN across the IP core network.

The following figure shows mDNS endpoints connecting the Layer 2 access switch in service-peer mode to the upstream BGP EVPN leaf switch in the Layer 2/3 distribution layer supporting overlay Bonjour service routing for a BGP EVPN-enabled wired and wireless enterprise network over various types of Layer 2 networks and Layer 3 segmented VRF-enabled networks.

Figure 8: mDNS Endpoints Connecting an L2 Switch to an Upstream BGP EVPN Leaf Switch



For more information about BGP EVPN networks, see *Cisco DNA Service for Bonjour Configuration Guide, Cisco IOS XE Bengaluru 17.6.x (Catalyst 9600 Switches)*.



CHAPTER 3

Guidelines and Limitations

• Guidelines and Limitations, on page 15

Guidelines and Limitations

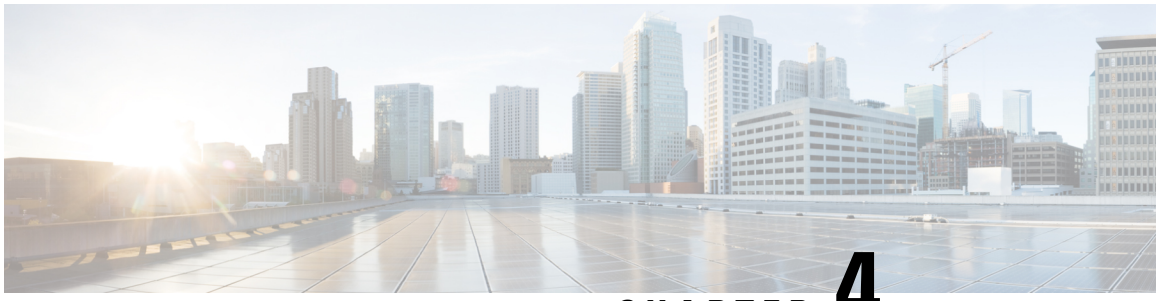
The following are the guidelines and limitations for Nexus 9300 Series of Switches for Bonjour Gateway:

- IPv6 mDNS packets are not supported.
- IPv6 connection towards Controller is not supported.
- Nexus 9300 supports only one Controller connection.
- No records are cached if corresponding PTR record is missing from the mDNS payload.
- mDNS traffic is not copied to SUP if port is configured with SPAN.
- For the mDNS gateway to work in Nexus 9000 Series of switches, the below TCAM carving followed by switch reload is required:

  hardware access-list tcam region ing-sup 768

- Beginning from Cisco NX-OS Release 10.2(3)F, N9K-C93180YC-EX, N9K-C93180YC-FX, N9K-C9336C-FX2, N9K-C9332C, and N9K-C93108TC-EX platforms are supported and discoverable by DNA center for Bonjour service.

Guidelines and Limitations



CHAPTER 4

Configuring Local Area Bonjour in Multicast DNS Mode for LAN

- How to configure Multicast DNS Mode for LAN and Wired Networks, on page 17
- Verifying Local Area Bonjour in Multicast DNS Mode for LAN, on page 22

How to configure Multicast DNS Mode for LAN and Wired Networks

This section provides information about how to configure Local Area Bonjour in multicast DNS mode.

Enabling mDNS Gateway on the Device

To configure mDNS on the device, follow these steps:

SUMMARY STEPS

1. **configure terminal**
2. **mdns-sd gateway**
3. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**mdns-sd gateway** **Example:**	Enables mDNS on the device and enters mDNS gateway configuration mode.

	Command or Action	Purpose
	`Device(config)# mdns-sd gateway`	Enter the following commands in mDNS gateway configuration mode to enable the respective functionalities: • **air-print helper**: Enables IOS devices like iPADs to discover and use older printers that support Bonjour • **ingress-client**: Configures Ingress Client Packet Tuners • **service announcement-count**: Configures maximum service advertisement count for controller • **service announcement-timer**: Configures advertisements announce timer periodicity for controller • **service query-count**: Configures maximum query count for controller • **service query-timer**: Configures query forward timer periodicity for controller **Note** For **ingress-client**, **service-announcement-count**, **service-announcement-timer**, **service-query-count**, and **service-query-timer** commands, you can retain the default value of the respective parameter for general deployments. Configure a different value, if required, for a specific deployment.
Step 3	**exit** **Example:** `Device(config-mdns-sd)# exit`	Exits mDNS gateway configuration mode.

Creating Custom Service Definition

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

SUMMARY STEPS

1. **configure terminal**
2. **mdns-sd service-definition** *service-definition-name*
3. **service-type** *string*
4. Repeat step 4 to configure more than one service type in the custom service definition.
5. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**mdns-sd service-definition** *service-definition-name* **Example:** `Device(config)# mdns-sd service-definition CUSTOM1`	Configures mDNS service definition. **Note** All the created custom service definitions are added to the primary service list. Primary service list comprises of a list of custom and built-in service definitions.
Step 3	**service-type** *string* **Example:** `Device(config-mdns-ser-def)# service-type _custom1._tcp.local`	Configures mDNS service type.
Step 4	Repeat step 4 to configure more than one service type in the custom service definition.	
Step 5	**exit** **Example:** `Device(config-mdns-ser-def)# exit`	Exit mDNS service definition configuration mode.

Creating Service List

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

SUMMARY STEPS

1. **configure terminal**
2. **mdns-sd service-list** *service-list-name* {**in** | **out**}
3. **match** {*ser-def-name* | *all*} **message-type** {**any** | **announcement** | **query**}
4. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:**	Enters global configuration mode.

	Command or Action	Purpose
	`Device# configure terminal`	
Step 2	**mdns-sd service-list** *service-list-name* {**in** | **out**} **Example:** `Device(config)# mdns-sd service-list VLAN100-list in`	Configures mDNS service list.
Step 3	**match** {*ser-def-name* | *all*} **message-type** {**any** | **announcement** | **query**} **Example:** `Device(config-mdns-sl-in)# match PRINTER-IPPS message-type announcement`	Matches the service and message type. Here, *service-definition-name* refers to the names of services, such as, airplay, airserver, airtunes, and so on. **Note** To add a service, the service name must be part of the primary service list. If the mDNS service list is set to IN, the applicable command syntax is: **match** {*ser-def-name* | *all*} **message-type** {**any** | **announcement** | **query**}. If the mDNS service list is set to OUT, the applicable command syntax is: **match** {*ser-def-name* | *all*} [**source-interface** *valns*].
Step 4	**exit** **Example:** `Device(config-mdns-sl-in)# exit`	Exits mDNS service list configuration mode.

Creating Service Policy

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

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

SUMMARY STEPS

1. **configure terminal**
2. **mdns-sd service-policy** *service-policy-name*
3. **service-list** *service-list-name* {**in** \| **out**}
4. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**mdns-sd service-policy** *service-policy-name* **Example:** `Device(config)# mdns-sd service-policy mdns-policy1`	Configures mDNS service policy.

Step 3	**service-list** *service-list-name* {**in** | **out**}
	Example:
	`Device(config-mdns-ser-pol)# service-list VLAN100-list in`
	`Device(config-mdns-ser-pol)# service-list VLAN300-list out`
		Configures service lists for IN and OUT directions.

Step 4	**exit** **Example:** `Device(config-mdns-ser-pol)# exit`	Exits mDNS service policy configuration mode.

Associating Service Policy to a VLAN

To configure mDNS on the device, follow these steps:

SUMMARY STEPS

1. **configure terminal**
2. **vlan configuration** *vlan-id*
3. **mdns-sd gateway**
4. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 2	**vlan configuration** *vlan-id* **Example:** `(config-vlan-config)# vlan configuration 601`	Enters VLAN configuration mode and enables VLAN configuration.
Step 3	**mdns-sd gateway** **Example:** `(config-vlan-mdns-sd)# mdns-sd gateway`	Configures mDNS gateway on the VLAN. Enter the following commands in the interface mDNS gateway configuration mode to enable the respective functionalities: • **active-query**: Sets the time interval for SDG agent to refresh the active status of connected Bonjour client services. The timer value ranges from 60 to 3600 seconds. **Note** The default active-query timer is for 1800 seconds and it will run for all VLANs where **mdns-sd gateway** is enabled. There is no way to disable it. • **service-policy** *policy-name*: Attaches the specified service policy to the VLAN. Bonjour announcements, and queries received by and sent from the VLAN are governed by the policies configured in the service policy. This configuration is not mandatory. If the user has not specified the service policy for a VLAN, then a default service policy **default-mdns-service-policy** will be used. **Note** Service policies can only be attached at VLAN level.
Step 4	**exit** **Example:** `Device(config-if-mdns-sd)# exit`	Exits mDNS gateway configuration mode.

Verifying Local Area Bonjour in Multicast DNS Mode for LAN

This section shows how to verify Local Area Bonjour in Multicast DNS mode for LAN.

Verifying SDG-Agent Status

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

```
Global mDNS Gateway
==========================================
mDNS Gateway                  : Enabled
```

```
Rate Limit                    : 200 PPS
Cache Memory Max              : 10 Percentage
AirPrint Helper               : Disabled

Ing-qry supp                  : Enabled
Ing-qry supp Packet Gap       : 15 PPS
Ing-qry reply service count   : 100
Service Announcement Count    : 100
Service Query Count           : 100
Announcement Timer            : 5 Seconds
Query Timer                   : 15 Seconds
```

The following is a sample output of the **show mdns-sd service-policy** [**name** *ser-pol-name*] command.

```
Service Policy Name     Service List IN Name             Service List Out
 Name
================================================================================

sp-one                                cus-sl-in
cus-sl-out
default-mdns-service-policy           default-mdns-in-service-list
default-mdns-out-service-list
Device#
```

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

```
Name                                Type      Service
Msg-Type       Source
================================================================================

macbook-list-out                    OUT       macbook_custom
none           all
appletv-list-out                    OUT       appletv_custom
none           all
default-mdns-in-service-list        IN        apple-airprint
any            none
                                              apple-remote-login
any            none
                                              apple-screen-share
any            none
                                              apple-tv
any            none
                                              apple-windows-fileshare
any            none
                                              google-chromecast
any            none
                                              google-expeditions
any            none
                                              homesharing
any            none
                                              multifunction-printer
any            none
                                              printer-ipps
```

```
any             none
l3vni-list-in                       IN        l3vni_custom
any             none
default-mdns-out-service-list       OUT       apple-airprint
none            all
                                              apple-remote-login
none            all
                                              apple-screen-share
none            all
                                              apple-tv
none            all
                                              apple-windows-fileshare
none            all
                                              google-chromecast
none            all
                                              google-expeditions
none            all
                                              homesharing
none            all
                                              multifunction-printer
none            all
                                              printer-ipps
none            all
l3vni-list-out                      OUT       l3vni_custom
none            all
macbook-list-in                     IN        macbook_custom
any             none
appletv-list-in                     IN        appletv_custom
any             none
list1                               IN        custom1
any             none
list2                               OUT       custom1
none            all
List2                               OUT       custom1
none            all
```

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

```
Service                       Type                      PTR
================================================================================
airplay                      built-in                _airplay._tcp.local

apple-screen-share           built-in                 _rfb._tcp.local

spotify                      built-in
_spotify-connect._tcp.local

apple-remote-login          built-in                _sftp-ssh._tcp.local

                                                      _ssh._tcp.local
```

```
apple-itunes-music          built-in                _daap._tcp.local

apple-tv                    built-in                _raop._tcp.local
                                                   _airplay._tcp.local

apple-homekit               built-in                _hap._tcp.local
                                                   _homekit._tcp.local

appletv_custom              custom                  _airplay._tcp.local


_companion-link._tcp.local
                                                   _homekit._tcp.local


_mediaremotetv._tcp.local
                                                    _raop._tcp.local

_sleep-proxy._udp.local

apple-itunes-library        built-in                _atc._tcp.local
Switch(config)#
```

Verifying Local Area Bonjour Configuration for LAN

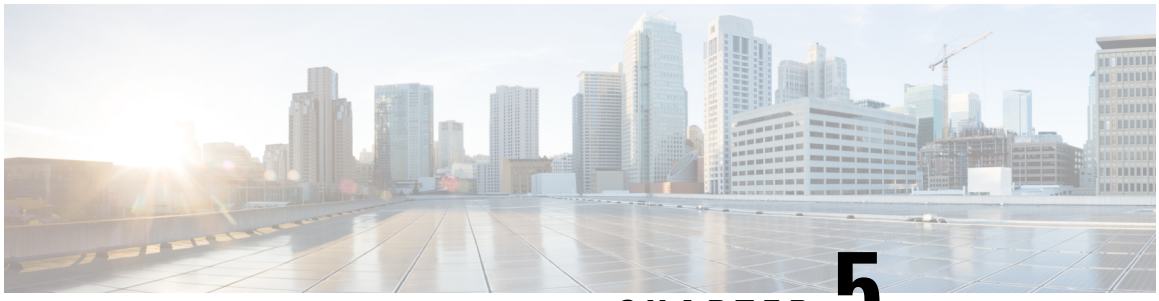
The following is a sample output of the **show running-config mdns [all]** command.

```
!Command: show running-config mdns
!No configuration change since last restart
!Time: Fri Apr 15 06:58:29 2022

version 10.2(3) Bios:version 07.69
feature mdns

mdns-sd gateway
  air-print helper
  ingress-client query-suppression
vlan configuration 10
mdns-sd gateway
  active-query timer 60
vlan configuration 2000
mdns-sd gateway
  active-query timer 60
mdns-sd controller bhag
  address 100.100.100.1
  source-interface Lo0
mdns-sd service-list cus-sl-in IN
  match all message-type any
mdns-sd service-list cus-sl-out OUT
```

```
  match all
mdns-sd service-policy sp-one
  service-list cus-sl-in IN
  service-list cus-sl-out OUT
```



CHAPTER 5

Configuring Wide Area Bonjour

Cisco Wide Area Bonjour domain enables global service-routing beyond a single IP gateway for traditional and overlay LAN networks. In Cisco Wide Area Bonjour domain, Cisco Nexus 9300 LAN switches are deployed in Layer 3 routed mode to act as distributed SDG Agents throughout the network. These SDG agents build a TCP-based, stateful, reliable, and light-weight communication channel with a Cisco DNA Center. The Cisco DNA Center must also be configured with Cisco Wide Area Bonjour application for policy-based global service discovery and distribution.

- Restrictions for Wide Area Bonjour for LAN, on page 27
- Information About Wide Area Bonjour LAN, on page 27
- How to Configure Wide Area Bonjour for LAN, on page 28
- Configuring Cisco Wide Area Bonjour Controller on Nexus 9300 Series Switches, on page 29
- Verifying Wide Area Bonjour for LAN, on page 30
- Additional References for Wide Area Bonjour for LAN, on page 32

Restrictions for Wide Area Bonjour for LAN

Wide Area Bonjour service-routing between Cisco DNA Center and a Nexus 9300 SDG Agent Switch over management port is not supported. We recommend that you use a switch Loopback interface instead.

Information About Wide Area Bonjour LAN

Wide Area Bonjour, by definition, allows service-routing over an IP network without network boundaries. Hence, the core objective of Cisco Wide Area Bonjour is to advertise and browse Bonjour services in a global IP network that is limited to local or remote sites, as required. Typically, the LAN and Wireless LAN IP gateway deployed in SDG Agent mode build the stateful TCP-based unicast connection to the Cisco DNA Center for Wide Area Bonjour service-routing.

The fundamentals of service-routing are based on the policies defined in Local Area and Wide Area Bonjour domains. The policy defines implicit guidelines to accept, process and respond to mDNS services on the SDG Agent and the Cisco DNA-Center. The service policy carries multiple tuples to distinctly classify and distribute the service provider information along with granular network.

How to Configure Wide Area Bonjour for LAN

This section provides information about how to configure Wide Area Bonjour for LAN. Configuration of Cisco Wide Area Bonjour requires you to configure the Cisco Nexus Series switch in SDG Agent mode and build the service policies in Wide Area Bonjour application of Cisco DNA Center.

Configuring Cisco Wide Area Bonjour Service Policy

To build and apply the Wide Area Bonjour export service policy and enable service-routing, perform the following steps.

Note The controller-bound service policy does not require an ingress service policy.

SUMMARY STEPS

1. **configure terminal**
2. **mdns-sd controller service-list** *service-list-name*
3. **match** {*ser-def-name* | *all*} **message-type** {**any** | **announcement** | **query**} [**source-interface vlans**]
4. **mdns-sd controller service-policy** *service-policy-name*
5. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**mdns-sd controller service-list** *service-list-name* **Example:** `Device(config)# mdns-sd controller service-list WIDE-AREA-SERVICES-LIST-OUT`	Configures the outgoing mDNS controller service list to classify one or more service types.

Step 3	**match** {*ser-def-name* | *all*} **message-type** {**any** | **announcement** | **query**} [**source-interface vlans**]
	Example:
	`Device(config-mdns-sl-out)# match APPLE-TV`
	`Device(config-mdns-sl-out)# match PRINTER-APPS`
		Checks and matches the outbound service list. The switch exports locally discovered services and requests remote service information from Wide Area Bonjour domain. The service announcement and query request are processed based on permitted, built-in, or custom service types.
		The service list contains an implicit deny at the end.
		The **message-type** is used and either announcement or query filter can be added.

	Command or Action	Purpose
Step 4	**mdns-sd controller service-policy** *service-policy-name* **Example:** `Device(config)# mdns-sd controller service-policy DNAC-CONTROLLER-POLICY`	Creates a unique mDNS service policy.
Step 5	**end** **Example:** `Device(config-mdns-sd)# end`	Returns to privileged EXEC mode.

Configuring Cisco Wide Area Bonjour Controller on Nexus 9300 Series Switches

To configure Cisco Wide Area Bonjour controller on Nexus 9300 series of switches, perform the following steps:

SUMMARY STEPS

1. **configure terminal**
2. **mdns-sd controller** *controller-name*
3. **address** *ipv4-address*
4. **source-interface** *interface-name*
5. **service-policy** *service-policy-name*
6. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**mdns-sd controller** *controller-name* **Example:** `Device(config)# mdns-sd controller DNAC-BONJOUR-CONTROLLER`	Configures the controller to enable Wide Area Bonjour service-routing with Cisco DNA Center. Only one controller can be configured.
Step 3	**address** *ipv4-address* **Example:** `Device(config-mdns-sd-se)# address 100.0.0.1`	Assigns the Cisco DNA Center IPv4 address to pair service-routing. **Note**

	Command or Action	Purpose
		Only one controller address can be configured. IPv6 address is not supported.
Step 4	**source-interface** *interface-name* **Example:** `Device(config-mdns-sd-se)# source-interface Loopback0`	Configures the source interface to build service-routing from the SDG-Agent and the Cisco DNA Center. Nexus 9300 Series of switches support only loopback interface as a source interface.
Step 5	**service-policy** *service-policy-name* **Example:** `Device(config-mdns-sd-se)# service-policy DNAC-CONTROLLER-POLICY`	Associates the controller-bound egress mDNS policy for Wide Area Bonjour service-routing. Specifies the service policy to be used by the controller. If no policy is configured, a default controller policy **default-mdns-ctrl-srv-policy** is used.
Step 6	**end** **Example:** `Device(config-mdns-sd)# end`	Returns to privileged EXEC mode.

Verifying Wide Area Bonjour for LAN

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

```
switch(config)# show mdns-sd controller service-policy name default-mdns-ctrl-srv-policy

Service Policy Name                    Service List Name
=================================================================
default-mdns-ctrl-srv-policy           default-mdns-ctrl-srv-list
```

The following is a sample output of the **show mdns controller service-list** command.

```
switch(config)# show mdns-sd controller service-list name default-mdns-ctrl-srv-list

Name                           Service                        Msg-Type
   Source
=============================================================================
default-mdns-ctrl-srv-list     apple-airprint                 any
   all
                               apple-remote-login             any
   all
                               apple-screen-share             any
   all
                               apple-tv                       any
   all
                               apple-windows-fileshare        any
   all
                               google-chromecast              any
   all
```

```
                                google-expeditions            any
   all
                                homesharing                   any
   all
                                multifunction-printer         any
   all
                                printer-ipps                  any
   all
```

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

```
switch(config)# show mdns-sd controller summary

Controller Summary
==================
Controller Name  : DNAC_BONJOUR_CONTROLLER
Controller IP    : 100.100.100.1
State            : UP
Port             : 9991
Interface        : Lo0
Filter List      : default-mdns-ctrl-srv-policy
Dead Time        : 120 sec
Service Buffer   : Disabled
```

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

```
switch(config)# show mdns-sd controller detail

Controller : DNAC_BONJOUR_CONTROLLER
IP 100.100.100.1, Dest Port : 9991, Src Port: 52482, State UP
Source Interface : Lo0, MD5 Disabled
Hello Timer 30 sec, Dead Timer 120 sec, Next Hello 00:00:06
Uptime 00:00:23
Service Buffer : Disabled
Service Announcement :
Filter : default-mdns-ctrl-srv-policy
Count 50, Delay timer 30 sec, Pending Announcement 0, Pending Withdraw 0
Total Export Count 0, Next Export in 00:00:06
Service Query :
Query Suppression Disabled
Query Count 50, Query Delay Timer 15 sec, Pending 0
Total Query Count 0, Next Query in 00:00:06
```

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

```
switch(config)# show mdns-sd controller statistics

Total messages sent              : 3130
Total messages received          : 3128
Keepalive message sent           : 3126
Keepalive messages received      : 3126
Interface WITHDRAW messages sent : 2
Vlan WITHDRAW messages sent      : 0
Clear cache messages sent        : 0
Total RESYNC state count         : 0
```

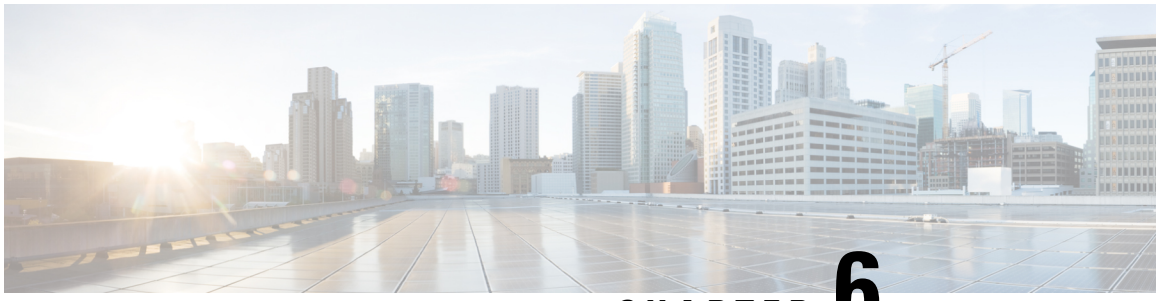
```
Last successful RESYNC           : Not-Applicable
Service Advertisements:
Advertisements sent              : 0
Withdraws sent                   : 0
Advertisements Filtered          : 0
Total service resynced           : 0
Service Queries:
Queries sent                      : 0
Queries Filtered                  : 0
Query responses received          : 0
```

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

```
switch(config)# mdns-sd controller export-summary
Controller Export Summary
=========================
Controller IP    : 100.100.100.1
State            : UP
Filter List      : default-mdns-ctrl-srv-policy
Count            : 50
Delay Timer      : 30
Export           : 0
Drop             : 0
Next Export      : 00:00:07
```

Additional References for Wide Area Bonjour for LAN

Related Topic	Document Title
Cisco Wide Area Bonjour Application on Cisco DNA Center User Guide	Cisco Wide Area Bonjour Application on Cisco DNA Center User Guide, Release 2.1.2



CHAPTER 6

Configuring VRF-Aware Local Area Bonjour Services

Beginning from Cisco NX-OS Release 10.2(3)F, Cisco Nexus 9300 Series switches supports Virtual Routing and Forwarding-Aware (VRF-Aware) services in Local Area Bonjour domain. VRF-Aware Local Area Bonjour services provide boundary-based service discovery for Layer 3 segmented IPv4 and IPv6 network and support policy-based (secure) routing services. VRF-Aware Local Area Bonjour service is supported on enterprise-grade, traditional, and next-generation fabric-based deployment models as described in Cisco DNA Service for Bonjour Solution Overview.

- Prerequisites for VRF-Aware Local Area Bonjour Services, on page 33
- Restrictions for VRF-Aware Local Area Bonjour Services, on page 34
- Information about VRF-Aware Local Area Bonjour Services, on page 34
- Understanding VRF-Aware Wide Area Bonjour Services, on page 35
- How to configure Intra-Virtual Network Proxy Service on Local Area Bonjour Domain, on page 36
- How to configure Inter-Virtual Network Proxy Service on Local Area Bonjour Domain, on page 37

Prerequisites for VRF-Aware Local Area Bonjour Services

- You must understand the mDNS service segmentation capabilities to implement, manage, and troubleshoot the proxy service in Local Area Bonjour domain.
- Ensure that the Cisco Nexus 9300 Series switch is configured in SDG-Agent mode. VRF-Aware Local Area Bonjour service is supported on first-hop IP gateway of switches configured in SDG-Agent mode in Wired networks.
- Ensure that the software version installed on the Cisco Nexus 9300 Series switch is 10.2(3)F or higher.
- Ensure that all required IP VRF with IPv4 or IPv6 address-family configurations is completed. These configurations are required to activate VRF on the switch configured in SDG-Agent mode.
- Ensure that the IP VRF configured to a local SVI interface supports IP gateway so that the mDNS Wired and Wireless endpoint can be attached directly or remotely.
- To activate mDNS gateway in Multicast mode for a VLAN, ensure that the mDNS gateway and service policy is configured after enabling the VLAN using the **vlan configuration** *id* command.

- Ensure that all configurations for IPv4 or IPv6-based data routing and forwarding both within the same VRF or different VRFs are complete including network requirements such as stateful firewall configuration, route-leaking configuration and so on.
- Ensure that all the prerequisites described in *Configuring Local Area Bonjour in Unicast Mode for LAN Networks* module are completed.

Restrictions for VRF-Aware Local Area Bonjour Services

- VRF-Aware Local Area Bonjour services are configured to provide mDNS service discovery information between Layer 3 segments within the same or different IP VRF, or share services from non-VRF enabled networks only. Any additional IP routing and data forwarding configurations are beyond the scope of this implementation.

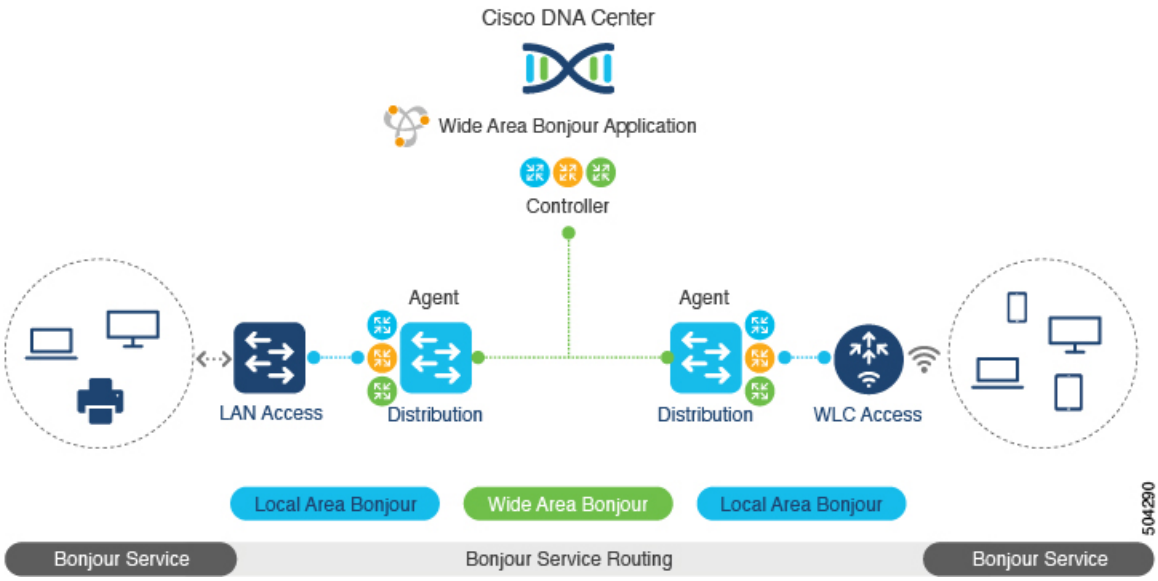
Information about VRF-Aware Local Area Bonjour Services

The Cisco DNA Service for Bonjour solution provides end-to-end service-routing for enterprise and data center networks. The enterprise and data center networks build secure and segmented networks that protect IT-managed infrastructure and shares services and resources among trusted and untrusted user group. The physical infrastructure can be logically virtualized into a private networking space that supports secure communication services within closed user groups and conditionally extends boundary services based on business and technical demands.

VRF-Aware Local Area Bonjour gateway services allow to dynamically discover and distribute mDNS services on the same VRF segmented Layer 3 overlay networks based on policy. The Layer 3 VRF segmented networks can also be configured to route in overlay using Cisco BGP EVPN VXLAN overlay networks.

Figure illustrates the Cisco DNA Service for Bonjour solution configured with VRF-Aware services for enterprise and data center networks.

Figure 9: Cisco DNA Service for Bonjour with VRF-Aware Services



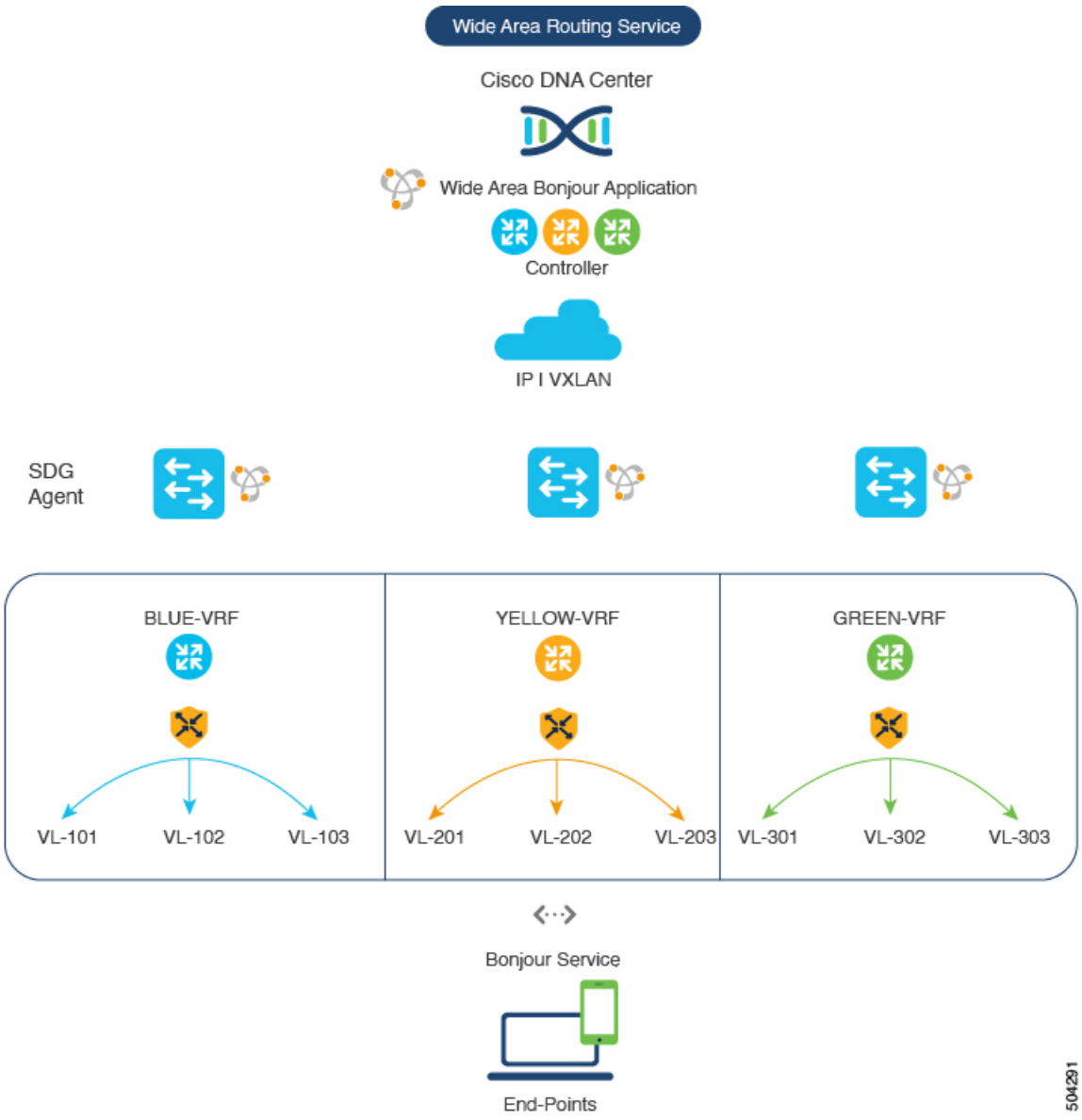
Understanding VRF-Aware Wide Area Bonjour Services

The VRF-Aware service discovery and distribution can be implemented across multiple switches in SDG-Agent mode on an IP, or VXLAN-enabled network with Wide Area Bonjour. The Cisco DNA-Center Wide Area Bonjour application supports granular and policy-based routing services that allow discovery and distribution of mDNS services dynamically over overlay networks. You can build a global policy combining one or more source and receiver SDG-Agents that allow distributing or advertising services from a specific IPv4 or even an IPv6 network mapped to the VRF.

The network wide and distributed switches in SDG-Agent mode transport locally discovered or requested mDNS service information over lightweight unicast routing services to a centralized Cisco DNA-Center controller in an underlay IPv4 network. These switches must be configured with a unified service-export policy for local networks mapped to one or more VRFs.

Figure illustrates VRF-Aware Wide Area Bonjour services for IP, or VXLAN enabled overlay networks.

Figure 10: VRF-Aware Wide Area Bonjour Services



The *Configuring Wide Area Bonjour* module lists the configuration procedures in detail.

How to configure Intra-Virtual Network Proxy Service on Local Area Bonjour Domain

Intra-Virtual Network (Intra-VN) Proxy Service is a policy-based VRF-Aware service discovery and distribution implemented on the IP VRF of a switch in SDG-Agent mode connected to multiple IP networks.

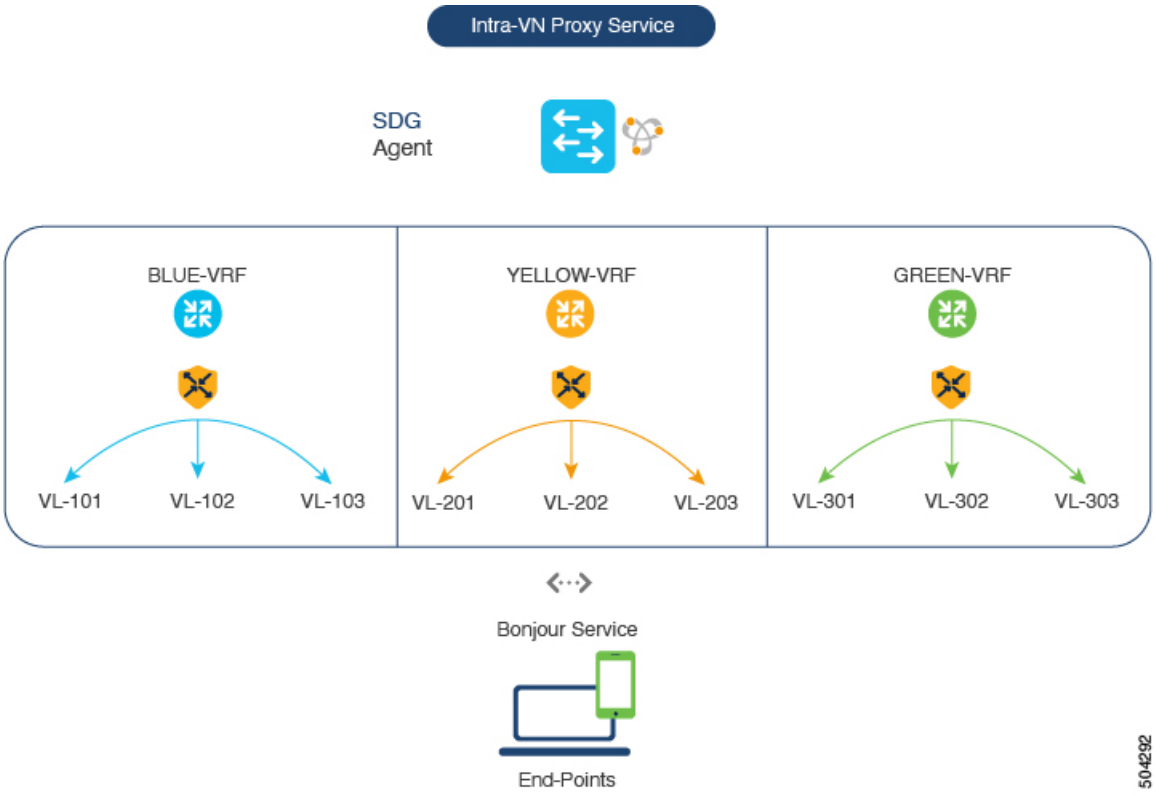
Beginning from Cisco NX-OS Release 10.2(3)F, the Cisco Nexus 9300 Series switches support mDNS gateway service as the default on each VRF. You must build a mDNS service policy that implicitly allows required

mDNS service types and mapping services to endpoint facing VLANs. The Cisco Nexus 9300 Series switch can automatically discover VRF associations to a VLAN interface without additional configurations.

The Cisco Nexus 9300 Series switch in SDG-Agent mode dynamically discovers mDNS services from a local network and automatically builds VRF-aware service information. To enable Layer 3 segmented proxy service by default, the SDG-Agent provides limited mDNS service proxy response to endpoints in other VLANs mapped with the same VRF.

Figure illustrates VRF-Aware enabled on an Intra-VN proxy service.

Figure 11: Intra-VN Service Proxy



How to configure Inter-Virtual Network Proxy Service on Local Area Bonjour Domain

Inter-VN Proxy Service is a policy-based VRF-Aware service discovery and distribution implemented on multiple IP VRFs or on a global IP routing domain of a switch in SDG-Agent mode connected to multiple IP networks.

Beginning from Cisco NX-OS Release 10.2(3)F, the Cisco Nexus 9300 Series switches support mDNS service discovery and distribution between IP VRFs or on a global routing domain. Although configuring inter-VN provides Extranet mDNS proxy services between Wired and Wireless networks, additional methods such as stateful firewall, route-leaking and so on must also be configured to handle the data transfer between Inter-VN or VRF to global IP routing.

Figure shows Inter-VN proxy service for Extranet network.

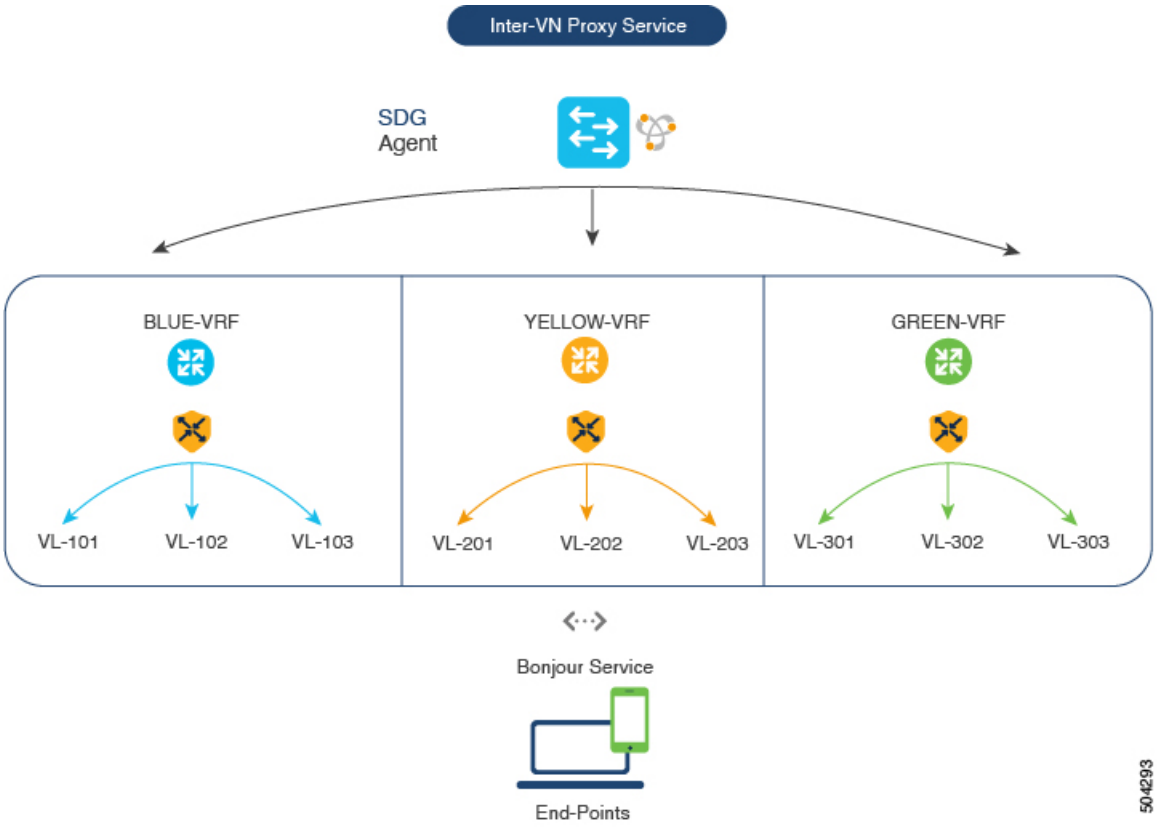



Figure 12: Inter-VN Proxy Service