

AireOS WLC 上的 802.11v 基本服務組 (BSS)

目錄

[簡介](#)

[背景資訊](#)

[定向多點傳播服務 \(DMS\) :](#)

[BSS 最大閒置期間 :](#)

[BSS 轉換管理](#)

[徵求的請求](#)

[未經徵求的負載平衡請求](#)

[未經徵求的最佳化漫遊請求](#)

[FRA AP \(彈性無線電指派 \) 上的用戶端指導](#)

[即將解除關聯](#)

[BSS 轉換管理回應](#)

[必要條件](#)

[需求](#)

[採用元件](#)

[設定](#)

[網路圖表](#)

[組態](#)

[定向多點傳播服務 \(DMS\)](#)

[BSS 最大閒置期間管理](#)

[BSS 轉換管理](#)

[驗證](#)

[SSID 支援](#)

[用戶端支援](#)

[偵錯用戶端活動](#)

[具有 DMS 功能的用戶端](#)

[用戶端支援 BSS 轉換](#)

[參考資料](#)

簡介

本文件描述了 WLC (無線 LAN 控制器) 對 802.11v 通訊協定的支援。

背景資訊

802.11v 是指 IEEE (電機與電子工程師協會) 802.11 無線網路管理 (第 8 修訂版) 。

支援 WNM (無線網路管理) 的站點可以相互交換資訊 (存取點和無線用戶端) 以提高其效能。

AireOS WLC 8.1 版或更新版本支援以下 WNM 服務 :

- 定向多點傳播服務 (DMS)

- BSS (基本服務組合) 最大閒置期間管理
- BSS 轉換管理

定向多點傳播服務 (DMS) :

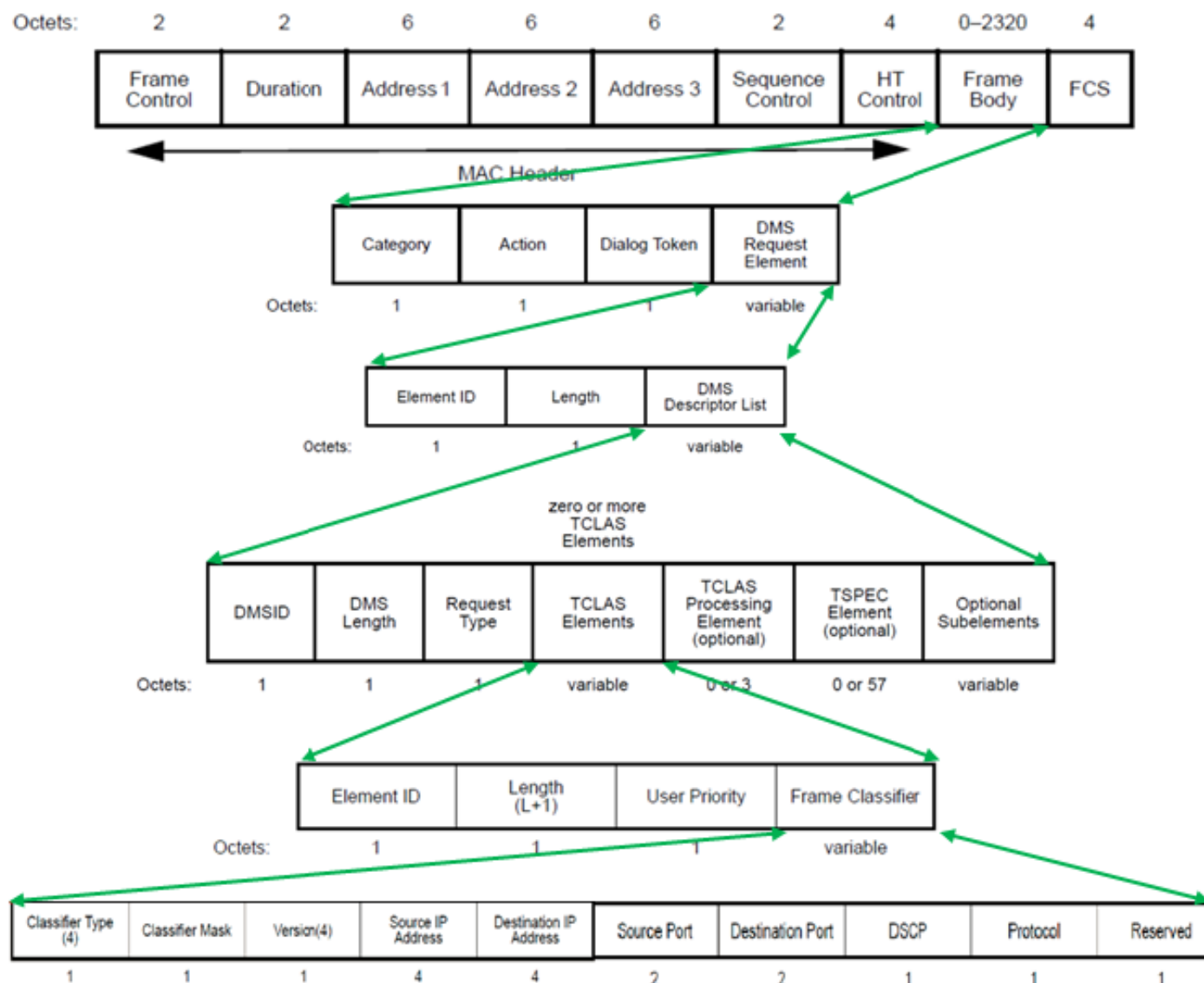
支援 DMS 的用戶端可以向 AP (存取點) 請求以單點傳播形式傳送多點傳播串流，就如同動態媒體資料流功能。

如需媒體資料流的詳細資訊：[VideoStream 部署指南](#)

如不使用 DMS，用戶端必須喚醒每個 DTIM 間隔才能接收多點傳播流量。使用 DMS 時，AP (存取點) 能緩衝特定用戶端的多點傳播流量，用戶端喚醒時會傳送單點傳播訊框以請求此流量。如此可讓用戶端休眠更久，並節省電池電量。多點傳播訊框透過無線方式以單點傳播形式傳輸，資料傳輸速度比未搭配 DMS 使用時更高。

無線用戶端可以傳送 DMS 請求類型「新增訊框」，以便要求 AP 將一個或多個特定多點傳播串流的流量以單點傳播方式傳送。

管理訊框 - DMS 請求類型



DMS 請求有三種類型：

說明 請求類型值

新增	0
移除	1
變更	2
保留	3-255

DMS request-Add 包含一個 DMS 描述元。

在 DMS 描述元清單中有 TCLAS 元素，指定無線用戶端請求以單點傳播形式取得的多點傳播流量串流。除其他欄位外，TCLAS 還指定來源/目的地 IP 位址、來源/目的地連接埠。

AP 會將這些流量串流做為單點傳播傳送至無線用戶端，並且繼而將這些串流做為多點傳播傳送至網路中不支援 DMS 的任何其他用戶端。

DMS 請求訊框內還可以有一個 TSPEC 元素（非必要），無線用戶端可以在其中定義流動的 QoS 要求和特徵。

附註：不支援 TSPEC

在本範例中，用戶端已傳送一個 DMS 請求（管理訊框，類別代碼 10：WNM，動作代碼 23：DMS 請求，針對群組 224.0.0.251、UDP（通訊協定 17）、目的地連接埠 9 上的多點傳播串流 IPv4（在本文件中，wireshark 無法完全解碼 DMS 請求）。

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]

0000	00000000	00000000	00010010	00000000	00101110	01001000	00000000	00000000	.....H..
0008	00010000	00000010	10000101	00001001	10100000	00000000	11011010	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	11011101	Category	Action	Dial.Token	Element-ID	Length	DMS ID	...c..
0030	DMS Length	Req-Type	Ele-ID-TCLAS	Length (L+1)	User Priority	Classif.Type	Classif.Mask	Version (4)	.....U.
0038	Source IP address				Destination IP address				.....
0040	Source Port		Destination Port		DSCP	Protocol		00000000 00111111?
0048	11001100	01010000	10111000						.P.

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]

0000	00000000	00000000	00010010	00000000	00101110	01001000	00000000	00000000	.....H..
0008	00010000	00000010	10000101	00001001	10100000	00000000	11011010	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	11011101	00001010	00010111	00000101	01100011	00011000	00000000	.....C..
0030	00010110	00000000	00001110	00010011	00000000	00000100	01010101	00000100	.....U.
0038	00000000	00000000	00000000	00000000	11100000	00000000	00000000	11111011	.....
0040	00000000	00000000	00000000	00001001	00000000	00010001	00000000	00111111	.....P
0048	11001100	01010000	10111000						.P.

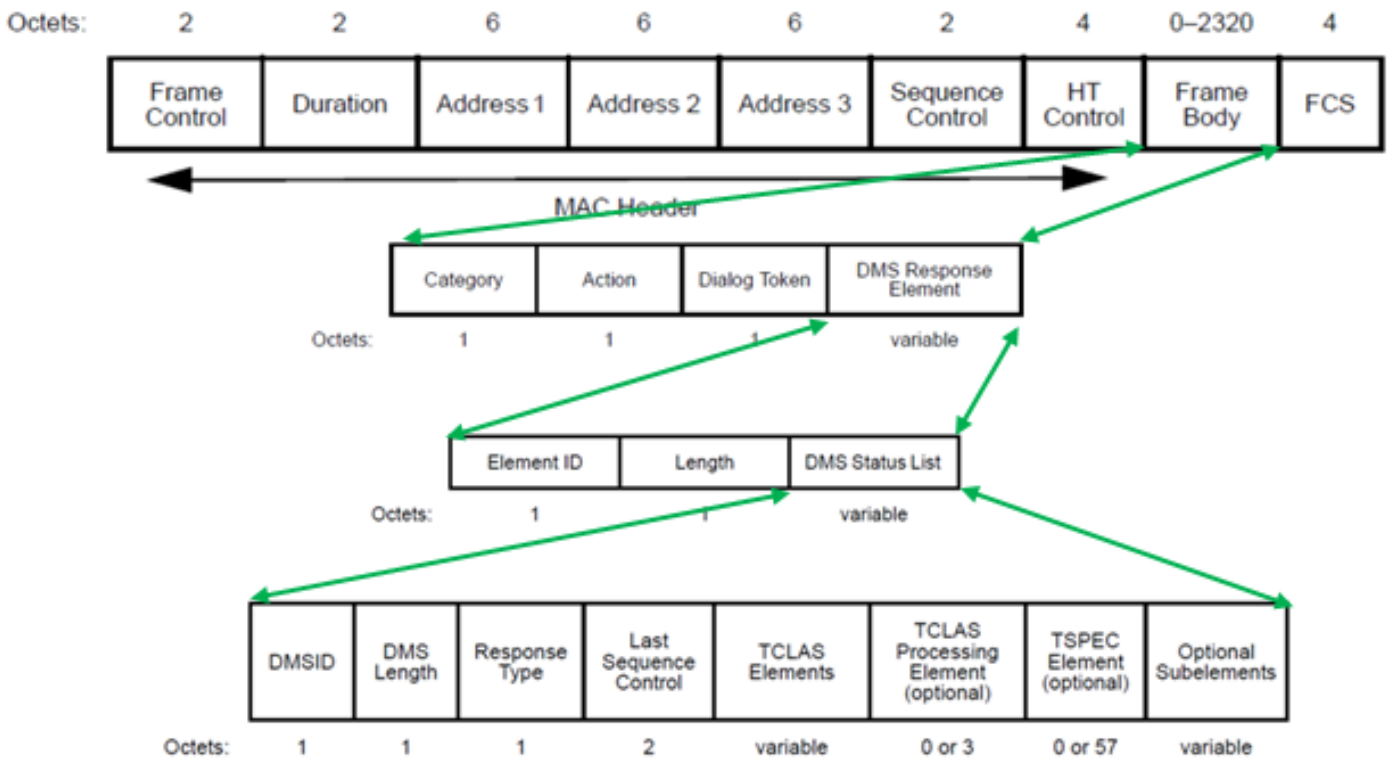
AP 使用 DMS 回應來回答 DMS 請求，該回應可能是 DMS response-Accept 或 DMS Response-Deny。

如果 AP 傳送 DMS response-Accept，它還會為該通訊流分配一個 DMSID。

無線用戶端可用 DMS 請求類型變更修改現有 DMSID，例如為流動請求不同的 TSPEC。

附註：不支援 DMS 變更

管理訊框 - DMS 回應類型



DMS 回應有三種類型：

欄位值說明

- 0 接受
- 1 已拒絕
- 2 終止
- 3-255 保留

在此範例中，AP 傳送了 DMS Response-Accept，並為用戶端傳送的 DMS 請求指派了 DMS ID 1。

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+..

此後，如果連接埠 9 上有一個目的地群組為 224.0.0.251 的封包，它會以多點傳播的形式採用無線方式傳送，並且會在 AP 上進行緩衝，直到傳送 DMS 請求的用戶端喚醒，並以單點傳播的形式接收封包。

這是以一般多點傳播傳送，目的地為連接埠 9 上群組 224.0.0.251 的封包範例。請注意，接收者和目的地 mac 位址指的是多點傳播群組。

```
+ Radiotap Header v0, Length 18
+ 802.11 radio information
- IEEE 802.11 Data, Flags: .....F.C
  Type/Subtype: Data (0x0020)
+ Frame Control Field: 0x0802
  .... 0000 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]
```

這是以單點傳播傳送至發出 DMS 請求的用戶端的訊框範例。這裡的目的地和接收位址是用戶端的 mac 位址，而不是多點傳播 mac 位址。而且多點傳播封包也做為 AMSDU 傳送。

```

+ 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]

```

一旦無線用戶端不要再以單點傳播形式接收多點傳播串流，就可以傳送新的 DMS 請求關閉該流，並使用之前由 AP 指定的 DMS ID。此為 DMS 請求 - 移除類型 (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	Category	Action	DiidToken	Element-ID	Length	DMS ID	...C..
0030	DMS Length	Req-Type	11010110	10111000	00111001	00110100			...94

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 00010100 00010111 00000110 01100011 00000011 00000001  .....C..
0030  00000001 00000001 11010110 10111000 00111001 00110100  .....94
  
```

並且 AP 會藉由 DMS 回應類型終止 (2) 確認此終止

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 00000000 00000000 00000000 00000000 00000000 00000000  .....d..
0030  00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000  .....:...
  
```

Category Action DialToken Element-ID Length DMS ID
 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 最大閒置期間：

AP 在一段時間內沒收到來自無線用戶端的訊框後，就會假定用戶端已離開網路，並解除關聯。BSS 最大閒置期間是 AP 可以保持用戶端關聯而不必接收任何訊框（用戶端可以保持睡眠狀態）的時間長度。此值透過關聯和重新關聯回應訊框通知無線用戶端。如此可使用戶端保持睡眠狀態更長的時間，同時節省電池電力。

BSS 最大閒置期間只出現在 association-response 或 re-association 回應訊框中

```

+ 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: Microsoft: WMM/WME: Parameter Element
    + Tag: QoS Map Set

```

BSS 最大閒置期間以 1000 TU (時間單位) 為單位標示。 每個時間單位等於 1.024 毫秒

閒置逾時 = 1.024 x BSS 最大空閒時間 = X 秒

在範例訊框中：

限制逾時= 1.024 x 405 = 414.72 秒

如果 Protected Keep-alive Required 位元設為 1，表示無線用戶端必須向 AP 傳送 RSN 保護訊框，以重置閒置計時器。如果設為 0，如本範例所示，無線用戶端可以傳送任何類型的訊框（受保護

或不受保護)，以重置 AP 的閒置計時器。

BSS 轉換管理

802.11v BSS 轉換管理請求是給用戶端的建議。用戶端可以自行決定是否遵循建議。如果啟用了即將解除關聯的功能，則可以強制解除用戶端的關聯。如果用戶端並未與建議的 AP 之一重新建立關聯，就會在一段時間後與用戶端取消關聯。

802.11v BSS 轉換適用於以下四種情況：

徵求的請求

無線用戶端在漫遊前傳送 802.11v BSS 轉換管理查詢，以取得更好的 AP 選項重新建立關聯。

802.11v BSS 轉換管理查詢範例

```
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 代表 BSS 轉換查詢原因，也就是用戶端請求候選 AP 清單的原因。在此範例中，用戶端傳送了一個原因 16，並對應至低 RSSI。轉換查詢原因的完整清單請參閱 IEEE 802.11-2012 的表 8-138。

在無線電接收到此訊框後，會回應一個 BSS 轉換管理請求，以提供 AP 候選清單。

```
1098 2.522295 CiscoInc 7d:d9:... CiscoInc 3a:0f: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...
```

未經徵求的負載平衡請求

當 WLC 啟用負載平衡功能和 BSS 轉換時，AP 就不會在負載沉重時向無線用戶端傳送取消驗證訊框，而是傳送 BSS 轉換管理請求，以便向無線用戶端建議另一個負載較低的 AP。

如需有關負載平衡功能的詳細資訊：[設定加強負載平衡](#)

未經徵求的最佳化漫遊請求

當 WLC 已啟用最佳化漫遊和 BSS 轉換時，當用戶端未達最小 RSSI (或與最佳化漫遊相關的任何其他參數) 時，AP 不會向無線用戶端傳送解除驗證訊框，而是傳送一個 BSS 轉換管理請求，以便向無線用戶端建議一個更好的 AP。

如需有關最佳化漫遊功能的詳細資訊：[Cisco Optimized Roaming](#)

FRA AP (彈性無線電指派) 上的用戶端指導

如果用戶端連接到 FRA AP 中狀況欠佳的基地台，AP 會向該用戶端傳送 802.11v BSS 轉換管理請求。

當一個支援 FRA 的 AP (如 2800 或 3800) 僅使用 5GHz 時，會有兩個基地台 (微型基地台和大型基地台)。如果用戶端連接到大型基地台，但微型基地台更理想 (以 RSSI 為基礎)，則 AP 會向用戶端傳送 802.11v BSS 轉換管理請求，以便建議用戶端移動到微型基地台，反之亦然。

此功能自 8.2.110.0 版起推出。

如需有關 FRA 的詳細資訊：[彈性無線電指派 \(FRA\) 和備援無線電](#)

即將解除關聯

在 BSS 轉換管理請求中，可以新增「即將解除關聯」欄位。如果用戶端沒有與另一個 AP 重新建立關聯，此功能就會在一段時間後與用戶端取消關聯。

當未經徵求的最佳化漫遊請求觸發時，AP 會向用戶端傳送 BSS 轉換管理請求，並等待一段時間 (在最佳化漫遊解除關聯計時器下設定的時間)，如果用戶端在這段時間內沒有漫遊到更好的 AP，AP 就會完成與用戶端的解除關聯。

當未經徵求的負載平衡請求觸發時，AP 會向用戶端傳送 BSS 轉換管理請求，並等待一段時間（在解除關聯計時器下設定的時間），如果用戶端在這段時間內沒有漫遊到較不壅塞的 AP，AP 就會完成與用戶端的解除關聯。

啟用即將解除關聯的 BSS 轉換管理訊框範例：

```
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: 341054a274ede004e702000000b070301ffdd1d0040960c...
```

BSS 轉換管理回應

無線用戶端收到 BSS 轉換管理請求後，可以或不能傳送 BSS 轉換管理回應。如果用戶端轉換到其他 AP，就會使用狀態代碼「接受」，但如果因為各種原因用戶端計劃留在相同 AP 上，則會傳送狀態代碼「拒絕」以及拒絕原因。

BSS 轉換管理回應訊框範例

```
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
IEEE 802.11 wireless LAN management frame
  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
```

在此範例中，無線用戶端拒絕 AP 候選清單，並未漫遊到不同的 AP。狀態代碼 1 顯示用戶端離開 ESS 的原因。有關狀態代碼定義的完整清單，請參閱 IEEE 802.11-2012 的表 8-253。

必要條件

需求

為利用 wlan 的 802.11v 功能，需要支援 802.11v 的無線用戶端。

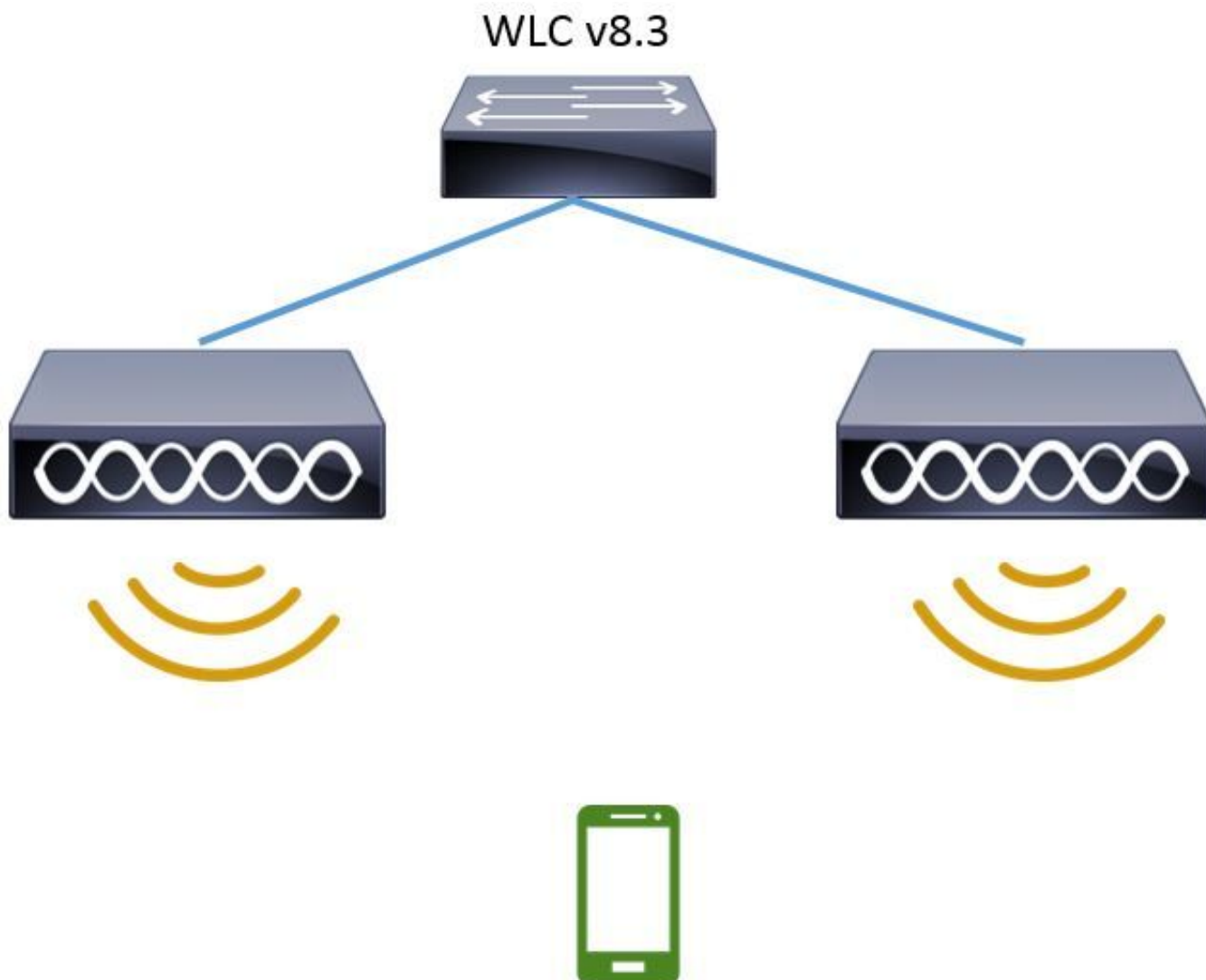
採用元件

WLC v8.3

Ipod Touch 第 6 代 v10.1.1

設定

網路圖表



組態

定向多點傳播服務 (DMS)

透過 WLAN 設定以啟用 DMS :

CLI 設定 :

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

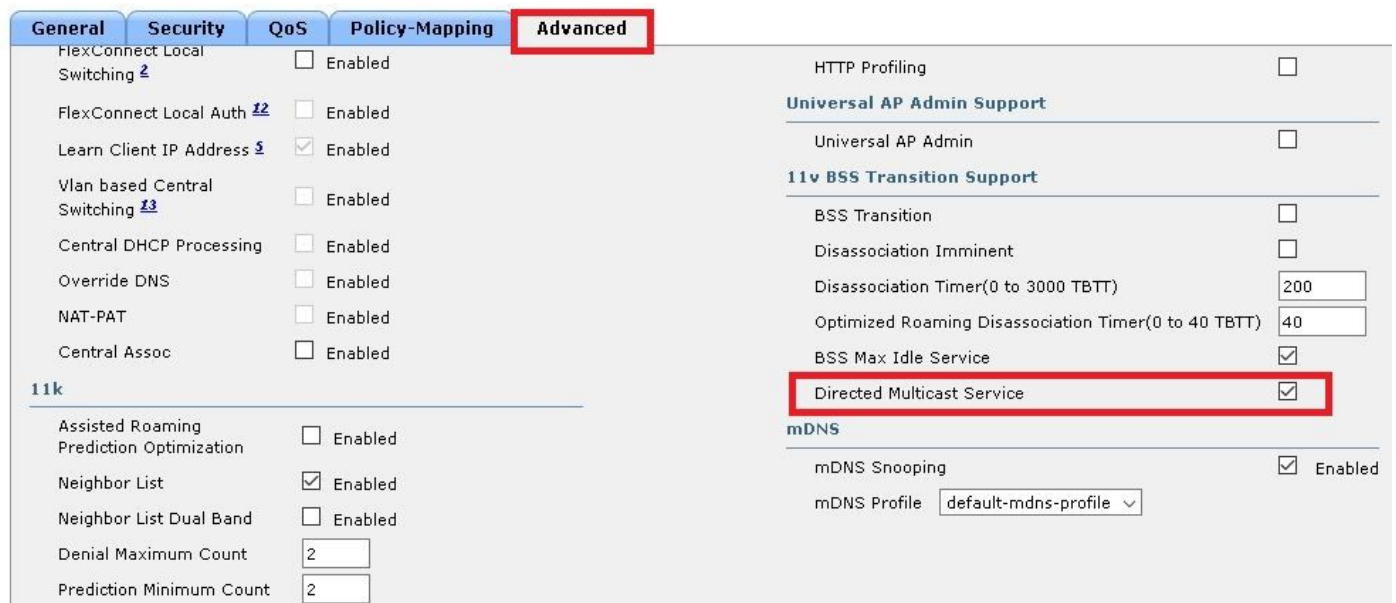
GUI 設定 (8.3 版起可用)

步驟 1. 導覽至「WLANs」>「Wlan-ID」然後按一下 WLAN 以啟用 DMS。



步驟 2. 導覽至「進階」>「11v BSS 轉換支援」並啟用「定向多點傳播服務」

WLANs > Edit '11v'



BSS 最大閒置期間管理

透過 WLAN 設定以啟用 BSS 最大閒置期間管理：

CLI 設定：

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

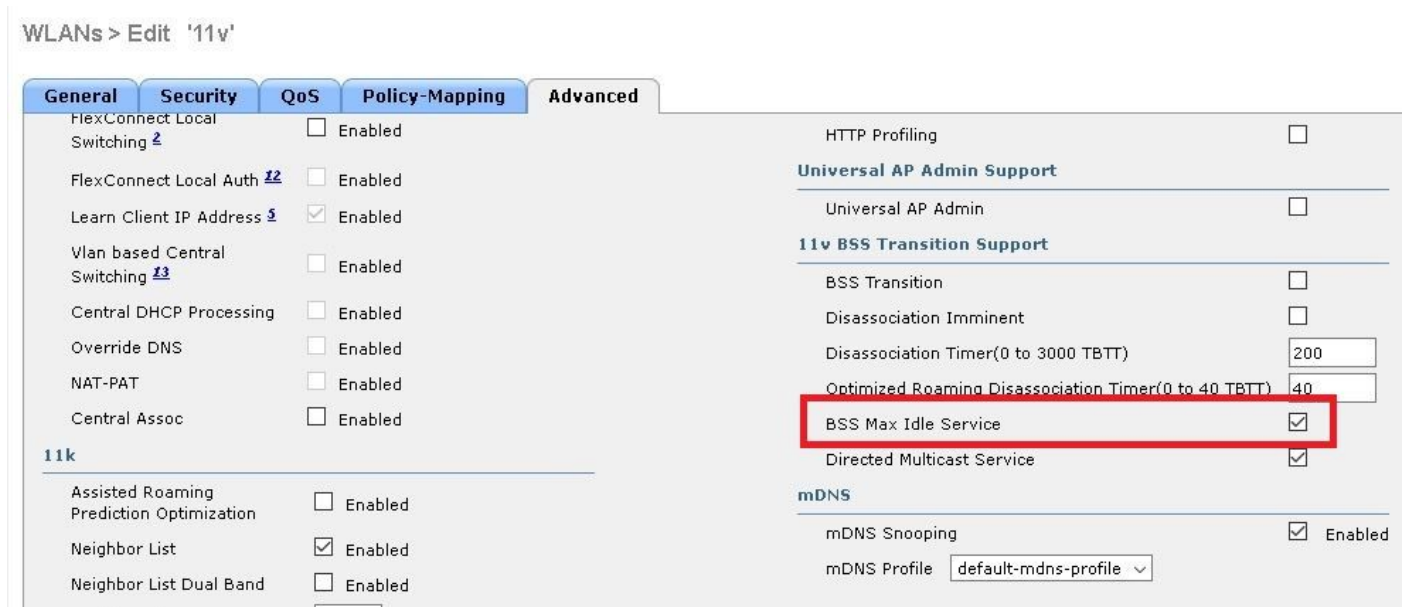
<seconds> Client Idle timeout(in seconds) on this WLAN. Range 0,15-100000 secs. 0 in order to disable

GUI 設定：

步驟 1. 導覽至「WLANs」>「WLAN-ID」然後按一下 WLAN 以設定 BSS 最大閒置期間。



步驟 2. 導覽至「進階」>「11v BSS 轉換支援」並啟用「BSS 最大閒置服務」



附註：此 GUI 選項是在 8.3 版中加入的。過去版本請使用指令 `config wlan bssmaxidle enable<wlan-id>`

步驟 3. 導覽至「進階」>「用戶端使用者閒置逾時」並設定以秒計算的逾時值。

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 轉換管理

透過 WLAN 設定以啟用 BSS 轉換管理：

附註：如果僅啟用 BSS 轉換，則存取點要傳送 BSS 轉換管理請求訊框的唯一方式，就是無線用戶端必須傳送 BSS 轉換管理查詢訊框。

附註：為了使 AP 在負載沉重時傳送 BSS 轉換管理請求，必須啟用 BSS 轉換與負載平衡功能。

附註：為了在無線用戶端沒有最佳 RSSI 時使 AP 傳送 BSS 轉換管理請求，必須啟用 BSS 轉換與最佳化漫遊功能。

徵求的請求

CLI 設定：

```
> config wlan disable <wlan-id>
> config wlan bss-transition enable <wlan-id>
> config wlan enable <wlan-id>
```

GUI 設定：

步驟 1. 導覽至「WLANs」>「WLAN ID」>「進階」，並啟用 BSS 轉換

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				
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"/>

未經徵求的負載平衡請求

CLI 設定：

```
> config wlan disable <wlan-id>
> config wlan bss-transition enable <wlan-id>
> config wlan load-balance allow enable <wlan-id>
> config wlan enable <wlan-id>
```

GUI 設定：

步驟 1. 導覽至「WLANs」>「WLAN ID」>「進階」，並啟用 BSS 轉換和用戶端負載平衡功能。

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 23	<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
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 4		<input type="text" value="0"/>		802.11b/g/n (1 - 255) <input type="text" value="1"/>
Static IP Tunneling 21	<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"/>

未經徵求的最佳化漫遊請求

CLI 設定：

```
> config wlan disable <wlan-id>
> config wlan bss-transition enable <wlan-id>
> config wlan chd <wlan-id> enable
> config wlan enable <wlan-id>
> config advanced { 802.11a | 802.11b } optimized-roaming enable
```

GUI 設定：

步驟 1. 導覽至「WLANs」>「WLAN ID」>「進階」，並啟用 BSS 轉換和覆蓋空洞偵測功能。

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 23	<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"/>
<hr/>				
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"/>			

步驟 2. 導覽至「無線網路」>「進階」>「最佳化漫遊」，並為兩個頻帶啟用最佳化漫遊模式。如需有關最佳化漫遊參數的詳細資訊，請參閱以下文件：[High Density Experience \(HDX\) 部署指南, 8.0 版本](#)

即將解除關聯

CLI 設定：

```
> config wlan disable <wlan-id>
> config wlan bss-transition enable <wlan-id>
> config wlan disassociation-imminent enable <wlan-id>
> config wlan bss-transition disassociation-imminent oproam-timer <timer-in-TBTT> <WLAN id>
> config wlan bss-transition disassociation-imminent timer <timer-in-TBTT> <WLAN id>
> config wlan enable <wlan-id>
```

步驟 1. 導覽至「WLANs」>「WLAN ID」>「進階」，啟用 BSS 轉換、即將解除關聯 並設定解除關聯計時器與最佳化漫遊解除關聯計時器。

GUI 設定：

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 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"/>
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 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 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

附註：計時器以 TBTT (目標信標傳輸時間) 為單位指定，即每個信標之間的時間。預設情況下，每個信標每 100 毫秒傳送一次，因此預設情況下 1 TBTT = 100 毫秒。計時器 = $X \text{ TBTT} / 10 = x \text{ 秒}$ 。

驗證

以下圖片顯示 WLAN (無線區域網路) 和無線用戶端對不同 802.11v 服務的支援。

SSID 支援

- 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 轉換管理

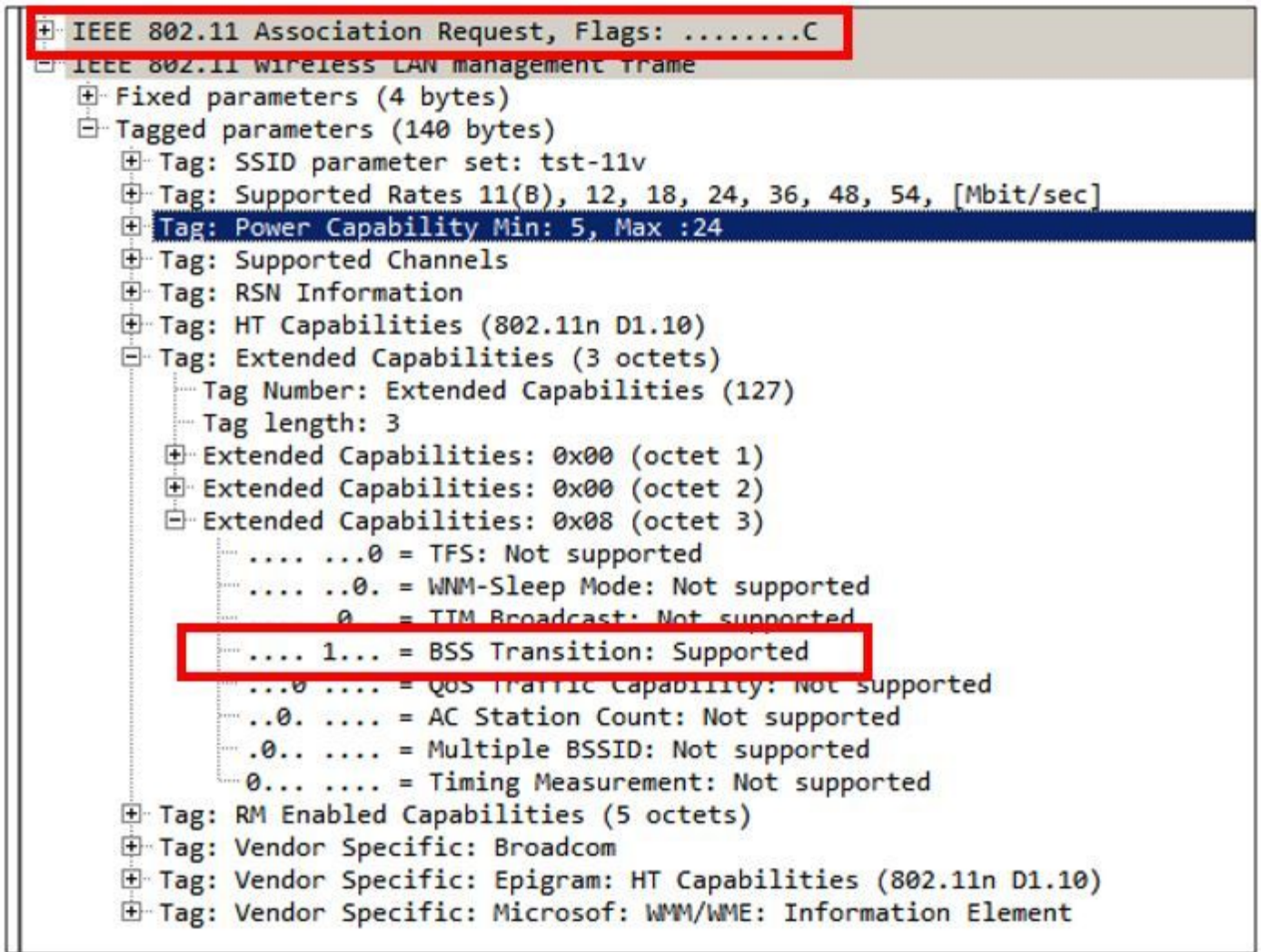
```
IEEE 802.11 Beacon frame, Flags: .....C
IEEE 802.11 wireless LAN management frame
  Fixed parameters (12 bytes)
  Tagged parameters (231 bytes)
    Tag: SSID parameter set: tst-11v
    Tag: Supported Rates 11(B), 12, 18, 24, 36, 48, 54, [Mbit/sec]
    Tag: DS Parameter set: Current Channel: 11
    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)
```

用戶端支援

- 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)
  ▲ Tag: 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 轉換管理



偵錯用戶端活動

為了監控 11v 用戶端活動，可以使用這些指令。

```
> debug client <mac-add-of-client>
> debug mac addr <mac-add-of-client>
> debug 11v all enable
```

具有 DMS 功能的用戶端

支援 11v 的用戶端

```
*apfMsConnTask_0: Nov 01 22:55:27.577: a4:f1:e8:58:95:0a Association received from mobile on
BSSID 7c:0e:ce:7d:d9:10 AP AP-3700-1
*apfMsConnTask_0: Nov 01 22:55:27.577: a4:f1:e8:58:95:0a Client is 11v BSS Transition capable
用戶端傳送群組 224.0.0.251 udp 連接埠 9 的 DMS 請求，AP 傳送 DMS 接受
```

```
*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

```

來自用戶端連接的 AP

```
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

```

之後，用戶端將新增至 wlan 中的 DMS 資料庫。為相同的多點傳播字串傳送 DMS Request-Add 的所有用戶端都列在相同的 DMS ID 下。

```
> 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 資料庫儲存在此用戶端連接的 AP 中：

```
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},

一旦無線用戶端關閉 DMS 流，就會傳送一個 DMS 請求移除

```
*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 lrادمac7c:0e:ce:7d:d9:10
*apf80211vTask: Nov 01 22:57:33.991: 11v g_msgQueue = 0x2b415828, osapiMessageSend rc
= 0
```

來自 AP

```
*Nov 1 22:57:33.167: DOT11v: Removing client A4:F1:E8:58:95:0A from DMS DB Entry
*Nov 1 22:57:33.167: DOT11v: DMS DB Delete Operation Succeeded
*Nov 1 22:57:33.167: Received and decoded a DMS client request payload SUCCESSFULLY
```

用戶端支援 BSS 轉換

支援 11v 的用戶端

```
*apfMsConnTask_3: Apr 12 10:46:36.239: 08:74:02:77:13:45 Association received from mobile on
BSSID f0:7f:06:e8:32:76 AP AP-3700
*apfMsConnTask_3: Apr 12 10:46:36.239: 08:74:02:77:13:45 Client is 11v BSS Transition capable
```

用戶端傳送 BSS 轉換管理查詢

```
*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
```

由於 wlan 啟用了即將解除關聯，系統會在解除關聯計時器結束後解除用戶端關聯

```
*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
```

因為負載平衡的緣故，AP 會傳送 BSS 轉換管理訊框

```
*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
```

因為最佳化漫遊的慣，AP 會傳送 BSS 轉換管理訊框

```
*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
```

參考資料

[章節：802.11r、802.11k、802.11v、802.11w 快速轉換漫遊](#)

IEEE 資訊技術標準–系統之間的電信和資訊交換，本機和城市區域網路–特定要求–第 11 部分：無線 LAN 媒體存取控制 (MAC) 和實體層 (PHY) 規格