

802.11v Basic Service Set (BSS) on AireOS WLC

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Introduction

This document describes the support of protocol 802.11v on a WLC (Wireless LAN controller).

Background Information

802.11v refers to the IEEE (Institute of Electrical and Electronics Engineers) 802.11 Wireless Network Management (Amendment 8).

Stations that support WNM (Wireless network management) can exchange information with each other (Access Points and wireless clients) in order to improve their performance.

AireOS WLC version 8.1 or higher support these WNM services:

- Directed multicast service (DMS)
- BSS (Basic Service Set) Max idle period management
- BSS transition management

Directed multicast service (DMS):

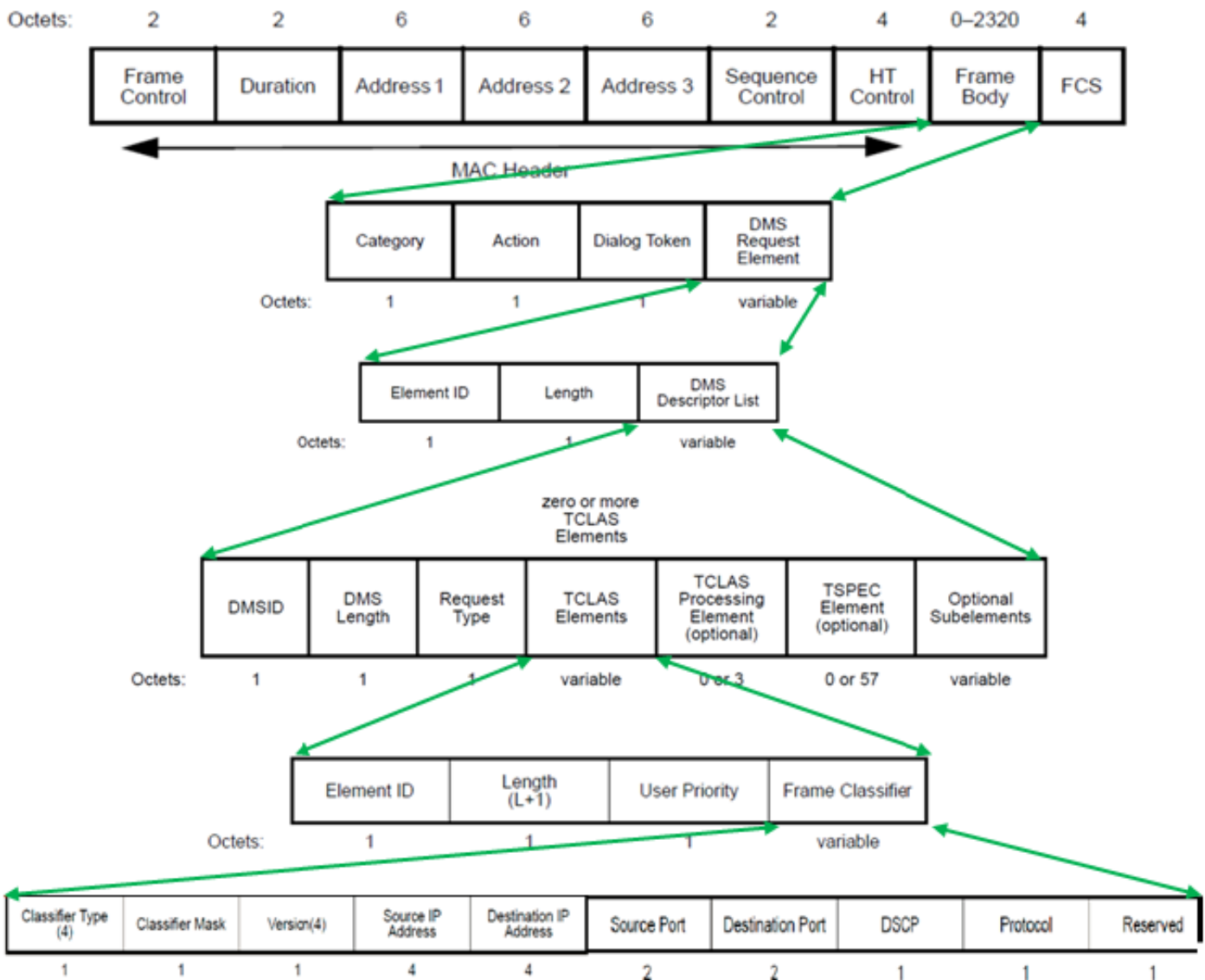
Clients that supports DMS can request to the AP (Access Point) to send a multicast stream as unicast, like a dynamic media stream function.

For more information for media stream: [VideoStream Deployment Guide](#)

Without the use of DMS a client has to wake up every DTIM interval in order to receive multicast traffic. With DMS, the AP (Access Point) buffers the multicast traffic for certain client, when client wakes up it sends a unicast frame in order to request this traffic. It allows the client to sleep for a longer time and save battery power. Multicast frames are transmitted as unicast over the air, sent at a higher data rate than which It would have been used without DMS.

Wireless clients can send a DMS request-type Add frame in order to ask the AP to send as unicast the traffic of one or more specific multicast streams.

Management Frame - DMS Request type



There are three types of DMS request:

Description Request type value

Add	0
Remove	1
Change	2
Reserved	3-255

The DMS request-Add includes a DMS Descriptor.

Inside the DMS Descriptor List there is the TCLAS element, which specifies the multicast traffic stream that the wireless client requests to get as unicast. TCLAS specifies source/destination IP address, source/destination port besides other fields.

The AP sends these traffic streams as unicast to the wireless client and also it continues to send those streams as multicast to any other client in the network that does not support DMS.

Inside a DMS request frame there can be also a TSPEC element (optional), where the wireless client can define the QoS requirements and characteristics of a traffic flow.

Note: TSPEC is not supported

In this example the client sent a DMS request (Management frame, Category Code 10: WNM, Action code 23: DMS Request, for the multicast stream IPv4 on group 224.0.0.251, UDP (Protocol 17), destination port 9 (At this document wireshark is not able to completely decode a DMS request).

3... Apple 58:95:0a CiscoInc 7d:d9:10 802.11 DMS Request[Malformed Packet]

Frame 34853: 75 bytes on wire (600 bits), 75 bytes captured (600 bits) on interface 0

Radiotap Header v0, Length 18

802.11 radio information

IEEE 802.11 Action, Flags:C

IEEE 802.11 wireless LAN management frame

- Fixed parameters
 - Category code: WNM (10)
 - Action code: DMS Request (23)
- Tagged parameters (27 bytes)
- [Malformed Packet: IEEE 802.11]

0028	11110000	11011101	Category	Action	Dial.Token	Element-ID	Length	DMS ID	
0030	DMS Length		Req- Type	Ele-ID-TCLAS	Length (L+1)	User Priority	Classif.Type	Classif.Mask	Version (4)
0038	Source IP address				Destination IP address				
0040	Source Port		Destination Port		DSCP	Protocol	00000000	00111111	

3... Apple 58:95:0a CiscoInc 7d:d9:10 802.11 DMS Request[Malformed Packet]

Frame 34853: 75 bytes on wire (600 bits), 75 bytes captured (600 bits) on interface 0

Radiotap Header v0, Length 18

802.11 radio information

IEEE 802.11 Action, Flags:C

IEEE 802.11 wireless LAN management frame

- Fixed parameters
 - Category code: WNM (10)
 - Action code: DMS Request (23)
- Tagged parameters (27 bytes)
- [Malformed Packet: IEEE 802.11]

0028	11110000	11011101	00001010	00010111	00000101	01100011	00011000	00000000	
0030	00010110	00000000	00001110	00010011	00000000	00000100	01010101	00000100	
0038	00000000 00000000 00000000 00000000				11100000	00000000	00000000	11111011	
0040	00000000 00000000		00000000	00001001	00000000	00010001	00000000	00111111	

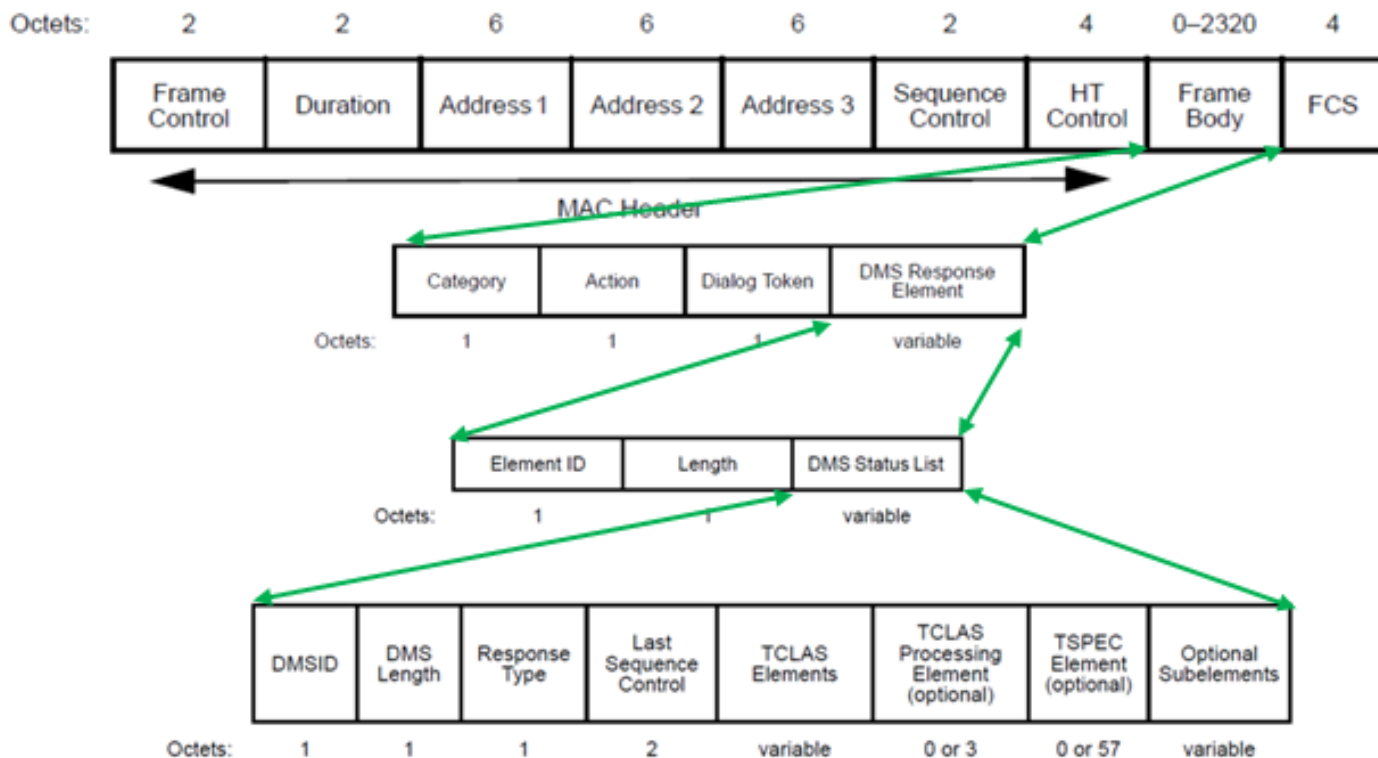
The AP answers the DMS request with a DMS response, which can be a DMS response-Accept or DMS Response-Deny.

If the AP sends a DMS response-Accept, it also assigns a DMSID to that communication flow.

DMS Request type Change can be used by the wireless client to modify an existent DMSID, for example to request a different TSPEC for a traffic flow.

Note: DMS change is not supported

Management Frame - DMS Response type



There are three DMS Response Types:

Field Value Description

- 0 Accept
- 1 Denied
- 2 Terminate
- 3-255 Reserved

In this example the AP sent a DMS Response-Accept and it assigns a DMS ID 1 to the DMS request sent by the client.

3... CiscoInc 7d:d9:10 Apple 58:95:0a 802.11 DMS Response[Malformed Packet]

```

+ Frame 34855: 56 bytes on wire (448 bits), 56 bytes captured (448 bits) on interface 0
+ Radiotap Header v0, Length 18
+ 802.11 radio information
+ IEEE 802.11 Action, Flags: .....C
- IEEE 802.11 wireless LAN management frame
  - Fixed parameters
    - Category code: WNM (10)
    - Action code: DMS Response (24)
  + Tagged parameters (8 bytes)
  + [Malformed Packet: IEEE 802.11]
  
```

0000	00000000	00000000	00010010	00000000	00101110	01001000	00000000	00000000	.....H..
0008	00010000	00000010	10000101	00001001	10100000	00000000	11010101	00000101	.....
0010	00000000	00000000	11010000	00000000	11011010	00000000	10100100	11110001	.....
0018	11101000	01011000	10010101	00001010	01111100	00001110	11001110	01111101	.X..|..}
0020	11011001	00010000	01111100	00001110	11001110	01111101	11011001	00010000	..|..}..
0028	01110000	01000000	Category	Action	Dial.Token	Element-ID	Length	DMS ID	p@...d..
0030	DMS Length	Resp- Type	Last Sequence Control	10011100	00101011	10011110	00000011+..	

3... CiscoInc 7d:d9:10 Apple 58:95:0a 802.11 DMS Response[Malformed Packet]

```

+ Frame 34855: 56 bytes on wire (448 bits), 56 bytes captured (448 bits) on interface 0
+ Radiotap Header v0, Length 18
+ 802.11 radio information
+ IEEE 802.11 Action, Flags: .....C
- IEEE 802.11 wireless LAN management frame
  - Fixed parameters
    - Category code: WNM (10)
    - Action code: DMS Response (24)
  + Tagged parameters (8 bytes)
  + [Malformed Packet: IEEE 802.11]
  
```

0000	00000000	00000000	00010010	00000000	00101110	01001000	00000000	00000000	.....H..
0008	00010000	00000010	10000101	00001001	10100000	00000000	11010101	00000101	.....
0010	00000000	00000000	11010000	00000000	11011010	00000000	10100100	11110001	.....
0018	11101000	01011000	10010101	00001010	01111100	00001110	11001110	01111101	.X..|..}
0020	11011001	00010000	01111100	00001110	11001110	01111101	11011001	00010000	..|..}..
0028	01110000	01000000	00001010	00011000	00000101	01100100	00000101	00000001	p@...d..
0030	00000011	00000000	11111111	11111111	10011100	00101011	10011110	00000011+..

After that if there is a packet with destination group 224.0.0.251 on port 9 it is sent to the air as multicast and it is also buffered on the AP until the client that sent the DMS request is awake is available to receive it as unicast.

This is an example of a packet destination to group 224.0.0.251 on port 9 sent as regular multicast. Notice that the receiver and destination mac address refers to the multicast group.

```
+ Radiotap Header v0, Length 18
+ 802.11 radio information
- IEEE 802.11 Data, Flags: .....F.C
  Type/Subtype: Data (0x0020)
+ Frame Control Field: 0x0802
  ... 000 0000 0000 0000 = Duration: 0 microseconds
  Receiver address: IPv4mcast fb (01:00:5e:00:00:fb)
  Destination address: IPv4mcast_fb (01:00:5e:00:00:fb)
  Transmitter address: CiscoInc_7d:d9:10 (7c:0e:ce:7d:d9:10)
  Source address: IntelCor_7c:30:58 (e4:b3:18:7c:30:58)
  BSS Id: CiscoInc_7d:d9:10 (7c:0e:ce:7d:d9:10)
  STA address: IPv4mcast_fb (01:00:5e:00:00:fb)
  .... .... .... 0000 = Fragment number: 0
  0110 0000 0010 .... = Sequence number: 1538
  Frame check sequence: 0xb8fad31e [correct]
  [FCS Status: Good]
+ Logical-Link Control
+ Internet Protocol Version 4, Src: 172.16.0.51, Dst: 224.0.0.251
- User Datagram Protocol, Src Port: 59887, Dst Port: 9
  Source Port: 59887
  Destination Port: 9
  Length: 110
  Checksum: 0x6288 [unverified]
  [Checksum Status: Unverified]
  [Stream index: 124]
```

This is an example of a frame sent as unicast to the client that sent the DMS request. Here the destination and receive address is the mac address of the client and not the multicast mac address. Also the multicast packet is sent as AMSDU.

```
⊕ Radiotap Header v0, Length 21
⊕ 802.11 radio information
⊖ IEEE 802.11 QoS Data, Flags: .....F.C
  ... Type/Subtype: QoS Data (0x0028)
  ⊕ Frame Control Field: 0x8802
  ... 000 0000 0010 1100 = Duration: 44 microseconds
  Receiver address: Apple 58:95:0a (a4:f1:e8:58:95:0a)
  Destination address: Apple 58:95:0a (a4:f1:e8:58:95:0a)
  ... Transmitter address: CiscoInc_7d:d9:10 (7c:0e:ce:7d:d9:10)
  ... Source address: IntelCor_7c:30:58 (e4:b3:18:7c:30:58)
  ... BSS Id: CiscoInc_7d:d9:10 (7c:0e:ce:7d:d9:10)
  ... STA address: Apple_58:95:0a (a4:f1:e8:58:95:0a)
  ... .... 0000 = Fragment number: 0
  ... 0000 0001 0000 .... = Sequence number: 16
  ... Frame check sequence: 0x174f6716 [correct]
  ... [FCS Status: Good]
  ⊕ Qos Control: 0x0083
⊖ IEEE 802.11 Aggregate MSDU
  ⊖ A-MSDU Subframe #1
  ... Destination address: IPv4mcast_00 (01:00:5e:00:00:00)
  ... Source address: IntelCor_7c:30:58 (e4:b3:18:7c:30:58)
  ... A-MSDU Length: 138
  ⊕ Logical-Link Control
  ⊕ Internet Protocol Version 4, Src: 172.16.0.51, Dst: 224.0.0.251
  ⊖ User Datagram Protocol, Src Port: 59887, Dst Port: 9
  ... Source Port: 59887
  ... Destination Port: 9
  ... Length: 110
  ... Checksum: 0x6288 [unverified]
  ... [Checksum Status: Unverified]
  ... [Stream index: 124]
```

Once a wireless client no longer wants to receive a multicast stream as unicast it can send a new DMS request to close that flow, it uses the DMS ID that was assigned before by the AP. It is a DMS Request - Remove Type (1)

49165 133.314820 Apple 58:95:0a CiscoInc 7d:d9:10 802.11 DMS Request

- Frame 49165: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface 0
- Radiotap Header v0, Length 18
- 802.11 radio information
- IEEE 802.11 Action, Flags:C
- IEEE 802.11 wireless LAN management frame
 - Fixed parameters
 - Category code: WNM (10)
 - Action code: DMS Request (23)
 - Tagged parameters (6 bytes)

```

0000  00000000 00000000 00010010 00000000 00101110 01001000 00000000 00000000  ....H..
0008  00010000 00000010 10000101 00001001 10100000 00000000 11011101 00000101  ....
0010  00000000 00000000 11010000 00000000 00111010 00000001 01111100 00001110  ....|.
0018  11001110 01111101 11011001 00010000 10100100 11110001 11101000 01011000  .}....X
0020  10010101 00001010 01111100 00001110 11001110 01111101 11011001 00010000  ..|...}..
0028  11110000 11100001 00001010 00001110 11001110 01111101 11011001 00010000  ..|...}..
0030  11110000 11100001 11010110 10111000 00111001 00110100 00000011 00000001  ..|...}..
      DMS Length  Req-Type  Category  Action  DielToken  Element-ID  Length  DMS ID
      00000001  00000001  11010110  10111000  00111001  00110100
  
```

49165 133.314820 Apple 58:95:0a CiscoInc 7d:d9:10 802.11 DMS Request

- Frame 49165: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface 0
- Radiotap Header v0, Length 18
- 802.11 radio information
- IEEE 802.11 Action, Flags:C
- IEEE 802.11 wireless LAN management frame
 - Fixed parameters
 - Category code: WNM (10)
 - Action code: DMS Request (23)
 - Tagged parameters (6 bytes)

```

0000  00000000 00000000 00010010 00000000 00101110 01001000 00000000 00000000  ....H..
0008  00010000 00000010 10000101 00001001 10100000 00000000 11011101 00000101  ....
0010  00000000 00000000 11010000 00000000 00111010 00000001 01111100 00001110  ....|.
0018  11001110 01111101 11011001 00010000 10100100 11110001 11101000 01011000  .}....X
0020  10010101 00001010 01111100 00001110 11001110 01111101 11011001 00010000  ..|...}..
0028  11110000 11100001 00001010 00001110 11001110 01111101 11011001 00010000  ..|...}..
0030  00000001 00000001 11010110 10111000 00111001 00110100 00000011 00000001  ..|...}..
      00001010  00010111  00000110  01100011  00000011  00000001
  
```

And the AP confirms this termination with a DMS Response Type Terminate (2)

49170 133.317305 CiscoInc 7d:d9:... Apple 58:95:0a 802.11 DMS Response

```

+ Frame 49170: 56 bytes on wire (448 bits), 56 bytes captured (448 bits) on interface 0
+ Radiotap Header v0, Length 18
+ 802.11 radio information
+ IEEE 802.11 Action, Flags: .....C
- IEEE 802.11 wireless LAN management frame
  - Fixed parameters
    - Category code: WNM (10)
    - Action code: DMS Response (24)
  + Tagged parameters (8 bytes)

```

0000	00000000	00000000	00010010	00000000	00101110	01001000	00000000	00000000	.....H..
0008	00010000	00000010	10000101	00001001	10100000	00000000	11010101	00000101	.....
0010	00000000	00000000	11010000	00000000	11011010	00000000	10100100	11110001	.....
0018	11101000	01011000	10010101	00001010	01111100	00001110	11001110	01111101	.X..|..}
0020	11011001	00010000	01111100	00001110	11001110	01111101	11011001	00010000	..|..}..
0028	01100000	01100000	Category	Action	DialToken	Element-ID	Length	DMS ID	..d..
0030	DMS Length	Resp-Type	Last Sequence Control	00111010	10011010	00010001	00000100		...:...

49170 133.317305 CiscoInc 7d:d9:... Apple 58:95:0a 802.11 DMS Response

```

+ Frame 49170: 56 bytes on wire (448 bits), 56 bytes captured (448 bits) on interface 0
+ Radiotap Header v0, Length 18
+ 802.11 radio information
+ IEEE 802.11 Action, Flags: .....C
- IEEE 802.11 wireless LAN management frame
  - Fixed parameters
    - Category code: WNM (10)
    - Action code: DMS Response (24)
  + Tagged parameters (8 bytes)

```

0000	00000000	00000000	00010010	00000000	00101110	01001000	00000000	00000000	.....H..
0008	00010000	00000010	10000101	00001001	10100000	00000000	11010101	00000101	.....
0010	00000000	00000000	11010000	00000000	11011010	00000000	10100100	11110001	.....
0018	11101000	01011000	10010101	00001010	01111100	00001110	11001110	01111101	.X..|..}
0020	11011001	00010000	01111100	00001110	11001110	01111101	11011001	00010000	..|..}..
0028	01100000	01100000	00001010	00011000	00000110	01100100	00000101	00000001	..d..
0030	00000011	00000010	11111111	11111111	00111010	10011010	00010001	00000100	...:...

BSS Max idle period:

When an AP no longer receives frames from a wireless client for a certain period of time it assumes the client left the network and it disassociates it. The BSS Max idle period is the amount of time an AP can keep a client associated without have to receive any frame (client can remain sleep). This value is informed to the wireless client through the association and re-association response frame. This allows the clients to remain asleep for a longer time and save battery power.

BSS Max idle period only appears in association-response or re-association response frames

```

+ 802.11 radio information
+ IEEE 802.11 Association Response, Flags: .....C
- IEEE 802.11 wireless LAN management frame
  + Fixed parameters (6 bytes)
  - Tagged parameters (153 bytes)
    + Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), 6, 9, 12, 18, [Mbit/sec]
    + Tag: Extended Supported Rates 24, 36, 48, 54, [Mbit/sec]
    + Tag: HT Capabilities (802.11n D1.10)
    + Tag: HT Information (802.11n D1.10)
    + Tag: Extended Capabilities (4 octets)
    - Tag: BSS Max Idle Period
      Tag Number: BSS Max Idle Period (90)
      Tag length: 3
      BSS Max Idle Period (1000 TUs): 400
      .... .0 = BSS Max Idle Period Options: Protected Keep-Alive Required: 0
    + Tag: Vendor Specific: Microsot: WMM/WME: Parameter Element
    + Tag: QoS Map Set

```

The BSS Max Idle Period is specified in units of 1000 TUs (Time units). Every time unit is equal to 1.024 milliseconds

$$\text{Idle timeout} = 1.024 \times \text{BSS Max Idle Period} = X \text{ seconds}$$

In the example frame:

$$\text{Idle timeout} = 1.024 \times 405 = 414.72 \text{ seconds}$$

If the Protected Keep-alive Required bit is set to 1, it means that the wireless client must send a RSN protected frame to the AP in order to reset the Idle Timer. If it is set to 0, as this example, the wireless client can send any type of frame (protected or unprotected) to reset the Idle timer at the AP.

BSS transition management

802.11v BSS Transition Management Request is a suggestion given to client. Client can make its own decision whether to follow the suggestion or not. The disassociation of a client can be forced if disassociation-imminent function is enabled. It disassociates the client after a period of time if the client does not re-associate to one of the suggested APs.

802.11v BSS Transition is applied to these four scenarios:

Solicited Request

Wireless client sends an 802.11v BSS Transition Management Query before they roam for a better option of APs to re-associate with.

Example of a 802.11v BSS Transition Management Query

```

1093 2.515163 CiscoInc 3a:0f:... CiscoInc 7d:d9:10 802.11 BSS Transition Management Query
-----
+ Frame 1093: 50 bytes on wire (400 bits), 50 bytes captured (400 bits) on interface 0
+ Radiotap Header v0, Length 18
+ 802.11 radio information
+ IEEE 802.11 Action, Flags: .....C
- IEEE 802.11 wireless LAN management frame
  + Fixed parameters
  + Tagged parameters (2 bytes)
-----
0000 00000000 00000000 00010010 00000000 00101110 01001000 00000000 00000000 .....H..
0008 00010000 00000010 10000101 00001001 10100000 00000000 11101011 00000101 .....
0010 00000000 00000000 11010000 00000000 00111010 00000001 01111100 00001110 .....|.
0018 11001110 01111101 11011001 00010000 11000100 01111101 01001111 00111010 .}...}0:
0020 00001111 01011100 01111100 00001110 11001110 01111101 11011001 00010000 .\|...}..
0028 11100000 11110010 Category Action DialToken QReason 00110001 10001001 .....1.
0030 01110101 01001111 u0

```

```

1093 2.515163 CiscoInc 3a:0f:... CiscoInc 7d:d9:10 802.11 BSS Transition Management Query
-----
+ Frame 1093: 50 bytes on wire (400 bits), 50 bytes captured (400 bits) on interface 0
+ Radiotap Header v0, Length 18
+ 802.11 radio information
+ IEEE 802.11 Action, Flags: .....C
- IEEE 802.11 wireless LAN management frame
  + Fixed parameters
  + Tagged parameters (2 bytes)
-----
0000 00000000 00000000 00010010 00000000 00101110 01001000 00000000 00000000 .....H..
0008 00010000 00000010 10000101 00001001 10100000 00000000 11101011 00000101 .....
0010 00000000 00000000 11010000 00000000 00111010 00000001 01111100 00001110 .....|.
0018 11001110 01111101 11011001 00010000 11000100 01111101 01001111 00111010 .}...}0:
0020 00001111 01011100 01111100 00001110 11001110 01111101 11011001 00010000 .\|...}..
0028 11100000 11110010 00001010 00000110 00000110 00010000 00110001 10001001 .....1.
0030 01110101 01001111 u0

```

QReason means BSS Transition Query Reason, which is the reason why the client requests the candidate AP list. In this example the client sent a reason 16, which correspond to Low RSSI. For full list of transition query reasons consult Table 8-138 of IEEE 802.11-2012.

After the radio receives this frame, it responds with a BSS Transition Management Request in order to provide the AP candidate list.

```

1098 2.522295 CiscoInc 7d:d9:... CiscoInc 3a:0t:5c 802.11 BSS Transition Management Request
-----
Frame 1098: 122 bytes on wire (976 bits), 122 bytes captured (976 bits) on interface 0
Radiotap Header v0, Length 18
802.11 radio information
IEEE 802.11 Action, Flags: .....C
IEEE 802.11 wireless LAN management frame
- Fixed parameters
  - Category code: WNM (10)
  - Action code: BSS Transition Management Request (7)
  - Dialog token: 0x06
  - .... ..1 = Preferred Candidate List Included: 1
  - .... ..0. = Abridged: 0
  - .... ..1.. = Disassociation Imminent: 1
  - .... ..0... = BSS Termination Included: 0
  - .... ..0 .... = ESS Disassociation Imminent: 0
  - Disassociation Timer: 1953
  - Validity Interval: 200
  - BSS Transition Candidate List Entries: 344300c88b262cd0e702000000060700000000000000000...

```

Unsolicited Load Balance request

When WLC has load balance feature + BSS transition enabled, the AP no longer sends a

deauthentication frame to a wireless client when it is heavily loaded, it sends a BSS transition management request in order to suggest the wireless client another less loaded AP.

For more information about load balance feature: [Configuring Aggressive Load Balancing](#)

Unsolicited Optimized Roaming request

When WLC has optimized roaming + BSS transition enabled, the AP no longer sends a deauthentication frame to a wireless client when the client does not meet the minimum RSSI (or any other parameter related to optimized roaming), it sends a BSS transition management in order to suggest the wireless client a better AP.

For more information about optimized roaming feature: [Cisco Optimized Roaming](#)

Client steer on FRA AP (Flexible Radio Assignment)

If a client connects to a less optimum cell within a FRA AP, AP sends out an 802.11v BSS transition Management Request to this client.

When an APs that supports FRA (like 2800 or 3800) uses only 5GHz, there are two cells (micro and macro cell). If a client connects to the macro-cell but micro-cell is more optimal (based on RSSI) then the AP sends a 802.11v BSS transition management request to the client in order to suggest to move the micro-cell and vice versa.

This feature is available since version 8.2.110.0.

For more information about FRA: [Flexible Radio Assignment \(FRA\) and Redundant Radios](#)

Disassociation Imminent

Within a BSS transition Management Request, Disassociation Imminent field can be added. This function is to disassociate the client after a period of time if the client does not re-associate to another AP.

When unsolicited optimized roaming request is triggered, the AP sends a BSS Transition Management Request to the client and wait for a certain period (time configured under Optimized Roaming Disassociation Timer), if the client does not roam to a better AP within that period of time, then the AP completes the disassociation of the client.

When Unsolicited Load Balance request is triggered, the AP sends a BSS Transition Management Request to the client and wait for a certain period (time configured under Disassociation Timer), if the client does not roam to a less congested AP within that period of time, then the AP completes the disassociation of the client.

Example of a BSS transition management frame with Disassociation imminent enabled:

```

+ 802.11 radio information
+ IEEE 802.11 Action, Flags: .....C
- IEEE 802.11 wireless LAN management frame
  - Fixed parameters
    - Category code: WNM (10)
    - Action code: BSS Transition Management Request (7)
    - Dialog token: 0x01
    - ... ..1 = Preferred Candidate List Included: 1
    - ... ..0. = Abridged: 0
    - ... ..1.. = Disassociation Imminent: 1
    - ... ..0... = BSS Termination Included: 0
    - ...0 .... = ESS Disassociation Imminent: 0
    - Disassociation Timer: 200
    - Validity Interval: 200
    - BSS Transition Candidate List Entries: 341054a274ede004e7020000000b070301ffdd1d0040960c...

```

BSS Transition Management Response

After a wireless client has received a BSS Transition Management Request, it can or cannot send a BSS Transition Management Response. If the client transitions to another AP it sends it with status code Accept, but if it plans to stay on the same AP due to several reasons it sends it with status code Reject plus the reason of rejection.

Example of a BSS Transition Management Response frame

```

60272 12:16:06.114913 Apple_58:95:0a CiscoInc_e8:32:70 BSS Transition Management Response
-----
> Frame 60272: 51 bytes on wire (408 bits), 51 bytes captured (408 bits) on interface 0
> Radiotap Header v0, Length 18
> 802.11 radio information
> IEEE 802.11 Action, Flags: .....C
v IEEE 802.11 wireless LAN management frame
  v Fixed parameters
    Category code: WNM (10)
    Action code: BSS Transition Management Response (8)
    Dialog token: 0x0c
    BSS Transition Status Code: 1
    BSS Termination Delay: 0

```

In this example the wireless client rejects the AP candidate list and does not roam to a different AP. The status code 1 shows the reason why the client leaves the ESS. For full list of status code definitions consult Table 8-253 of IEEE 802.11-2012.

Prerequisites

Requirements

In order to take advantage of 802.11v capabilities of a wlan it is needed to have wireless clients that supports 802.11v.

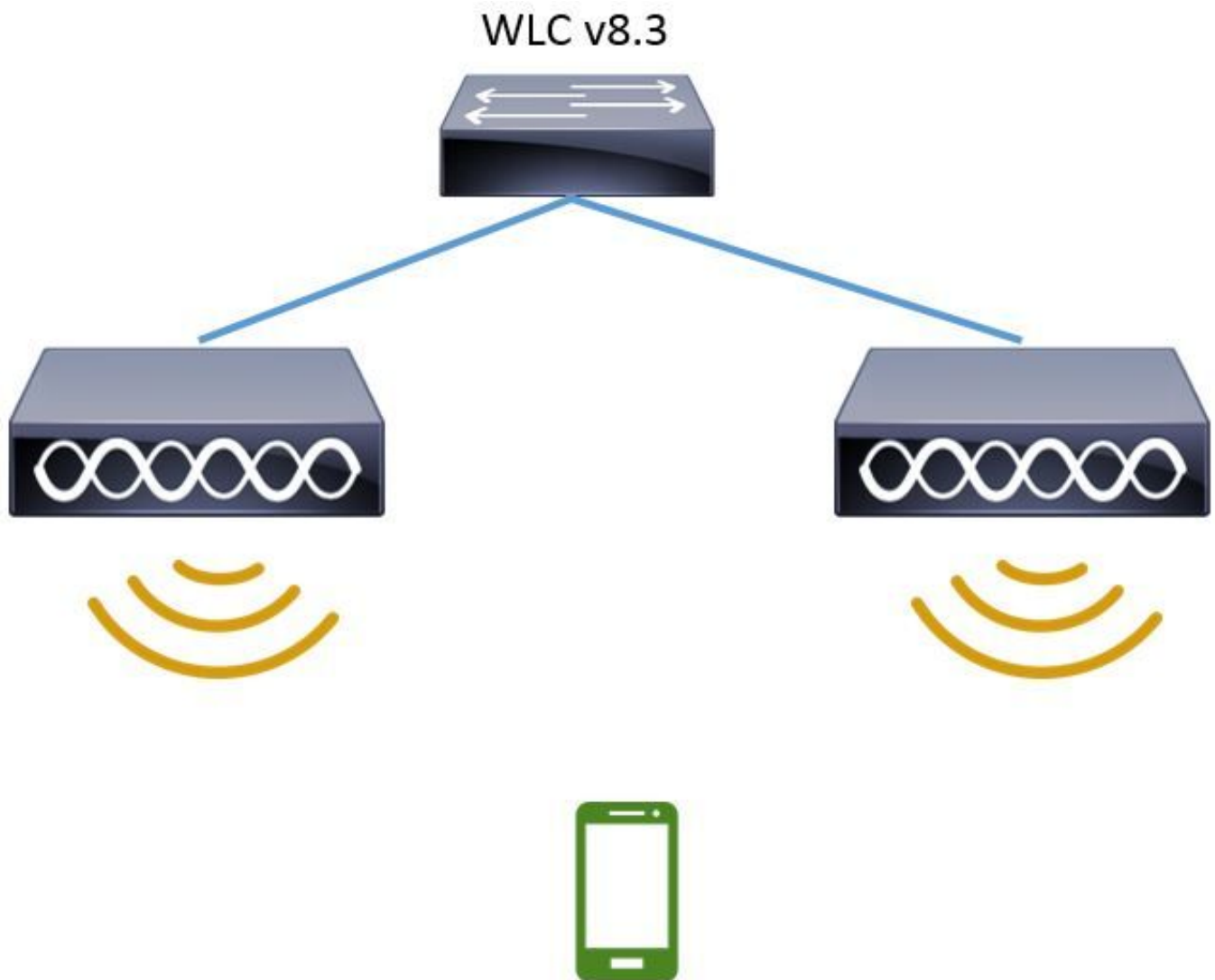
Components Used

WLC v8.3

Ipod Touch 6th Generation v10.1.1

Configure

Network Diagram



Configurations

Directed multicast service (DMS)

Configuration over WLAN to enable DMS:

CLI config:

```
> config wlan disable <wlan-id>  
> config wlan dms enable <wlan-id>  
> config wlan enable <wlan-id>
```

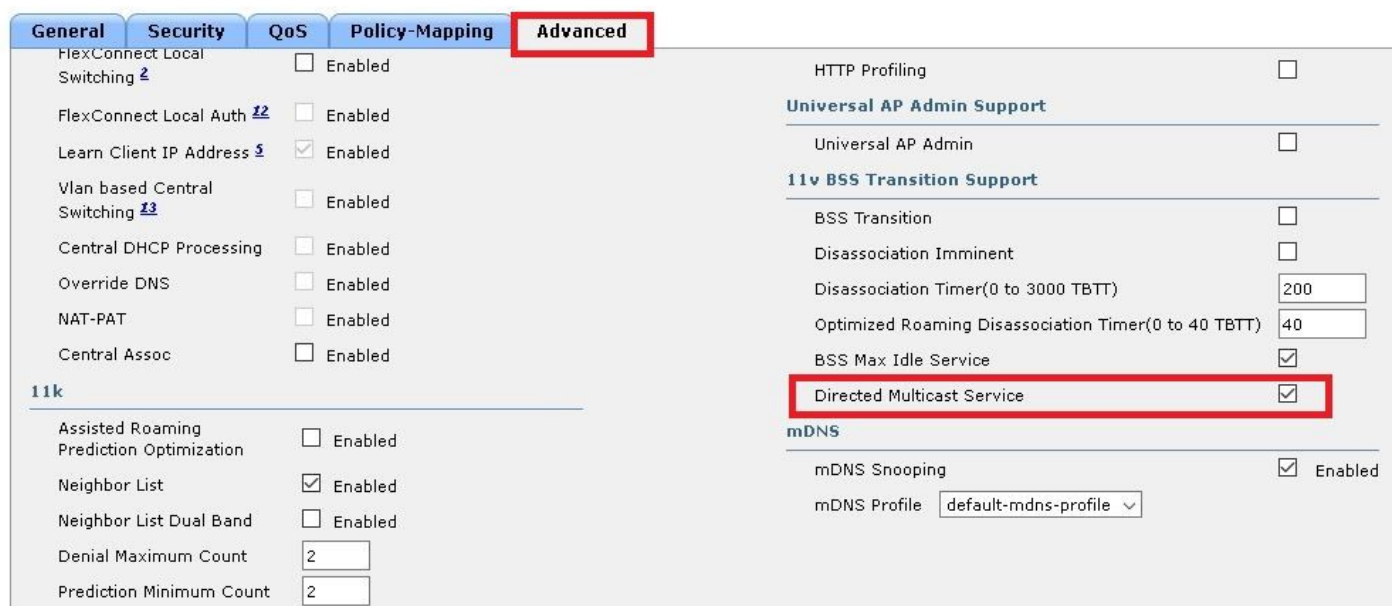
GUI config (available from version 8.3)

Step 1. Navigate to **WLANS > Wlan-ID** and click the WLAN to enable DMS.



Step 2. Navigate to **Advanced > 11v BSS Transition Support** and enable **Directed Multicast Service**

WLANs > Edit '11v'



BSS Max idle period management

Configuration over WLAN to enable BSS Max Idle period management:

CLI config:

```
> config wlan disable <wlan-id>
> config wlan bssmaxidle enable <wlan-id>
> config wlan usertimeout <seconds> <wlan-id>
> config wlan enable <wlan-id>
```

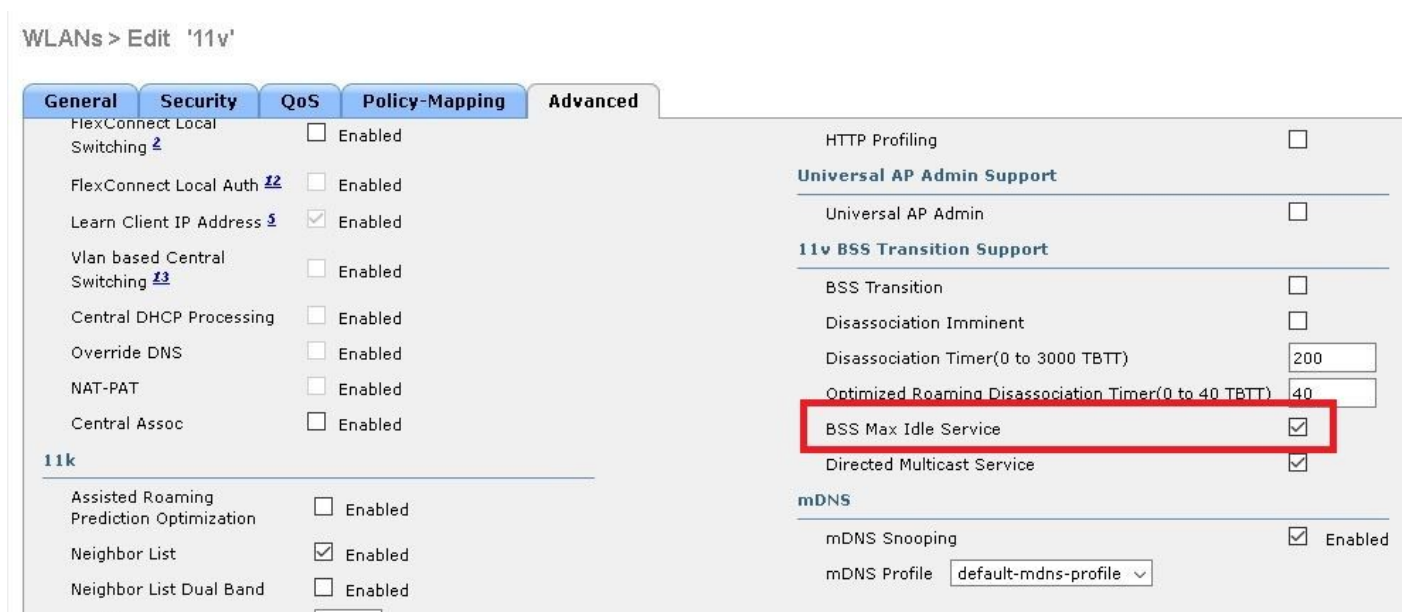
<seconds> Client Idle timeout(in seconds) on this WLAN. Range 0,15-100000 secs. 0 in order to disable

GUI config:

Step 1. Navigate to **WLANS > WLAN-ID** and click the WLAN to set the BSS Max idle period.



Step 2. Navigate to **Advanced > 11v BSS Transition Support** and enable **BSS Max Idle Service**.



Note: This GUI options is introduced on version 8.3. For previous versions use command **config wlan bssmaxidle enable <wlan-id>**

Step 3. Navigate to **Advanced > Client User Idle timeout** and set the timeout value in seconds.

WLANs > Edit '11v'

General	Security	QoS	Policy-Mapping	Advanced
Static IP Forwarding		<input type="checkbox"/> Enabled		
Wi-Fi Direct Clients Policy		Disabled		
Maximum Allowed Clients Per AP Radio		200		
Clear HotSpot Configuration		<input type="checkbox"/> Enabled		
Client user idle timeout(15-100000)		<input checked="" type="checkbox"/>	400	Timeout Value (secs)
Client user idle threshold (0-10000000)		0 Bytes		
Radius NAI-Realm		<input type="checkbox"/>		
11ac MU-MIMO		<input checked="" type="checkbox"/>		
Off Channel Scanning Defer				
Scan Defer Priority		0 1 2 3 4 5 6 7		
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>		
Scan Defer Time(msecs)		100		
FlexConnect				

BSS transition management

Configuration over WLAN to enable BSS transition management:

Note: If only BSS transition is enabled, the only way the Access Points sends BSS transition Management Request frames is if a wireless client sends a BSS Transition Management Query Frame.

Note: In order to make the APs to send BSS transition Management Request when they are heavily loaded It is needed to enable BSS transition + load balance.

Note: In order to make the APs to send BSS transition Management Request when a wireless client does not have the best RSSI, it is needed to enable BSS transition + optimized roaming.

Solicited request

CLI config:

```

> config wlan disable <wlan-id>
> config wlan bssmaxidle enable <wlan-id>
> config wlan usertimeout <seconds> <wlan-id>
> config wlan enable <wlan-id>

```

<seconds> Client Idle timeout(in seconds) on this WLAN. Range 0,15-100000 secs. 0 in order to disable

GUI config:

Step 1. Navigate to **WLANs > WLAN ID > Advanced** and enable **BSS Transition**.

WLANs > Edit '11v'

General	Security	QoS	Policy-Mapping	Advanced
FlexConnect Local Switching ²	<input type="checkbox"/>	Enabled		HTTP Profiling <input type="checkbox"/>
FlexConnect Local Auth ¹²	<input type="checkbox"/>	Enabled		Universal AP Admin Support
Learn Client IP Address ³	<input checked="" type="checkbox"/>	Enabled		Universal AP Admin <input type="checkbox"/>
Vlan based Central Switching ¹³	<input type="checkbox"/>	Enabled		11v BSS Transition Support
Central DHCP Processing	<input type="checkbox"/>	Enabled		BSS Transition <input checked="" type="checkbox"/>
Override DNS	<input type="checkbox"/>	Enabled		Disassociation Imminent <input type="checkbox"/>
NAT-PAT	<input type="checkbox"/>	Enabled		Disassociation Timer(0 to 3000 TBTT) <input type="text" value="200"/>
Central Assoc	<input type="checkbox"/>	Enabled		Optimized Roaming Disassociation Timer(0 to 40 TBTT) <input type="text" value="40"/>
				BSS Max Idle Service <input checked="" type="checkbox"/>
11k				Directed Multicast Service <input checked="" type="checkbox"/>
Assisted Roaming Prediction Optimization	<input type="checkbox"/>	Enabled		mDNS
Neighbor List	<input checked="" type="checkbox"/>	Enabled		mDNS Snooping <input checked="" type="checkbox"/> Enabled
Neighbor List Dual Band	<input type="checkbox"/>	Enabled		mDNS Profile <input type="text" value="default-mdns-profile"/>
Denial Maximum Count	<input type="text" value="2"/>			
Prediction Minimum Count	<input type="text" value="2"/>			

Unsolicited Load Balance request

CLI config:

```

> config wlan disable <wlan-id>
> config wlan bssmaxidle enable <wlan-id>
> config wlan usertimeout <seconds> <wlan-id>
> config wlan enable <wlan-id>

```

<seconds> Client Idle timeout(in seconds) on this WLAN. Range 0,15-100000 secs. 0 in order to disable

GUI config:

Step 1. Navigate to **WLANs > WLAN ID > Advanced** and enable **BSS Transition** and **Client Load Balancing**.

WLANs > Edit '11v'

General	Security	QoS	Policy-Mapping	Advanced
FlexConnect Local Switching 2	<input type="checkbox"/>	Enabled		HTTP Profiling <input type="checkbox"/>
FlexConnect Local Auth 22	<input type="checkbox"/>	Enabled		Universal AP Admin Support
Learn Client IP Address 1	<input checked="" type="checkbox"/>	Enabled		Universal AP Admin <input type="checkbox"/>
Vlan based Central Switching 13	<input type="checkbox"/>	Enabled		11v BSS Transition Support
Central DHCP Processing	<input type="checkbox"/>	Enabled		BSS Transition <input checked="" type="checkbox"/>
Override DNS	<input type="checkbox"/>	Enabled		Disassociation Imminent <input type="checkbox"/>
NAT-PAT	<input type="checkbox"/>	Enabled		Disassociation Timer(0 to 3000 TBTT) <input type="text" value="200"/>
Central Assoc	<input type="checkbox"/>	Enabled		Optimized Roaming Disassociation Timer(0 to 40 TBTT) <input type="text" value="40"/>
11k				
Assisted Roaming Prediction Optimization	<input type="checkbox"/>	Enabled		BSS Max Idle Service <input checked="" type="checkbox"/>
Neighbor List	<input checked="" type="checkbox"/>	Enabled		Directed Multicast Service <input checked="" type="checkbox"/>
Neighbor List Dual Band	<input type="checkbox"/>	Enabled		mDNS
Denial Maximum Count <input type="text" value="2"/>				mDNS Snooping <input checked="" type="checkbox"/> Enabled
Prediction Minimum Count <input type="text" value="2"/>				mDNS Profile <input type="text" value="default-mdns-profile"/>

WLANs > Edit '11v'

General	Security	QoS	Policy-Mapping	Advanced
Layer2 Acl		<input type="text" value="None"/>		Management Frame Protection (MFP)
URL ACL		<input type="text" value="None"/>		MFP Client Protection 2 <input type="text" value="Optional"/>
P2P Blocking Action		<input type="text" value="Disabled"/>		DTIM Period (in beacon intervals)
Client Exclusion 3	<input checked="" type="checkbox"/>	Enabled	<input type="text" value="60"/> Timeout Value (secs)	802.11a/n (1 - 255) <input type="text" value="1"/>
Maximum Allowed Clients 8		<input type="text" value="0"/>		802.11b/g/n (1 - 255) <input type="text" value="1"/>
Static IP Tunneling 11	<input type="checkbox"/>	Enabled		NAC
Wi-Fi Direct Clients Policy		<input type="text" value="Disabled"/>		NAC State <input type="text" value="None"/>
Maximum Allowed Clients Per AP Radio		<input type="text" value="200"/>		Load Balancing and Band Select
Clear HotSpot Configuration	<input type="checkbox"/>	Enabled		Client Load Balancing <input checked="" type="checkbox"/>
Client user idle timeout(15-100000)	<input checked="" type="checkbox"/>	<input type="text" value="400"/> Timeout Value (secs)		Client Band Select <input type="checkbox"/>
Client user idle threshold (0-100000000)		<input type="text" value="0"/> Bytes		Passive Client
Radius NAI-Realm	<input type="checkbox"/>			Passive Client <input type="checkbox"/>
				Voice
				Media Session Snooping <input type="checkbox"/>

Unsolicited Optimized Roaming request

CLI config:

```
> config wlan disable <wlan-id>
> config wlan bssmaxidle enable <wlan-id>
> config wlan usertimeout <seconds> <wlan-id>
> config wlan enable <wlan-id>
```

<seconds> Client Idle timeout(in seconds) on this WLAN. Range 0,15-100000 secs. 0 in order to disable

GUI config:

Step 1. Navigate to **WLANs > WLAN ID > Advanced** and enable **BSS Transition** and **Coverage**

Hole Detection.

WLANs > Edit '11v'

General	Security	QoS	Policy-Mapping	Advanced
FlexConnect Local Switching ²	<input type="checkbox"/>	Enabled		HTTP Profiling <input type="checkbox"/>
FlexConnect Local Auth ²²	<input type="checkbox"/>	Enabled		Universal AP Admin Support
Learn Client IP Address ⁵	<input checked="" type="checkbox"/>	Enabled		Universal AP Admin <input type="checkbox"/>
Vlan based Central Switching ⁴³	<input type="checkbox"/>	Enabled		11v BSS Transition Support
Central DHCP Processing	<input type="checkbox"/>	Enabled		BSS Transition <input checked="" type="checkbox"/>
Override DNS	<input type="checkbox"/>	Enabled		Disassociation Imminent <input type="checkbox"/>
NAT-PAT	<input type="checkbox"/>	Enabled		Disassociation Timer(0 to 3000 TBTT) <input type="text" value="200"/>
Central Assoc	<input type="checkbox"/>	Enabled		Optimized Roaming Disassociation Timer(0 to 40 TBTT) <input type="text" value="40"/>
11k				BSS Max Idle Service <input checked="" type="checkbox"/>
Assisted Roaming Prediction Optimization	<input type="checkbox"/>	Enabled		Directed Multicast Service <input checked="" type="checkbox"/>
Neighbor List	<input checked="" type="checkbox"/>	Enabled		mDNS
Neighbor List Dual Band	<input type="checkbox"/>	Enabled		mDNS Snooping <input checked="" type="checkbox"/> Enabled
Denial Maximum Count	<input type="text" value="2"/>			mDNS Profile <input type="text" value="default-mdns-profile"/>
Prediction Minimum Count	<input type="text" value="2"/>			

WLANs > Edit '11v'

General	Security	QoS	Policy-Mapping	Advanced
Allow AAA Override	<input type="checkbox"/>	Enabled		
Coverage Hole Detection	<input checked="" type="checkbox"/>	Enabled		
Enable Session Timeout	<input type="checkbox"/>			
Aironet IE	<input type="checkbox"/>	Enabled		
Diagnostic Channel ¹⁸	<input type="checkbox"/>	Enabled		
Override Interface ACL	IPv4	<input type="text" value="None"/>		IPv6 <input type="text" value="None"/>
Layer2 Acl	<input type="text" value="None"/>			
URL ACL	<input type="text" value="None"/>			
P2P Blocking Action	<input type="text" value="Disabled"/>			
Client Exclusion ³	<input checked="" type="checkbox"/>	Enabled	<input type="text" value="60"/>	Timeout Value (secs)
Maximum Allowed Clients ⁸	<input type="text" value="0"/>			

Step 2. Naviaget to **WIRELESS > Advanced > Optimized Roaming** and enable for both band **Optimized Roaming Mode**. For more information about Optimized Roaming parameters consult this document: [High Density Experience \(HDX\) Deployment Guide, Release 8.0](#)

Disassociation Imminent

CLI config:

```
> config wlan disable <wlan-id>
> config wlan bssmaxidle enable <wlan-id>
> config wlan usertimeout <seconds> <wlan-id>
> config wlan enable <wlan-id>
```

<seconds> Client Idle timeout(in seconds) on this WLAN. Range 0,15-100000 secs. 0 in order to disable

Step 1. Navigate to **WLANs > WLAN ID > Advanced**, enable **BSS Transition, Disassociation Imminent** and set **Disassociation Timer** and **Optimized Roaming Disassociation Timer**.

GUI config:

General	Security	QoS	Policy-Mapping	Advanced
FlexConnect Local Switching 2	<input type="checkbox"/>	Enabled		HTTP Profiling <input type="checkbox"/>
FlexConnect Local Auth 22	<input type="checkbox"/>	Enabled		Universal AP Admin Support
Learn Client IP Address 5	<input checked="" type="checkbox"/>	Enabled		Universal AP Admin <input type="checkbox"/>
Vlan based Central Switching 13	<input type="checkbox"/>	Enabled		11v BSS Transition Support
Central DHCP Processing	<input type="checkbox"/>	Enabled		BSS Transition <input checked="" type="checkbox"/>
Override DNS	<input type="checkbox"/>	Enabled		Disassociation Imminent <input type="checkbox"/>
NAT-PAT	<input type="checkbox"/>	Enabled		Disassociation Timer(0 to 3000 TBTT) <input type="text" value="200"/>
Central Assoc	<input type="checkbox"/>	Enabled		Optimized Roaming Disassociation Timer(0 to 40 TBTT) <input type="text" value="40"/>
11k				BSS Max Idle Service <input checked="" type="checkbox"/>
Assisted Roaming Prediction Optimization	<input type="checkbox"/>	Enabled		Directed Multicast Service <input checked="" type="checkbox"/>
Neighbor List	<input checked="" type="checkbox"/>	Enabled		mDNS
Neighbor List Dual Band	<input type="checkbox"/>	Enabled		mDNS Snooping <input checked="" type="checkbox"/> Enabled
Denial Maximum Count	<input type="text" value="2"/>			mDNS Profile <input type="text" value="default-mdns-profile"/>
Prediction Minimum Count	<input type="text" value="2"/>			

General	Security	QoS	Policy-Mapping	Advanced
FlexConnect Local Switching 2	<input type="checkbox"/>	Enabled		HTTP Profiling <input type="checkbox"/>
FlexConnect Local Auth 22	<input type="checkbox"/>	Enabled		Universal AP Admin Support
Learn Client IP Address 5	<input checked="" type="checkbox"/>	Enabled		Universal AP Admin <input type="checkbox"/>
Vlan based Central Switching 13	<input type="checkbox"/>	Enabled		11v BSS Transition Support
Central DHCP Processing	<input type="checkbox"/>	Enabled		BSS Transition <input checked="" type="checkbox"/>
Override DNS	<input type="checkbox"/>	Enabled		Disassociation Imminent <input checked="" type="checkbox"/>
NAT-PAT	<input type="checkbox"/>	Enabled		Disassociation Timer(0 to 3000 TBTT) <input type="text" value="200"/>
Central Assoc	<input type="checkbox"/>	Enabled		Optimized Roaming Disassociation Timer(0 to 40 TBTT) <input type="text" value="40"/>
11k				BSS Max Idle Service <input checked="" type="checkbox"/>
Assisted Roaming Prediction Optimization	<input type="checkbox"/>	Enabled		Directed Multicast Service <input checked="" type="checkbox"/>
				mDNS

Note: Timers are specified in TBTT (Target Beacon Transmission Time) units, which is the interval time between every beacon. By default every beacon is sent every 100ms, so by default 1 TBTT = 100ms. Timers = X TBTT/10 = x seconds.

Verify

These images show the support of the WLAN (Wireless Local Area Network) and the wireless clients for the different 802.11v services.

SSID support

- DMS

```

> 802.11 radio information
> IEEE 802.11 Beacon frame, Flags: .....C
< IEEE 802.11 Wireless LAN management frame
  < Fixed parameters (12 bytes)
    Timestamp: 0x0000002a95f28006
    Beacon Interval: 0.104448 [Seconds]
  > Capabilities Information: 0x1011
  < Tagged parameters (267 bytes)
    > Tag: SSID parameter set: tst-80211v
    > Tag: Supported Rates 12(B), 18, 24, 36, 48, 54, [Mbit/sec]
    > Tag: Traffic Indication Map (TIM): DTIM 0 of 0 bitmap
    > Tag: Country Information: Country Code US, Environment Any
    > Tag: QBSS Load Element 802.11e CCA Version
    > Tag: HT Capabilities (802.11n D1.10)
    > Tag: RSN Information
    > Tag: HT Information (802.11n D1.10)
  < Tag: Extended Capabilities (8 octets)
    Tag Number: Extended Capabilities (127)
    Tag length: 8
    > Extended Capabilities: 0x00 (octet 1)
    > Extended Capabilities: 0x10 (octet 2)
    > Extended Capabilities: 0x00 (octet 3)
  < Extended Capabilities: 0x04 (octet 4)
    .... ..0 = Channel Usage: Not supported
    .... ..0. = SSID List: Not supported
    .... .1.. = DMS: Supported
    .... 0... = UTC TSF Offset: Not supported
    ...0 .... = Peer U-APSD Buffer STA Support: Not supported
    ..0. .... = TDLS Peer PSM Support: Not supported
    .0.. .... = TDLS channel switching: Not supported
    0... .... = Interworking: Not supported
    > Extended Capabilities: 0x01 (octet 5)
    > Extended Capabilities: 0x40 (octet 6)
    > Extended Capabilities: 0x00 (octet 7)
    > Extended Capabilities: 0x40 (octet 8)
  > Tag: Cisco CCX1 CKIP + Device Name
  > Tag: Vendor Specific: Aironet: Aironet DTPC Powerlevel 0x03
  > Tag: VHT Capabilities (IEEE Std 802.11ac/D3.1)
  < Tag: VHT Operation (IEEE Std 802.11ac/D3.1)

```

- BSS transition management


```
IEEE 802.11 Beacon frame, Flags: .....C
IEEE 802.11 wireless LAN management frame
  Fixed parameters (12 bytes)
  Tagged parameters (231 bytes)
    Tag: SSID parameter set: tst-11v
    Tag: Supported Rates 11(B), 12, 18, 24, 36, 48, 54, [Mbit/sec]
    Tag: DS Parameter set: Current Channel: 11
    Tag: Traffic Indication Map (TIM): DTIM 0 of 0 bitmap
    Tag: Country Information: Country Code MX, Environment Any
    Tag: QBSS Load Element 802.11e CCA Version
    Tag: Power Constraint: 3
    Tag: ERP Information
    Tag: HT Capabilities (802.11n D1.10)
    Tag: RSN Information
    Tag: HT Information (802.11n D1.10)
    Tag: RM Enabled Capabilities (5 octets)
    Tag: Extended Capabilities (6 octets)
      Tag Number: Extended Capabilities (127)
      Tag length: 6
      Extended Capabilities: 0x00 (octet 1)
      Extended Capabilities: 0x10 (octet 2)
      Extended Capabilities: 0x08 (octet 3)
        .... 0 = TFS: Not supported
        .... 0. = WNM-Sleep Mode: Not supported
        ..0. = TIM Broadcast: Not supported
        ... 1... = BSS Transition: Supported
        ...0 .... = QoS Traffic Capability: Not supported
        ..0. .... = AC Station Count: Not supported
        .0.. .... = Multiple BSSID: Not supported
        0... .... = Timing Measurement: Not supported
      Extended Capabilities: 0x00 (octet 4)
      Extended Capabilities: 0x01 (octet 5)
      Extended Capabilities: 0x40 (octet 6)
    Tag: Vendor Specific: Aironet: Aironet DTPC Powerlevel 0x02
      Tag Number: Vendor Specific (150)
```

Client support

- DMS

```
802.11 radio information
IEEE 802.11 Association Request, Flags: .....C
IEEE 802.11 wireless LAN management frame
  Fixed parameters (4 bytes)
    Capabilities Information: 0x1011
    Listen Interval: 0x0014
  Tagged parameters (144 bytes)
    Tag: SSID parameter set: tst-80211v
    Tag: Supported Rates 12(B), 18, 24, 36, 48, 54, [Mbit/sec]
    Tag: Power Capability Min: 3, Max :22
    Tag: Supported Channels
    Tag: RSN Information
    Tag: HT Capabilities (802.11n D1.10)
  Extended Capabilities (4 octets)
    Tag Number: Extended Capabilities (127)
    Tag length: 4
    Extended Capabilities: 0x00 (octet 1)
    Extended Capabilities: 0x00 (octet 2)
    Extended Capabilities: 0x00 (octet 3)
  Extended Capabilities: 0x04 (octet 4)
    ....0 = Channel Usage: Not supported
    ....0 = SSID List: Not supported
    ... .1.. = DNS: Supported
    ....0... = UTC TSF Offset: Not supported
    ...0 .... = Peer U-APSD Buffer STA Support: Not supported
    ..0. .... = TDLS Peer PSM Support: Not supported
    .0.. .... = TDLS channel switching: Not supported
    0... .... = Interworking: Not supported
  Tag: Vendor Specific: Broadcom
  Tag: Vendor Specific: Epigram: HT Capabilities (802.11n D1.10)
  Tag: Vendor Specific: Microsof: WMM/WME: Information Element
```

- BSS transition management

```

+ IEEE 802.11 Association Request, Flags: .....C
- IEEE 802.11 Wireless LAN management frame
  + Fixed parameters (4 bytes)
  - Tagged parameters (140 bytes)
    + Tag: SSID parameter set: tst-11v
    + Tag: Supported Rates 11(B), 12, 18, 24, 36, 48, 54, [Mbit/sec]
    + Tag: Power Capability Min: 5, Max :24
    + Tag: Supported Channels
    + Tag: RSN Information
    + Tag: HT Capabilities (802.11n D1.10)
    - Tag: Extended Capabilities (3 octets)
      Tag Number: Extended Capabilities (127)
      Tag length: 3
      + Extended Capabilities: 0x00 (octet 1)
      + Extended Capabilities: 0x00 (octet 2)
      - Extended Capabilities: 0x08 (octet 3)
        .... 0 = TFS: Not supported
        .... 0 = WMM-Sleep Mode: Not supported
        .... 0 = TIM Broadcast: Not supported
        .... 1... = BSS Transition: Supported
        .... 0 = QoS Traffic Capability: Not supported
        ..0. .... = AC Station Count: Not supported
        .0.. .... = Multiple BSSID: Not supported
        0... .... = Timing Measurement: Not supported
    + Tag: RM Enabled Capabilities (5 octets)
    + Tag: Vendor Specific: Broadcom
    + Tag: Vendor Specific: Epigram: HT Capabilities (802.11n D1.10)
    + Tag: Vendor Specific: Microsof: WMM/WME: Information Element
  
```

Debug client activity

In order to monitor 11v client activity these commands are available.

```

> config wlan disable <wlan-id>
> config wlan bssmaxidle enable <wlan-id>
> config wlan usertimeout <seconds> <wlan-id>
> config wlan enable <wlan-id>
  
```

<seconds> Client Idle timeout(in seconds) on this WLAN. Range 0,15-100000 secs. 0 in order to disable

Client with DMS capabilities

Client is 11v capable

```

> config wlan disable <wlan-id>
> config wlan bssmaxidle enable <wlan-id>
> config wlan usertimeout <seconds> <wlan-id>
> config wlan enable <wlan-id>
  
```

<seconds> Client Idle timeout(in seconds) on this WLAN. Range 0,15-100000 secs. 0 in order to disable

Client sends a DMS request for group 224.0.0.251 udp port 9 and the AP sends the DMS accept

```
*apfMsConnTask_0: Nov 01 22:56:43.928: a4:f1:e8:58:95:0a Got action frame from this client.
*apfMsConnTask_0: Nov 01 22:56:43.928: a4:f1:e8:58:95:0a Received a 11v Action Frame with code
[23] from mobile station
*apfMsConnTask_0: Nov 01 22:56:43.928: Received 80211v_DMS_REQ Action Frame
*apfMsConnTask_0: Nov 01 22:56:43.928: WLAN-id : 1 | vap_ip : 1
*apfMsConnTask_0: Nov 01 22:56:43.928: a4:f1:e8:58:95:0a Posting msg of type:
APF_80211v_MSG_DMS_REQ for STA and LRAD:7c:0e:ce:7d:d9:10,slot:0, len:26
*apfMsConnTask_0: Nov 01 22:56:43.928: 11v g_msgQueue = 0x2b415828,          osapiMessageSend
rc = 0
*apf80211vTask: Nov 01 22:56:43.929: Tclas found:
*apf80211vTask: Nov 01 22:56:43.929: [
*apf80211vTask: Nov 01 22:56:43.929: Version = 4,
*apf80211vTask: Nov 01 22:56:43.929: Destination IP = 224.0.0.251,
*apf80211vTask: Nov 01 22:56:43.929: Destination Port = 9,
*apf80211vTask: Nov 01 22:56:43.929: Protocol = 17,
*apf80211vTask: Nov 01 22:56:43.929: ]
*apf80211vTask: Nov 01 22:56:43.929: a4:f1:e8:58:95:0a New client requesting DMS for this Tclas
*apf80211vTask: Nov 01 22:56:43.929: DMS Request IE processed: State: DMS_REQ_ADD_ACCEPTED
*apf80211vTask: Nov 01 22:56:43.929: DMS Response IE created.
*apf80211vTask: Nov 01 22:56:43.929: Element ID: 100, Length: 5
*apf80211vTask: Nov 01 22:56:43.929: DMS ID: 1, DMS Length: 3, Response Type: DMS_RESP_ACCEPT,
Last Sequence Control: 65535
*apf80211vTask: Nov 01 22:56:43.929: dmsRequestState = DMS_REQ_ADD_ACCEPTED
*apf80211vTask: Nov 01 22:56:43.929: a4:f1:e8:58:95:0a apf80211vSendPacketToMs: 802.11v Action
Frame sent successfully to wlc
*apf80211vTask: Nov 01 22:56:43.929: apf80211vDmsDB_AddSTA: New DMS Client: a4:f1:e8:58:95:0a
created and added under DMS ID: 1
*apf80211vTask: Nov 01 22:56:43.929: a4:f1:e8:58:95:0a apfPostDmsClientRequestMsg: posting
capwap for ms lrادمac7c:0e:ce:7d:d9:10
*apf80211vTask: Nov 01 22:56:43.929: 11v g_msgQueue = 0x2b415828,          osapiMessageSend rc
= 0
*apf80211vTask: Nov 01 22:56:43.929: a4:f1:e8:58:95:0a apf80211vHandleDmsMsgSend: send capwap
for STA lrادمac 7c:0e:ce:7d:d9:10
```

From the AP where the client is connected

```
AP# debug dot11 dot11v all
```

```
*Nov 1 22:51:04.323: DOT11v: Inside DMS ADD Operation
*Nov 1 22:51:04.323: DOT11v: TCLAS found in DMS DB
*Nov 1 22:51:04.323: DOT11v: New client detected
*Nov 1 22:51:04.323: DOT11v: Ref Cnt: 1
*Nov 1 22:51:04.323: DOT11v: Client A4:F1:E8:58:95:0A added to DMS DB Entry
*Nov 1 22:51:04.323: DOT11v: DMS Add Operation Succeeded
*Nov 1 22:51:04.323: Received and decoded a DMS client request payload SUCCESSFULLY
```

After that the client is added to the DMS database on the wlan. All the clients that send a DMS Request-Add for the same multicast string are listed under the same DMS ID.

```
> show wlan 1
```

```
WLAN Identifier..... 1
Profile Name..... 11v
Network Name (SSID)..... 11v
Status..... Enabled
.
.
.
```

Number of active DMS Clients..... 1

DMS ID Client MAC Addresses

1 a4:f1:e8:58:95:0a

DMS Database is stored in the AP where this client is connected:

AP# show controllers dot11Radio { 0 | 1 } | beg Global DMS

Global DMS - requests:2 uc:130 drop:0

DMS enabled on WLAN(s): 11v

11v

DMS database:

Entry 1: mask=0x55 version=4 dstIp=0xE00000FB srcIp=0x00000000 dstPort=9 srcPort=0 dcsp=0
protocol=17

{Client, SSID}: {08:74:02:77:13:45, 11v}, {A4:F1:E8:58:95:0A, 11v},

Once the wireless client closes the DMS flow, it sends a DMS Request Remove

```
*apfMsConnTask_0: Nov 01 22:57:33.990: a4:f1:e8:58:95:0a Got action frame from this client.
*apfMsConnTask_0: Nov 01 22:57:33.990: a4:f1:e8:58:95:0a Received a 11v Action Frame with code
[23] from mobile station
*apfMsConnTask_0: Nov 01 22:57:33.990: Received 80211v_DMS_REQ Action Frame
*apfMsConnTask_0: Nov 01 22:57:33.990: WLAN-id : 1 | vap_ip : 1
*apfMsConnTask_0: Nov 01 22:57:33.990: a4:f1:e8:58:95:0a Posting msg of type:
APF_80211v_MSG_DMS_REQ for STA and LRAD:7c:0e:ce:7d:d9:10,slot:0, len:5
*apfMsConnTask_0: Nov 01 22:57:33.990: 11v g_msgQueue = 0x2b415828, osapiMessageSend
rc = 0
*apf80211vTask: Nov 01 22:57:33.991: DMS Request IE processed: State: DMS_REQ_DEL_ACCEPTED
*apf80211vTask: Nov 01 22:57:33.991: DMS Response IE created.
*apf80211vTask: Nov 01 22:57:33.991: Element ID: 100, Length: 5
*apf80211vTask: Nov 01 22:57:33.991: DMS ID: 1, DMS Length: 3, Response Type:
DMS_RESP_TERMINATE, Last Sequence Control: 65535
*apf80211vTask: Nov 01 22:57:33.991: dmsRequestState = DMS_REQ_DEL_ACCEPTED
*apf80211vTask: Nov 01 22:57:33.991: a4:f1:e8:58:95:0a apf80211vSendPacketToMs: 802.11v Action
Frame sent successfully to wlc
*apf80211vTask: Nov 01 22:57:33.991: STA: a4:f1:e8:58:95:0a has dequeued and deleted from the
DMS Entry with ID: 1
*apf80211vTask: Nov 01 22:57:33.991: apf80211vDmsDB_DeleteSTA: STA: a4:f1:e8:58:95:0a deleted
successfully under DMS ID: 1
*apf80211vTask: Nov 01 22:57:33.991: a4:f1:e8:58:95:0a apfPostDmsClientRequestMsg: posting
capwap for ms lradmac7c:0e:ce:7d:d9:10
*apf80211vTask: Nov 01 22:57:33.991: 11v g_msgQueue = 0x2b415828, osapiMessageSend rc
= 0
```

From the AP

```
*apfMsConnTask_0: Nov 01 22:57:33.990: a4:f1:e8:58:95:0a Got action frame from this client.
*apfMsConnTask_0: Nov 01 22:57:33.990: a4:f1:e8:58:95:0a Received a 11v Action Frame with code
[23] from mobile station
*apfMsConnTask_0: Nov 01 22:57:33.990: Received 80211v_DMS_REQ Action Frame
*apfMsConnTask_0: Nov 01 22:57:33.990: WLAN-id : 1 | vap_ip : 1
*apfMsConnTask_0: Nov 01 22:57:33.990: a4:f1:e8:58:95:0a Posting msg of type:
APF_80211v_MSG_DMS_REQ for STA and LRAD:7c:0e:ce:7d:d9:10,slot:0, len:5
*apfMsConnTask_0: Nov 01 22:57:33.990: 11v g_msgQueue = 0x2b415828, osapiMessageSend
rc = 0
*apf80211vTask: Nov 01 22:57:33.991: DMS Request IE processed: State: DMS_REQ_DEL_ACCEPTED
*apf80211vTask: Nov 01 22:57:33.991: DMS Response IE created.
*apf80211vTask: Nov 01 22:57:33.991: Element ID: 100, Length: 5
*apf80211vTask: Nov 01 22:57:33.991: DMS ID: 1, DMS Length: 3, Response Type:
```

DMS_RESP_TERMINATE, Last Sequence Control: 65535

*apf80211vTask: Nov 01 22:57:33.991: dmsRequestState = DMS_REQ_DEL_ACCEPTED
*apf80211vTask: Nov 01 22:57:33.991: **a4:f1:e8:58:95:0a apf80211vSendPacketToMs: 802.11v Action Frame sent successfully to wlc**
*apf80211vTask: Nov 01 22:57:33.991: **STA: a4:f1:e8:58:95:0a has dequeued and deleted from the DMS Entry with ID: 1**
*apf80211vTask: Nov 01 22:57:33.991: **apf80211vDmsDB_DeleteSTA: STA: a4:f1:e8:58:95:0a deleted successfully under DMS ID: 1**
*apf80211vTask: Nov 01 22:57:33.991: a4:f1:e8:58:95:0a apfPostDmsClientRequestMsg: posting capwap for ms lradmac7c:0e:ce:7d:d9:10

*apf80211vTask: Nov 01 22:57:33.991: 11v g_msgQueue = 0x2b415828, osapiMessageSend rc = 0

Client BSS Transition Capable

Client is 11v capable

*apfMsConnTask_0: Nov 01 22:57:33.990: a4:f1:e8:58:95:0a Got action frame from this client.
*apfMsConnTask_0: Nov 01 22:57:33.990: a4:f1:e8:58:95:0a Received a 11v Action Frame with code [23] from mobile station
*apfMsConnTask_0: Nov 01 22:57:33.990: **Received 80211v_DMS_REQ Action Frame**
*apfMsConnTask_0: Nov 01 22:57:33.990: WLAN-id : 1 | vap_ip : 1
*apfMsConnTask_0: Nov 01 22:57:33.990: a4:f1:e8:58:95:0a Posting msg of type: APF_80211v_MSG_DMS_REQ for STA and LRAD:7c:0e:ce:7d:d9:10,slot:0, len:5
*apfMsConnTask_0: Nov 01 22:57:33.990: 11v g_msgQueue = 0x2b415828, osapiMessageSend rc = 0
*apf80211vTask: Nov 01 22:57:33.991: **DMS Request IE processed: State: DMS_REQ_DEL_ACCEPTED**
*apf80211vTask: Nov 01 22:57:33.991: DMS Response IE created.
*apf80211vTask: Nov 01 22:57:33.991: Element ID: 100, Length: 5
*apf80211vTask: Nov 01 22:57:33.991: **DMS ID: 1, DMS Length: 3, Response Type:**
DMS_RESP_TERMINATE, Last Sequence Control: 65535
*apf80211vTask: Nov 01 22:57:33.991: dmsRequestState = DMS_REQ_DEL_ACCEPTED
*apf80211vTask: Nov 01 22:57:33.991: **a4:f1:e8:58:95:0a apf80211vSendPacketToMs: 802.11v Action Frame sent successfully to wlc**
*apf80211vTask: Nov 01 22:57:33.991: **STA: a4:f1:e8:58:95:0a has dequeued and deleted from the DMS Entry with ID: 1**
*apf80211vTask: Nov 01 22:57:33.991: **apf80211vDmsDB_DeleteSTA: STA: a4:f1:e8:58:95:0a deleted successfully under DMS ID: 1**
*apf80211vTask: Nov 01 22:57:33.991: a4:f1:e8:58:95:0a apfPostDmsClientRequestMsg: posting capwap for ms lradmac7c:0e:ce:7d:d9:10

*apf80211vTask: Nov 01 22:57:33.991: 11v g_msgQueue = 0x2b415828, osapiMessageSend rc = 0

Client sends a BSS Transition Management Query

*apfMsConnTask_1: Nov 14 05:40:32.857: **c4:7d:4f:3a:0f:5c Got action frame from this client.**
*apfMsConnTask_1: Nov 14 05:40:32.858: c4:7d:4f:3a:0f:5c Received a 11v Action Frame with code [6] from mobile station
*apfMsConnTask_1: Nov 14 05:40:32.858: **Received 80211v_BSS_TRANS_QUERY Action Frame**
*apfMsConnTask_1: Nov 14 05:40:32.859: WLAN-id : 1 | vap_ip : 1
*apfMsConnTask_1: Nov 14 05:40:32.859: **c4:7d:4f:3a:0f:5c Posting msg of type: APF_80211v_MSG_BSS_TRANS_QUERY for STA and LRAD:00:c8:8b:26:2c:d0,slot:0, len:1**
*apf80211vTask: Nov 14 05:40:32.860: Session URL is not NULL
*apf80211vTask: Nov 14 05:40:32.860: **Disassociation Imminent is 1**
*apf80211vTask: Nov 14 05:40:32.860: **Disassociation Timer is 200**
*apf80211vTask: Nov 14 05:40:32.860: Building BSS Transition Request Frame
*apf80211vTask: Nov 14 05:40:32.860: Adding Neighbor List Subelement
*apfMsConnTask_1: Nov 14 05:40:32.861: 11v g_msgQueue = 0x2b415828, osapiMessageSend rc = 0

*apf80211vTask: Nov 14 05:40:32.861: Location Info: 0,0,0 for BSSID: 7c:0e:ce:7d:d9:10
*apf80211vTask: Nov 14 05:40:32.861: Data Length of BSS Transition Request Frame: 73
*apf80211vTask: Nov 14 05:40:32.862: apf80211vHandleBSSTransQuery: lradMacAddr:
00:c8:8b:26:2c:d0 rscb parent MAC ADDR: 00:c8:8b:26:2c:d0 rscb mac address: 00:00:00:00:00:00
*apf80211vTask: Nov 14 05:40:32.862: 11v Action Frame sent:
*apf80211vTask: Nov 14 05:40:32.863: c4:7d:4f:3a:0f:5c apf80211vSendPacketToMs: 802.11v Action
Frame sent successfully to wlc
*apf80211vTask: Nov 14 05:40:32.863: **Successfully sent BSS Transition Request Action Frame to
STA: c4:7d:4f:3a:0f:5c**

As the wlan has enabled Disassociation Imminent, the client gets disassociated after the
Disassociation timer is over

*apf80211vTask: Nov 14 05:40:32.863: **c4:7d:4f:3a:0f:5c Setting Session Timeout to 20 sec -
starting session timer for the mobile**
*apf80211vTask: Nov 14 05:40:32.863: **c4:7d:4f:3a:0f:5c Disassociate client in 20 seconds**
*osapiBsnTimer: Nov 14 05:40:52.768: c4:7d:4f:3a:0f:5c Authentication session timer expired:
mark mobile for immediate deletion
*osapiBsnTimer: Nov 14 05:40:52.768: c4:7d:4f:3a:0f:5c apfMsSessionExpireCallback (apf_ms.c:707)
Expiring Mobile!
*apfReceiveTask: Nov 14 05:40:52.769: apfMsExpireMobileStation: Delete Immediately
*apfReceiveTask: Nov 14 05:40:52.769: c4:7d:4f:3a:0f:5c apfMsExpireMobileStation (apf_ms.c:7521)
Changing state for mobile c4:7d:4f:3a:0f:5c on AP 00:c8:8b:26:2c:d0 from Associated to
Disassociated
*apfReceiveTask: Nov 14 05:40:52.769: c4:7d:4f:3a:0f:5c apfSendDisAssocMsgDebug
(apf_80211.c:3541) Changing state for mobile c4:7d:4f:3a:0f:5c on AP 00:c8:8b:26:2c:d0 from
Disassociated to Disassociated
*apfReceiveTask: Nov 14 05:40:52.769: c4:7d:4f:3a:0f:5c Sent Disassociate to mobile on AP
00:c8:8b:26:2c:d0-0 (reason 1, caller apf_ms.c:7614)
*apfReceiveTask: Nov 14 05:40:52.769: c4:7d:4f:3a:0f:5c Sent Deauthenticate to mobile on BSSID
00:c8:8b:26:2c:d0 slot 0(caller apf_ms.c:7616)
*apfReceiveTask: Nov 14 05:40:52.769: c4:7d:4f:3a:0f:5c Setting active key cache index 8 ---> 8
*apfReceiveTask: Nov 14 05:40:52.769: c4:7d:4f:3a:0f:5c Deleting the PMK cache when de-
authenticating the client.
*apfReceiveTask: Nov 14 05:40:52.769: **Sent Deauthenticate to STA: c4:7d:4f:3a:0f:5c on BSSID:
00:c8:8b:26:2c:d0, slotId: 0, vapId: 1**

AP sends BSS Transition Management Frame due to load balancing

*apfMsConnTask_3: Apr 12 10:47:18.785: **08:74:02:77:13:45 11v BSS Transition Request is posted to
11v queue.**
*apf80211vTask: Apr 12 10:47:18.789: Session URL is not NULL
*apf80211vTask: Apr 12 10:47:18.789: Disassociation Imminent is 1
*apf80211vTask: Apr 12 10:47:18.789: Disassociation Timer is 200
*apf80211vTask: Apr 12 10:47:18.789: Building BSS Transition Request Frame
*apf80211vTask: Apr 12 10:47:18.789: Adding Neighbor List Subelement
*apf80211vTask: Apr 12 10:47:18.789: Data Length of BSS Transition Request Frame: 22
*apf80211vTask: Apr 12 10:47:18.789: apf80211vHandleBSSTransQuery: lradMacAddr:
f0:7f:06:e8:32:70 rscb parent MAC ADDR: f0:7f:06:e8:32:70 rscb mac address: 00:00:00:00:00:00
*apf80211vTask: Apr 12 10:47:18.789: 11v Action Frame sent:
*apf80211vTask: Apr 12 10:47:18.790: 08:74:02:77:13:45 apf80211vSendPacketToMs: 802.11v Action
Frame sent successfully to wlc
*apf80211vTask: Apr 12 10:47:18.790: **Successfully sent BSS Transition Request Action Frame to
STA: 08:74:02:77:13:45**

AP sends BSS Transition Management Frame due to optimized roaming

*apfMsConnTask_0: Nov 04 04:58:55.320: a4:f1:e8:58:95:0a Posting msg of type:
APF_80211v_MSG_BSS_TRANS_QUERY for STA and LRAD:7c:0e:ce:7d:d9:10,slot:0, len:0
*apfMsConnTask_0: Nov 04 04:58:55.320: 11v g_msgQueue = 0x2b415828, osapiMessageSend

rc = 0

*apfMsConnTask_0: Nov 04 04:58:55.320: **a4:f1:e8:58:95:0a 11v BSS Transition Request is posted to 11v queue.**

*apf80211vTask: Nov 04 04:58:55.321: Session URL is not NULL

*apf80211vTask: Nov 04 04:58:55.321: Disassociation Imminent is 1

*apf80211vTask: Nov 04 04:58:55.321: Disassociation Timer is 40

*apf80211vTask: Nov 04 04:58:55.321: Building BSS Transition Request Frame

*apf80211vTask: Nov 04 04:58:55.321: Adding Neighbor List Subelement

*apf80211vTask: Nov 04 04:58:55.321: No Neighbor Candidate found :Resetting Candidate Included List

*apf80211vTask: Nov 04 04:58:55.321: Data Length of BSS Transition Request Frame: 4

*apf80211vTask: Nov 04 04:58:55.321: apf80211vHandleBSSTransQuery: lradMacAddr:

7c:0e:ce:7d:d9:10 rscb parent MAC ADDR: 7c:0e:ce:7d:d9:10 rscb mac address: 00:00:00:00:00:00

*apf80211vTask: Nov 04 04:58:55.322: 11v Action Frame sent:

*apf80211vTask: Nov 04 04:58:55.322: a4:f1:e8:58:95:0a apf80211vSendPacketToMs: 802.11v Action Frame sent successfully to wlc

*apf80211vTask: Nov 04 04:58:55.322: **Successfully sent BSS Transition Request Action Frame to STA: a4:f1:e8:58:95:0a**

*apf80211vTask: Nov 04 04:58:55.322: **a4:f1:e8:58:95:0a Setting Session Timeout to 4 sec - starting session timer for the mobile**

*apf80211vTask: Nov 04 04:58:55.322: **a4:f1:e8:58:95:0a Disassociate client in 4 seconds**

References

[Chapter: 802.11r, 802.11k, 802.11v, 802.11w Fast Transition Roaming](#)

IEEE Standard for Information technology—Telecommunications and information exchange between systems Local and metropolitan area networks—Specific requirements-Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications