Bonjour Gateway Deployment Guide

Release 7.4
April 04, 2013

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Bonjour Gateway Deployment Guide

Preface v

Objectives v

Audience v

Cisco IOS Software Documentation v

Organization vi

Command Syntax Conventions vi

CHAPTER 1 **Bonjour Deployment** 1-1

Deployment Considerations 1-1

Cisco Bonjour Gateway Solution in Release 7.4 1-2

Bonjour Deployment Using mDNS Gateway 1-4

Bonjour Configuration on WLAN Through the User Interface 1-4

mDNS Profile Configuration Through the User Interface 1-7

mDNS Services with Wired Bonjour Devices 1-10

CHAPTER 2 **Printer Services** 2-1

Bonjour Printer Services 2-1

Bonjour and Guest Anchoring 2-3

Bonjour Layer 3 Roaming 2-3

Bonjour Services Summary 2-4

Bonjour Services Support in FlexConnect Mode 2-4

Bonjour Configuration on the WLC Through the CLI 2-4

Configure Commands 2-5

Show Commands 2-6

Clear Commands 2-6

Debug Commands 2-6

Preface

Revised: April 04, 2013,

This section discusses the objectives, audience, conventions, and organization of the *Cisco Bonjour Gateway Deployment Guide* and provides general information about Cisco IOS software documentation.

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM, a member of the Cisco Connection Family, is updated monthly. Therefore, it might be more up to date than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. The CD-ROM package is available as a single package or as an annual subscription.

Objectives

This document provides information on the theory of operation and configuration for the Cisco Unified Wireless LAN solution in support of multicast applications such as the Apple Bonjour protocol. The Bonjour protocol enables Apple devices to query and announce for specific services such as AirPlay, which allows audio and video to be shared between devices dynamically.

Audience

This publication is intended primarily for users who configure and maintain routers, but are not necessarily familiar with tasks, the relationship between tasks, or the commands necessary to perform particular tasks. In addition, this publication is intended for users with some familiarity with IP and telephony networks.

Cisco IOS Software Documentation

In addition to the information provided in this publication, you might need to refer to the Cisco IOS documentation set. The Cisco IOS software documentation is divided into nine modules and two master indexes. Each module consists of two books: a configuration guide and a corresponding command reference. Chapters in a configuration guide describe protocols, configuration tasks, and Cisco IOS software functionality and contain comprehensive configuration examples. Chapters in a command reference provide complete command syntax information. Each configuration guide can be used in conjunction with its corresponding command reference.

Organization

This chapter describes the contents of each chapter in this document.

Table 1 Organization

Chapter	Title	Description
Chapter 1	Bonjour Deployment	Overview of the Bonjour Deployment.
Chapter 2	Printer Services	A general description of Printer Services and commands.

Command Syntax Conventions

Table 2 describes the syntax used with the commands in this document.

Table 2 Command Syntax Guide

Convention	Description
boldface	Commands and keywords.
italic	Command input that is supplied by you.
[ ]	Keywords or arguments that appear within square brackets are optional.
{ x | x | x }	A choice of keywords (represented by x) appears in braces separated by vertical bars. You must select one.
^ or Ctrl	Represent the key labeled *Control*. For example, when you read ^*D* or *Ctrl-D*, you should hold down the Control key while you press the D key.
`screen font`	Examples of information displayed on the screen.
boldface screen font	Examples of information that you must enter.
< >	Nonprinting characters, such as passwords, appear in angled brackets.
[ ]	Default responses to system prompts appear in square brackets.

Bonjour Deployment

Revised: April 04, 2013

Deployment Considerations

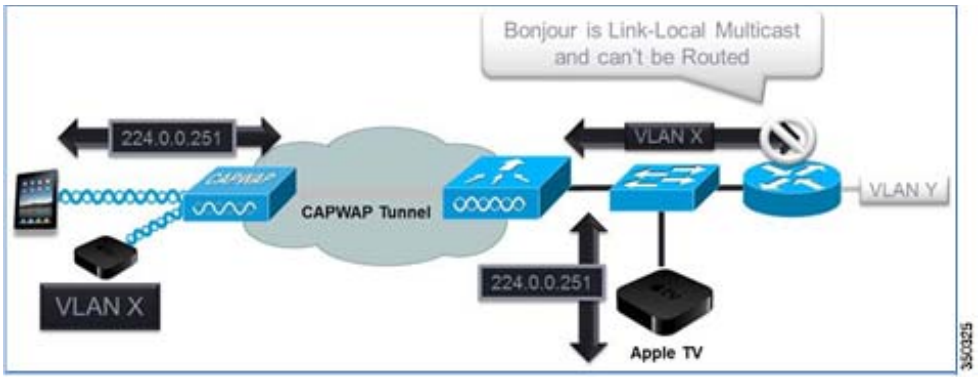
The Bonjour protocol operates on service announcements and service queries, which allow devices to ask and advertise specific applications such as:

- Printing Services
- File Sharing Services
- Remote Desktop Services
- iTunes File Sharing
- iTunes Wireless iDevice Syncing (in Apple iOS v5.0+)
  - Music broadcasting in iOS v4.2+
  - Video broadcasting in iOS v4.3+
  - Full screen mirroring in iOS v5.0+ (iPad2, iPhone4S, or later)

Each query or advertisement is sent to the Bonjour multicast address for delivery to all clients on the subnet. The Apple Bonjour protocol relies on Multicast DNS (mDNS) operating at User Datagram Protocol (UDP) port 5353 and sending to the reserved group addresses listed below:

- IPv4 Group Address - 224.0.0.251
- IPv6 Group Address - FF02::FB

The addresses used by the Bonjour protocol are link-local multicast addresses and are only forwarded on the local Layer 2 (L2) domain, since link-local multicast is meant to stay local by design. Routers cannot use multicast routing to redirect the traffic because the time to live (TTL) is set to one.



Cisco Bonjour Gateway Solution in Release 7.4

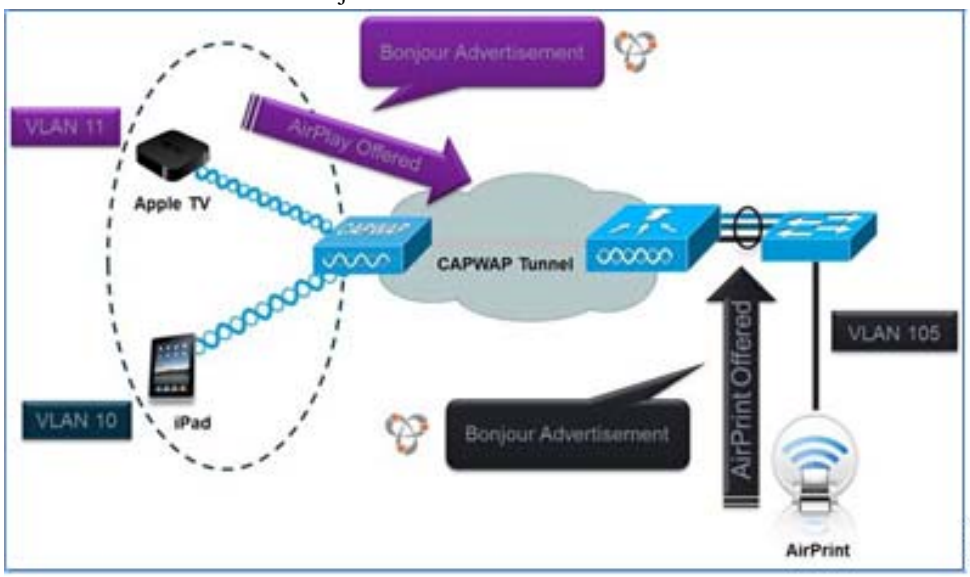
In the 7.4 release, the wireless LAN controller (WLC) supports Bonjour gateway functionality on the WLC itself. You do not need to enable multicast on the controller. The WLC snoops all Bonjour discovery packets but does not forward them on the AIR or Infra network.

Bonjour is the Apple version of zero configuration networking (Zeroconf); it is mDNS with DNS Service Discovery (DNS-SD). Apple devices advertise their services via IPv4 and IPv6 simultaneously (IPv6 link local and Globally Unique). The current 7.4 implementation does not support Bonjour Snooping for IPv6 Addresses. On the iPad, you cannot turn off IPv6 or change any of the Bonjour settings.

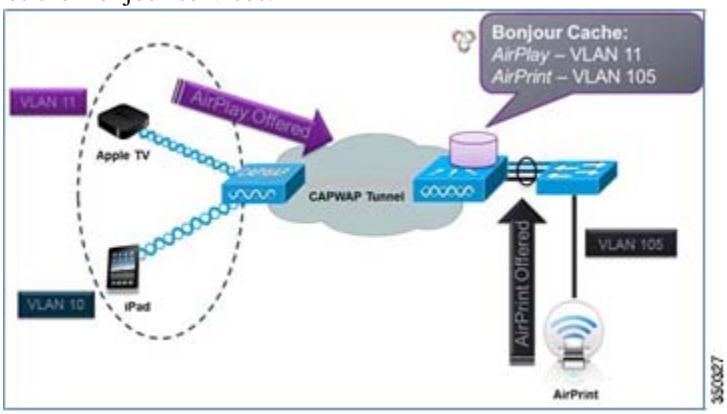
If you want to control mDNS/Bonjour, the key is to limit the size of the local segment.

To address this issue, the Cisco WLC acts as a Bonjour gateway. The WLC listens for Bonjour services and by caching those Bonjour advertisements (AirPlay, AirPrint, and so forth) from the source/host (such as AppleTV) and responding back to Bonjour clients when they ask for or request a service. This process is shown below.

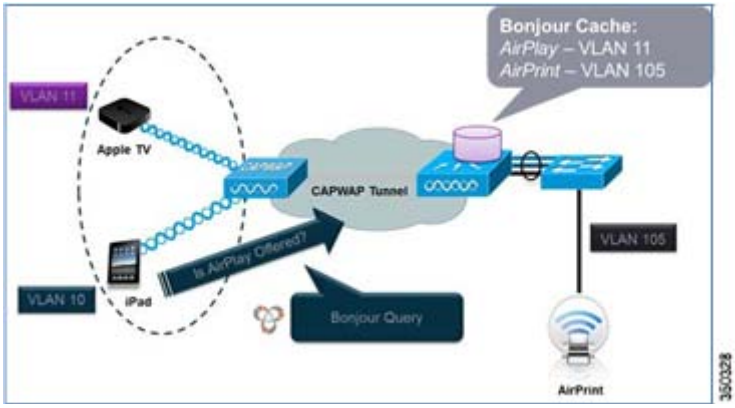
1. The controller listens for the Bonjour services.



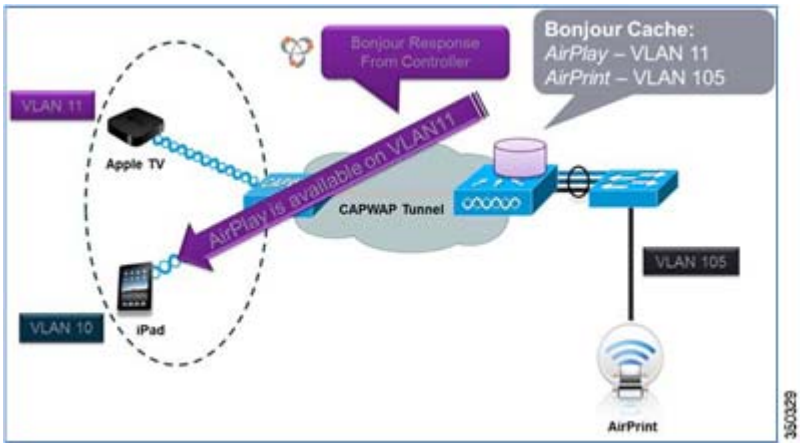
2. The WLC caches the Bonjour services.



3. The WLC listens for the client queries for services.



4. The WLC sends a unicast response to the client queries for Bonjour services.



Bonjour Deployment Using mDNS Gateway

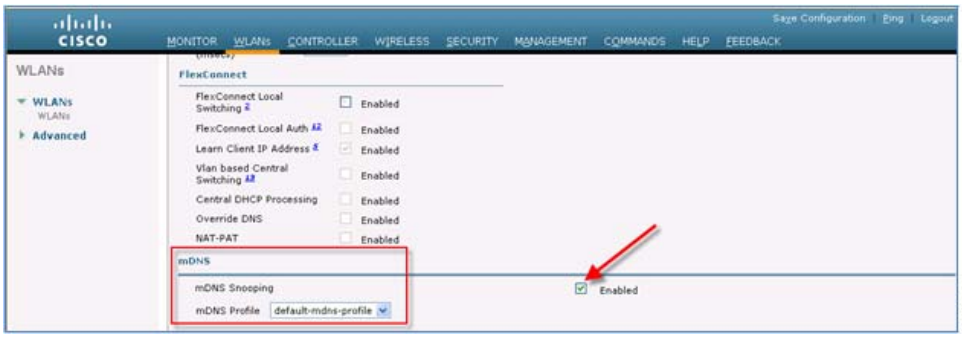
Bonjour Configuration on WLAN Through the User Interface

In the 7.4 release, the WLC supports Bonjour gateway functionality on the WLC itself. You do not need to enable multicast on the WLC. The WLC snoops all Bonjour discovery packets but does not forward them on the AIR or Infra network.

1. To configure and demonstrate the Bonjour feature on the WLC, create a dynamic interface for Bonjour services on a separate VLAN from the client VLAN.

   The example below shows different interfaces and VLANs for Apple Clients and Apple TV:

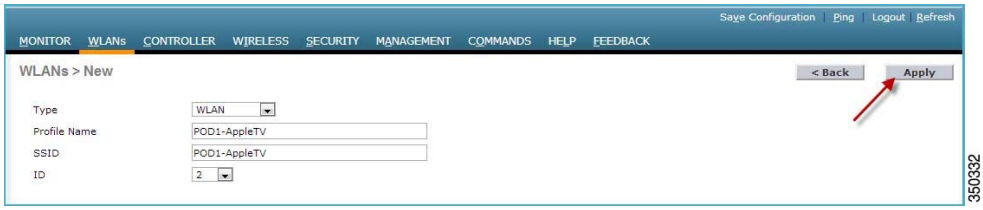
2. Create a wireless LAN (WLAN) for clients with any security type. By default, mDNS snooping is enabled on the WLAN.
3. To confirm, click **WLAN id**, click the **Advanced** tab, and make sure that the mDNS Snooping option is Enabled. Select **default-mdns-profile** as the mDNS Profile to allow the Bonjour services you require to advertise on the particular WLAN.
4. Click **Apply**.

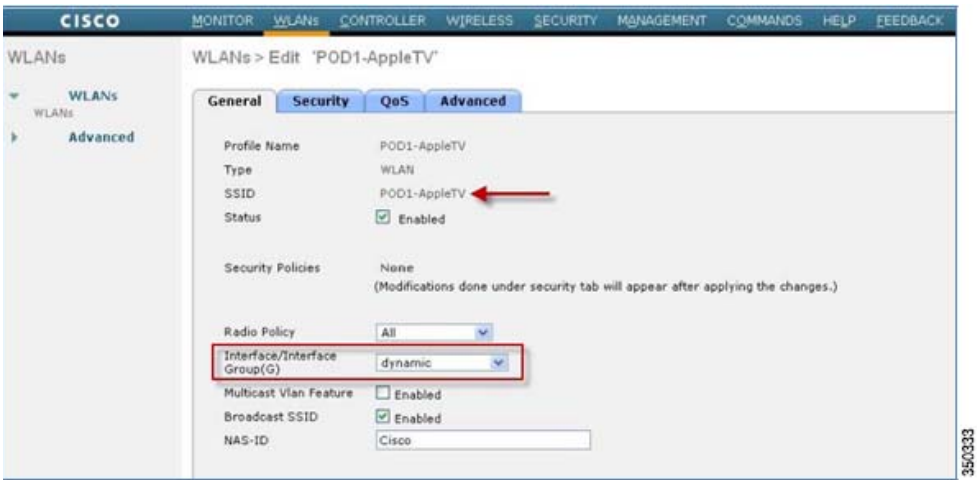


Note Only one mDNS profile can be applied to one WLAN.

5. Create another WLAN for services and make sure that the WLAN is mapped to an interface other than management, as shown below.

Note Release v5.0 of Apple TV does not support Wi-Fi Protected Access 2 (WPA2)-Enterprise authentication. For 802.1x networks, you can work around this problem by creating a WPA2-Pre- Shared Key (PSK) WLAN using the same wired interface.





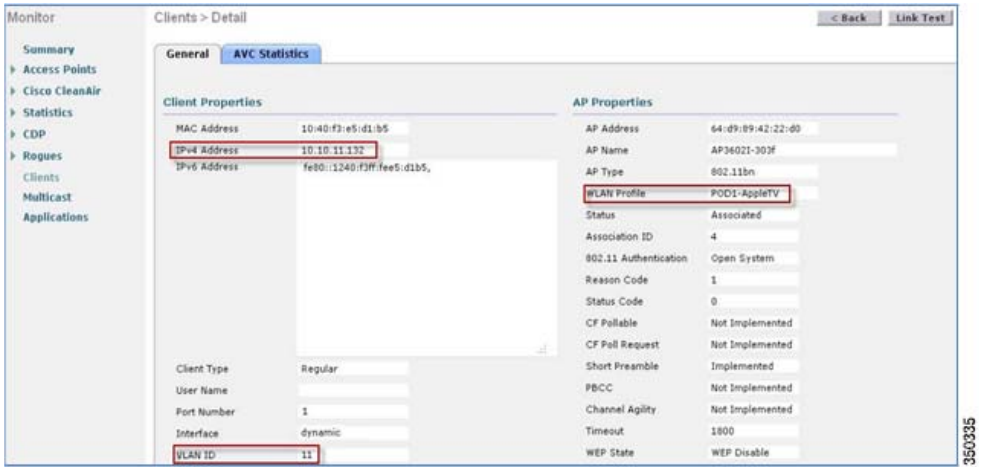
6. Connect the Apple TV to the service set identifier (SSID) created for device services, and connect the Bonjour client (iPad/iPhone) to the SSID for clients.

7. Navigate to **Monitor > Clients** to see that the Bonjour servicing Apple TV and the Bonjour client (your iPad/IPhone) are associated with two different SSIDs, as shown below:

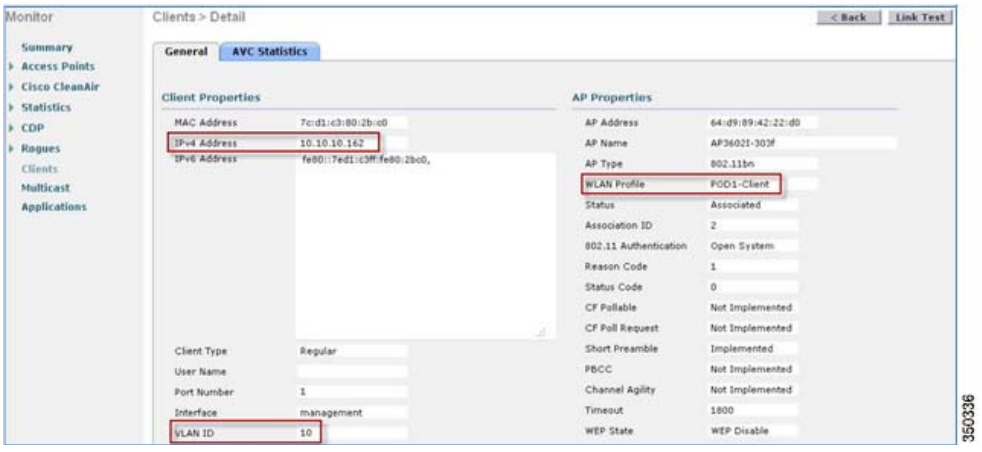
As shown above, it is implied that the Apple TV and the client are connected on different VLANs. This mapping will be confirmed in the next steps.

8. Click the client MAC address of the Bonjour device Apple TV, as shown above, to view its details.

9. Verify that the Apple TV associated to the interface is mapped to a different VLAN than the VLAN of the client. In this case, it is VLAN 11.



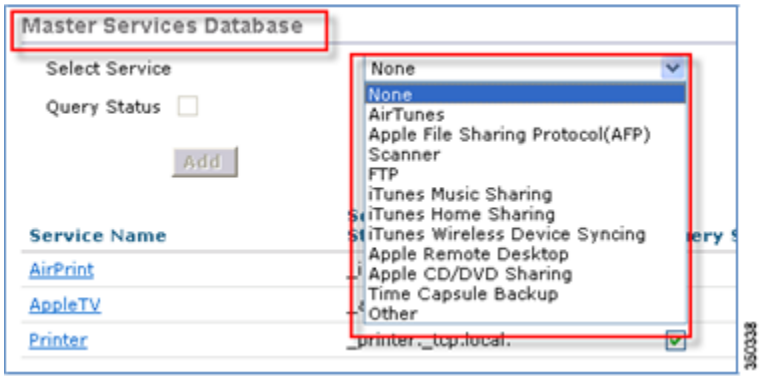
10. Click the MAC address of the client (iPad/iPhone) to view its details. As shown below, ensure that the iPad/iPhone is associated to an interface other than the services interface. In this case, it is VLAN 10.



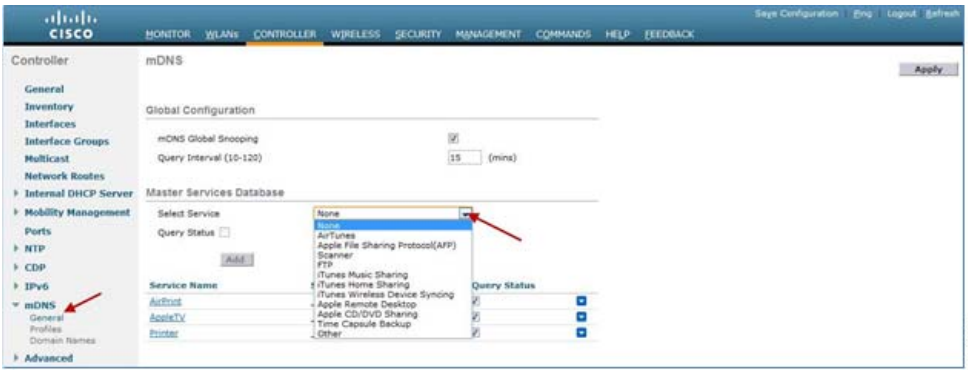
mDNS Profile Configuration Through the User Interface

1. To create and apply the Bonjour services, go to CONTROLLER > mDNS > General.
2. Under Global Configuration, check the mDNS Global Snooping checkbox to enable snooping; it is disabled by default. The Master Services Database shows the default profiles, which are preconfigured.

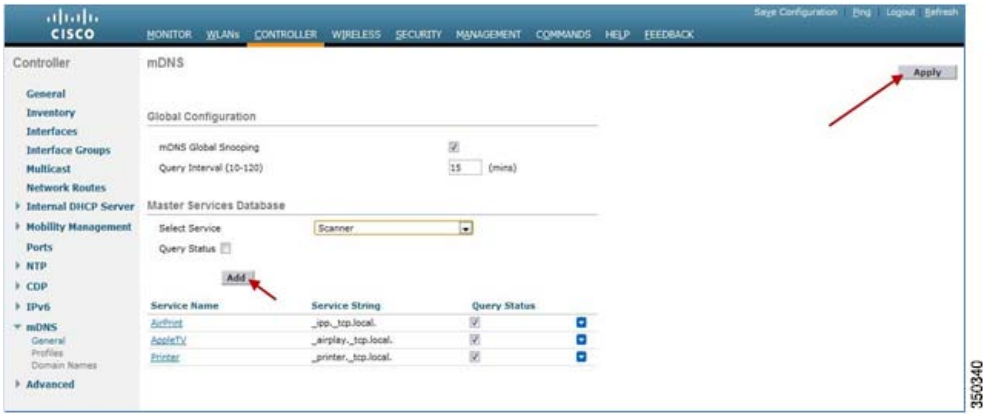
The Master Service Database is a user-configured database for all Bonjour services supported by the WLC. As shown above, a default list of services, like Apple TV and Printer, are added to this list on start-up. The WLC snoops and learns about mDNS service advertisements only if the service is present in the master-service-list database. Similarly, only those queries for services listed in the master-service-list are responded back to clients, as long as the Bonjour profile name associated with the client allows for the service query. A maximum of 64 services can be included in the master-service-list database, so the controller has the potential to snoop and learn about 64 different services.



3. To add Bonjour services, select the desired option from the Select Service drop-down list. In this example, select Scanner.



4. Click the **Add** button, then click **Apply**. Each service name has a predefined service string.



5. To select the services to be advertised, click **mDNS > Profiles.** The default profile appears.
6. Navigate to **Controller > mDNS > Profiles**, and select the default-mdns-profile.

Note If the requirement is to use only default services, assign the default?mdns?profile to that particular WLAN.

To check which Bonjour services are running, click **mDNS > Domain Names**.

In the example below, Apple TV is being discovered as the wireless medium.

7. When the Bonjour service appears under Domain Name, navigate to mDNS > General > AppleTV to check which mDNS profile the service is using. Since this example uses the default profile, the services appear under default-mdns-profile.

8. Once the profile is attached to the WLAN, check to see if the Bonjour services are routed across the VLANs.

9. Make sure your Apple iPhone/iPad Client is connected to the client SSID.
10. Using the TV remote for the monitor, select AirPlay from the Settings menu, and ensure AirPlay is enabled. You can set an optional passcode for security.
11. On your Apple iOS device, double-click the home button to reveal the multi-tasking view.

12. Swipe left to right (twice for an iPhone, once for an iPad) to reveal a menu with the AirPlay icon, as shown below.

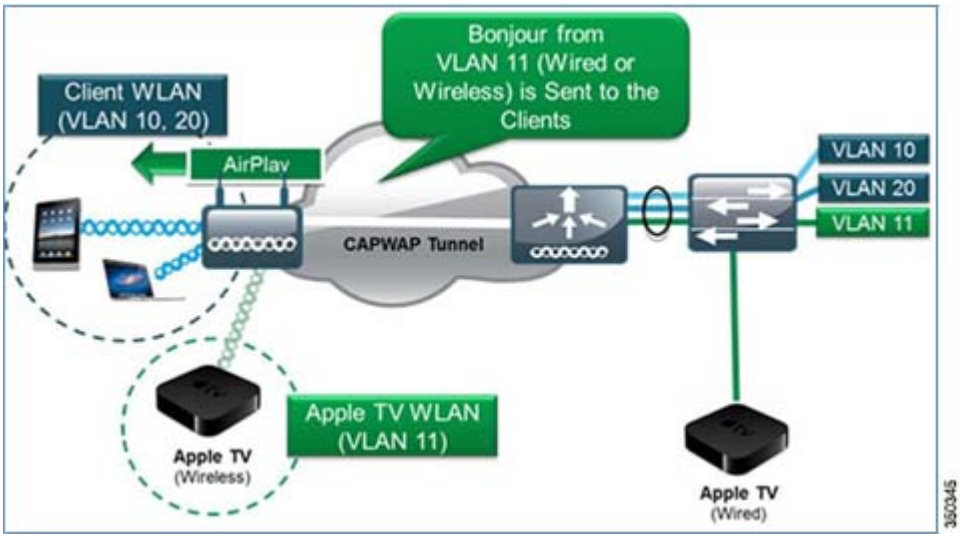
13. Select the Apple TV from the list, and enable mirroring.

14. The status bar at the top of the Apple device turns blue and displays an icon for AirPlay to signify that you are broadcasting your screen on the Apple TV.

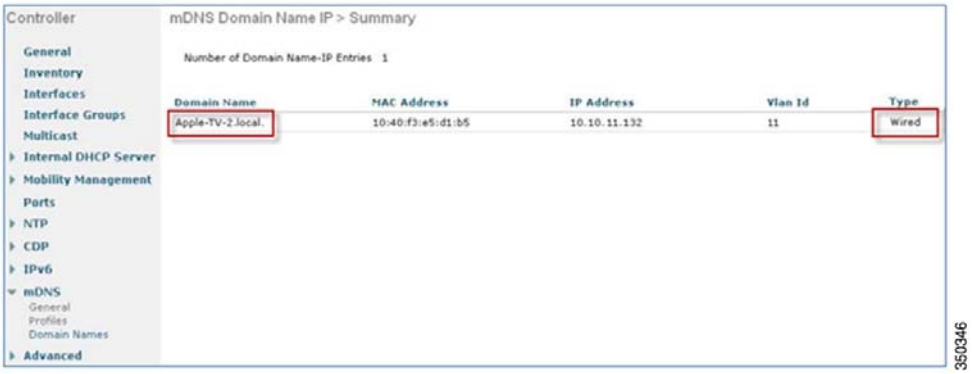
mDNS Services with Wired Bonjour Devices

In most scenarios, some Bonjour devices may be directly connected to the switch or device. Bonjour services can be accessed even when the Bonjour device is connected via an Ethernet cable on a network.

The VLAN of wired Bonjour devices must be trunked to the controller so that their advertisements can be seen and sent out to wireless clients. In this example, the Bonjour device (Apple TV) is on VLAN 11 tied to the dynamic interface on the controller.



1. On the WLC user interface, navigate to **Controller > mDNS > Domain Names**. Apple TV is now discovered as the wired medium in the dynamic VLAN, as shown below.



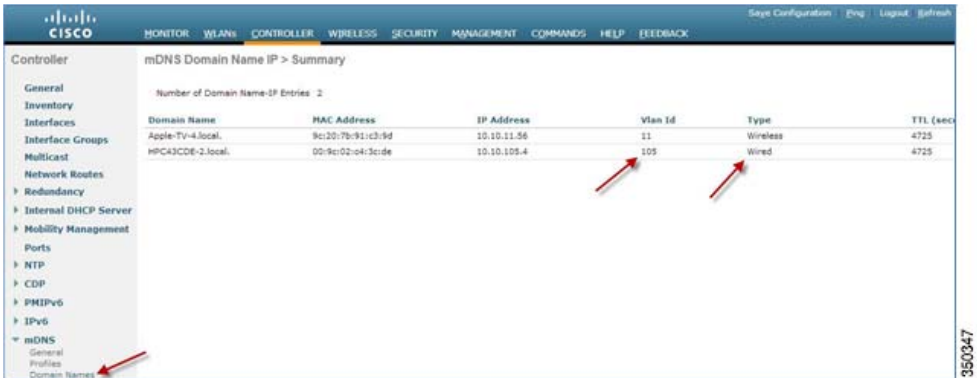
2. Use your Apple Client (iPhone/iPad) to check that the Apple services are still being broadcasted.

Printer Services

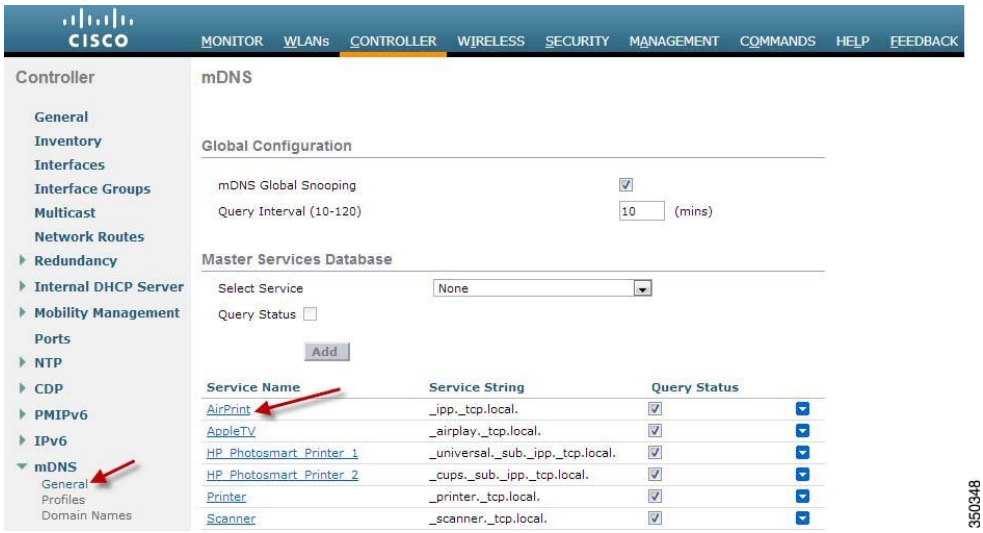
Bonjour Printer Services

In most networks, the printers are wired into the network. You can also show case and verify that the AirPrint Services are being cached and advertised by the controller when the client queries for the service. The same principal applies as discussed above for the wired Bonjour device (Apple TV).

1. To check if the Bonjour Printer Service is discovered by the WLC, navigate to **CONTROLLER > mDNS > Domain Names**. The printer appears under Domain Name IP Entries with Type Wired and Vlan Id.

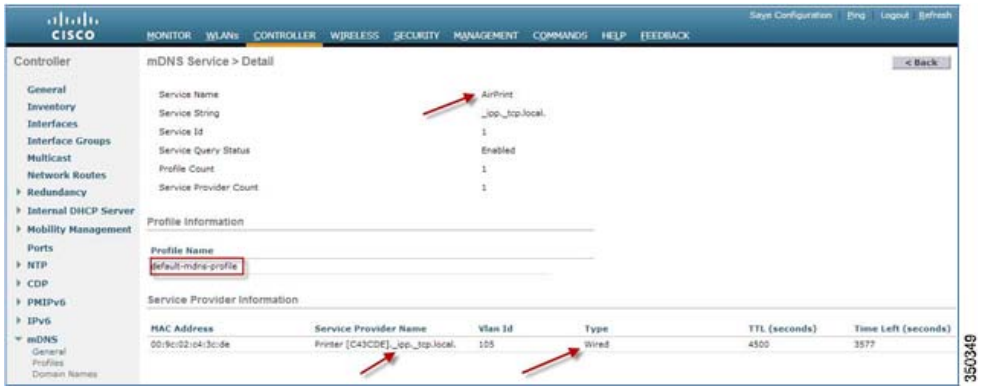


2. A single Bonjour device can advertise multiple Bonjour services; for example, a printer can advertise AirPrint, Printer, Scanner, Photosmart, and so forth. To confirm which service is being cached by the WLC, go to **CONTROLLER > mDNS > General**, and click the appropriate service name.



Note Any printer services that advertise Service String _ipp._tcp.local are cached by the WLC under Service Name AirPrint. Likewise, if the printer also advertises the string _printer._tcp.local, it appears under the Printer service name

Below, the Bonjour printer advertises the AirPrint Service and is part of default-mdns-profile.



3. Once the services are visible on the WLC, check if wired Bonjour Printer services are routed across the VLANs and if the printer is detected by your iOS device. Make sure your Apple iPhone/iPad Client is connected the client SSID.
4. Use your iOS device to test the AirPrint services.

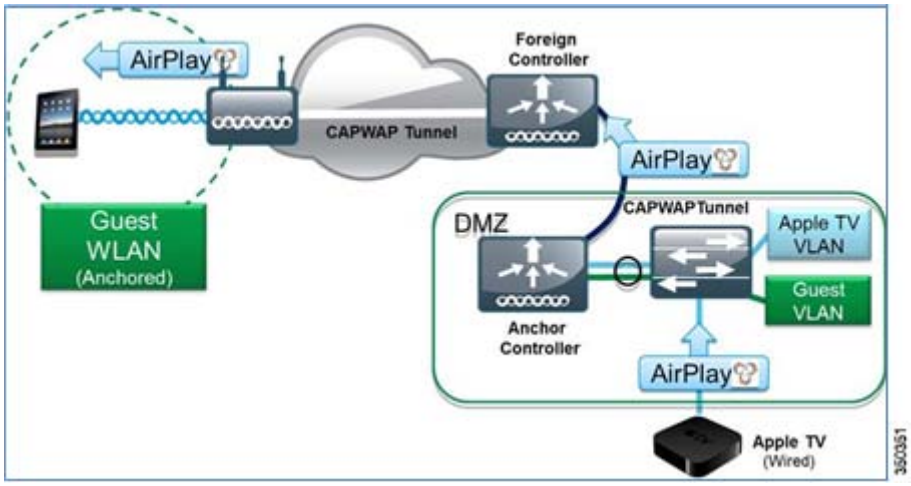
a. As shown below, click the Print icon in iOS6 or click the Print tab in iOS5.

b. Under Printer Options, click Select Printer to see the Bonjour printer that was discovered by the device.

c. Select that printer, and click Print to test the AirPrint Services.

Bonjour and Guest Anchoring

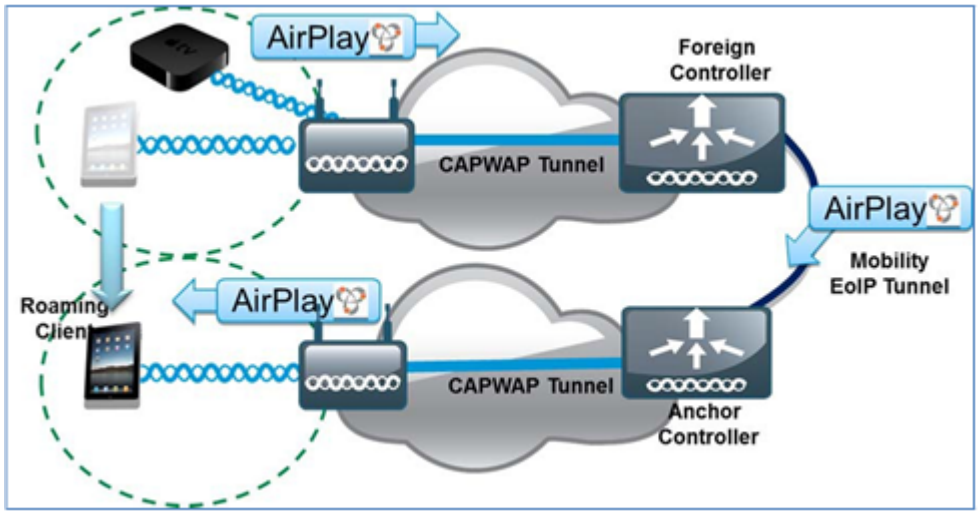
For guest anchoring, the guest WLAN is able to see Bonjour services advertised to the anchor controller. The Bonjour queries and advertisements are sent inside the Control and Provisioning of Wireless Access Points (CAPWAP) tunnel.



Bonjour Layer 3 Roaming

The Layer 3 roaming works across the Ethernet over IP (EoIP) tunnel to ensure users moving among access points (APs) on different controllers continue to see the devices they saw on the original controller.

The Bonjour services on the anchor controller are displayed to the client, including both wired and wireless devices.



Bonjour Services Summary

- The 7.4 release supports up to 64 services and 100 service providers per service type.
- Each service provider is registered in the WLC as its domain name.
- A client that meets the profile requirements receives unicast service directly from the service provider.
- Each Bonjour service has an advertised TTL. The controller asks the device for an update at 85% of this TTL.

Bonjour Services Support in FlexConnect Mode

- For centrally switched WLANs, the behavior for Bonjour is the same as if the AP was in local mode.
- Bonjour queries from the client are sent to the controller and Bonjour responses from the controller are sent back to the AP in the unicast CAPWAP tunnel.
- FlexConnect APs do not require the Multicast?Unicast mode to support Bonjour.
- For locally switched WLANs, Bonjour continues to work in a single subnet only.

Bonjour Configuration on the WLC Through the CLI

This is a list of command line interface (CLI) commands that can be used to configure Bonjour on the WLC.

Configure Commands

To enable or disable global mDNS snooping

```
WLC>config mdns snooping { enable | disable }
```

To create a new mDNS profile name

```
WLC>config mdns profile create profile-name
```

To delete an existing mDNS profile name

```
WLC>config mdns profile delete profile-name
```

To attach a mDNS profile name to an interface

```
WLC>config interface mdns-profile { management | all interface-name } {profile-name |
none}
```

Note If a WLAN is attached to interface, the WLC issues a dependency error.

To attach a mDNS profile name to an interface-group

```
WLC>config interface group mdns-profile { all | interface-group-name } {profile-name |
none }
```

Note If a WLAN is attached to Interface, the WLC issues a dependency error.

To enable or disable mDNS support for a WLAN

```
WLC>config wlan mdns { enable | disable } { wlan id | all }
```

Note The default value is enabled.

To attach a mDNS profile to a WLAN

```
WLC>config wlan mdns { profile-name | none } { wlan id | all }
```

To create a new mDNS service

```
WLC>config mdns service create service-name service string query { enable | disable }
```

To enable/disable query for a service

```
WLC>config mdns service query { enable | disable } service-name
```

To delete a mDNS service

```
WLC>config mdns service delete service-name
```

To attach a service to a given profile name

```
WLC>config mdns profile service add service-name profile-name
```

To remove the service from a profile name

```
WLC>config mdns profile service delete service-name profile-name
```

To configure query interval

```
WLC>config mdns query interval interval-value
```

Note The default value is 15 minutes; the range is 10 minutes to 2 hours

Show Commands

```
WLC>show mdns profile summary
WLC>show mdns profile detailed profile-name
WLC>show mdns service summary
WLC>show mdns service detailed service-name
WLC>show interface detailed interface-name
WLC>show interface group detailed interface-group-name
WLC>show wlan wlan-id
WLC>show client detail mac-address
WLC>show network summary
```

Clear Commands

To clear the mDNS database learned dynamically per service

```
WLC>clear mdns service-database { all | service-name }
```

Debug Commands

To display events related to mDNS

```
WLC>debug mdns message { enable | disable }
```

To display mDNS details of the events

```
WLC>debug mdns detail { enable | disable }
```

To display errors related to mDNS processing

```
WLC>debug mdns error { enable | disable }
```

To enable all debugs

```
WLC>debug mdns all { enable | disable }
```

All the debugs can be filtered based on the MAC address.