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        CAPWAP Extension for 802.11n and Power/channel Reconfiguration
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Abstract

   CAPWAP binding for 802.11 is specified by RFC5416 and it was based on
   IEEE 802-11.2007 standard. After RFC5416 was published in 2009,
   there was several new amendent of 802.11 has been published. 802.11n
   is one of those amendent and it has been widely used in real
   deployment. This document extends the CAPWAP binding for 802.11 to
   support 802.11n.

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1. Introduction

   IEEE 802.11n standard was published in 2009 and it is an amendment to
   the IEEE 802.11-2007 standard to improve network throughput. The
   maximum data rate increases to 600Mbit/s physical throughput rate.
   In the physical layer, 802.11n use OFDM and MIMO to achive the high
   throughput. 802.11n use multiple antennas to form antenna array which
   can be dynamically adjusted to imporve the signal strength and extend
   the coverage.

   There are couple of capabilities of 802.11n need to be supported by
   CAPWAP control message such as radio capability, radio configuration
   and station information.

2. Conventions used in this document

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL","SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in [RFC2119].

3. CAPWAP 802.11n support

   IEEE 802.11n standard was published in 2009 and it is an amendment to
   the IEEE 802.11-2007 standard to improve network throughput. The
   maximum data rate increases to 600Mbit/s physical throughput rate.
   In the physical layer, 802.11n use OFDM and MIMO to achive the high
   throughput. 802.11n use multiple antennas to form antenna array which
   can be dynamically adjusted to imporve the signal strength and extend
   the coverage.

   802.11n support three modes of channel usage: 20MHz mode, 40Mhz mode
   and mixed mode.802.11n has a new feature called channel binding. It
   can bind two adjacent 20MHz channel to one 40MHz channel to improve
   the throughput.If using 40Mhz channel configuration there will be
   only one non-overlapping channel in 2.4GHz. In the large scale
   deployment scenario, operator need to use 20MHz channel configuration
   in 2.4GHz to allow more non-overlapping channels.

   In MAC layer, a new feature of 802.11n is Short Guard Interval(GI).
   802.11a/g use 800ns guard interval between the adjacent information
   symbols. In 802.11n, the GI can be configured to 400nm under good
   wireless condition.

   Another feature in 802.11 MAC layer is Block ACK. 802.11n can use one
   ACK frame to acknowledge several MPDU receiving event.

CAPWAP need to be extended to support the above new 802.11n features.
For example, CAPWAP should allow the access controller to know the
supported 802.11n features and the access controller should be able
to configure the differe channel binding modes. One possible
solution is to extend the CAPWAP information element for 802.11n.

4. CAPWAP extension for 802.11n support

There are couple of capabilities of 802.11n need to be supported by
CAPWAP control message such as radio capability, radio configuration
and station information. This section defines the extension of
current CAPWAP 802.11 information element to support 802.11n.

1. 802.11n Radio Capability Information Element. The information
element need to be extended to include 802.11n radio capability.
Below is an example of the 802.11n radio capability information
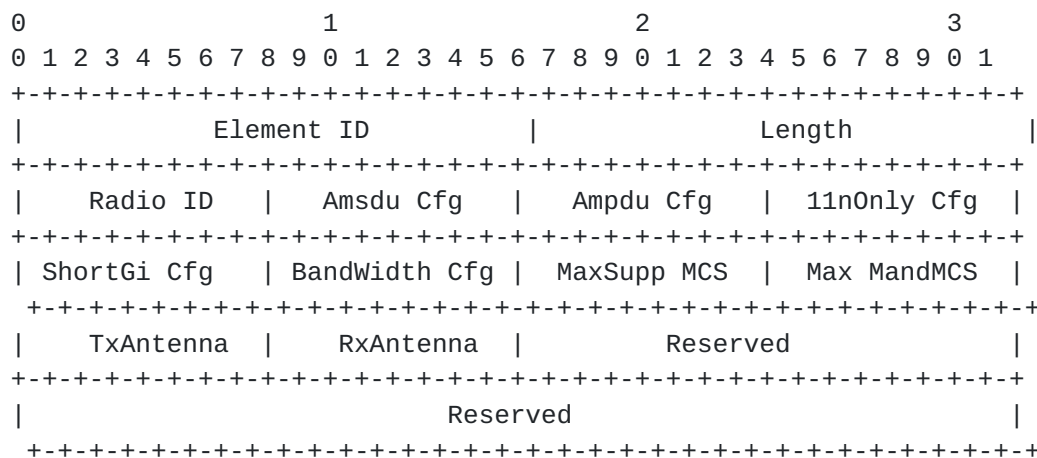element.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|             Element ID           |             Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Radio ID    |SupChanl width |   Power Save   |  ShortGi20   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  ShortGi40    | HtDelyBlkack  |  Max Amsdu     | Max RxFactor|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Min StaSpacing | HiSuppDataRate|  AMPDUBufSize  |  HtcSupp     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        20MHZ 11gMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        20MHZ 11gMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        20MHZ 11gMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        20MHZ 11gMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        20MHZ 11aMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        20MHZ 11aMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        20MHZ 11aMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        20MHZ 11aMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        40MHZ 11gMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        40MHZ 11gMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        40MHZ 11gMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        40MHZ 11gMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        40MHZ 11aMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        40MHZ 11aMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        40MHZ 11aMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        40MHZ 11aMCS                           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

1.   SupChanl width: The supported bandwith mode. 0x01: 20MHz
     bandwidth binding mode. 0x02: 40MHz bandwidth binding mode.

2.   Power Save: 0x00: Static power saving mode. 0x01: Dynamic power
     saving mode. 0x03: Do not support power saving mode.
3.   ShortGi20: Whether support short GI. 0x00: Do not support short
     GI. ox01: Support short GI.
4.   HtDelyBlkack: Whether block Ack support delay mode. 0x00: Do not
     support delay mode. 0x01: Support delay mode.
5.   Max Amsdu: The maximal AMSDU length. 0: 3839 bytes. 1: 7935
     bytes.
6.   Max RxFactor: The maximal receiving AMPDU factor. Default
     value: 3.
7.   Min StaSpacing: Minimum MPDU Start Spacing.
8.   HiSuppDataRate: Maximal transmission speed.
9.   AMPDUBufSize: AMPDU buffer size.
10. HtcSupp: Whether the packet have HT header.
11. 20MHZ 11gMCS: 128 bitmap.If support should be all zero,
     otherwise all one.
12. 20MHZ 11aMCS: 128 bitmap.If support should be all zero,
     otherwise all one.
13. 40MHZ 11gMCS: 128 bitmap.If support should be all zero,
     otherwise all one.
14. 40MHZ 11aMCS: 128 bitmap.If support should be all zero,
     otherwise all one.
15. 2. 802.11n Raido Configuration TLV. Following figure is an
     example of 802.11n radio configuration TLV.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|            Element ID          |              Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Radio ID   |   Amsdu Cfg    |   Ampdu Cfg    |  11nOnly Cfg  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| ShortGi Cfg   | BandWidth Cfg  |  MaxSupp MCS   |  Max MandMCS  |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   TxAntenna   |    RxAntenna   |          Reserved             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Reserved                             |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

1.   A-MSDU CFG: 0x00: Disable 0x01: Enalbe
2.   A-MPDU CFG: 0x00: Disable 0x01: Enalbe
3.   11N Only CFG: Whether allow only 11n user access. 0x00: Allow
     non-802.11n user access. 0x01: Do not allow non-802.11n user
     access.
4.   Short GI CFG: 0x00: Disable 0x01: Enable
5.   Bandwidth CFG: Bandwidth binding mode. 0x00: 40MHz 0x01: 20MHz

6.   Max Support MCS: Maximal MCS.
7.   Max Mandantory MCS: Maximal mandantory MCS.
8.   TxAntenna: Transmitting antenna configuration.
9.   RxAntenna: Receiving antenna configuration.
10.   Each TxAntenna and RxAntenna bit represent one antenna, 1 means
      enable, 0 means disable.

3. 802.11n Station Information. Following figure is an example of
802.11n station information information element.

```
0                   1                   2                   3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Element ID           |             Length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          MAC Address                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|SupChanl width |   Power Save  |                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  ShortGi20    |  ShortGi40    | HtDelyBlkack  |  Max Amsdu    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Max RxFactor | Min StaSpacing|        HiSuppDataRate         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          AMPDUBufSize         |   HtcSupp     |    MCS Set     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   MCS Set                                                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   MCS Set                                                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     MCS Set    |
+-+-+-+-+-+-+-+-+-
```

1.   SupChanl width: Supporting bandwidth mode. 0x01: 20MHz bandwidth
      mode. 0x02: 40MHz bandwidth binding mode.
2.   Power Save: 0x00: Static power saving mode. 0x01: Dynamic power
      saving mode. 0x03: Do not support power saving mode.
3.   ShortGi20: Whether support short GI in 20MHz bandwidth mode.
      0x00: Do not support short GI. ox01: Support short GI.
4.   ShortGi40: Whether support short GI in 40MHz bandwidth mode.
      0x00: Do not support short GI. ox01: Support short GI.
5.   HtDelyBlkack: Whether block Ack support delay mode. 0x00: Do not
      support delay mode. 0x01: Support delay mode.
6.   Max Amsdu: The maximal AMSDU length. 0x00: 3839 bytes. 0x01:
      7935 bytes.
7.   Max RxFactor: The maximal receiving AMPDU factor.
8.   Min StaSpacing: Minimum MPDU Start Spacing.

9.   HiSuppDataRate: Maximal transmission speed.
10.   AMPDUBufSize: AMPDU buffer size.
11.   HtcSupp: Whether the packet have HT header.
12.   MCS Set: The MCS bitmap that the station supports.

5. **Power and Channel auto reconfiguration**

   Power and channel auto reconfiguration could avoid potential radio
   interference and improve the Wi-Fi performance. In general, the
   auto-configuration of radio power and channel could occurre at two
   stages: when the AP power on or during the AP running time.

   When the AP is power-on, it is of necessity to configure a proper
   channel to the AP in order to achieve best status of radio links.
   IEEE 802.11 Direct Sequence Control elements or IEEE 802.11 OFDM
   Control element defined in RFC5416 should be carried to offer AP a
   channel at this stage. Those element should be carried in the
   Configure Status Response message. If those information element is
   zero, the AP will determine its channel by itself, otherwise the AP
   should be configured according to the provided information element.

   When the AP determines its own channel configuration, it should first
   scan the channel information, then determine which channel it will
   work on and form a channel quality scan report. The channel quality
   report will be sent to the AC using WTP Event Request message by the
   AP. The AC can use IEEE 802.11 Direct Sequence Control or IEEE
   802.11 OFDM Control information element carried by the configure
   Update Request message to configure a new channel for the AP.

   IEEE 802.11 Tx Power information element is used by the AC to control
   the transmission power of the AP. The 802.11 Tx Power information
   element is carried in the Configure Status Response message during
   the power on phase or in the Configure Update Request message during
   the running phase.

   Channel Scan Procedure.

   The Channel Scan Procedure is illustrated by the following figure.

```
   WTP                 Configure Status Req              AC
      ------------------------------------------------------->
         Configure Status Res(Scan Para TLV, Chl Bind TLV)
      <------------------------------------------------------
   or

   WTP Configure Update Req(Scan Para, Bind TLV)        AC
      <------------------------------------------------------
                      Configure Update Res
      ------------------------------------------------------->
```

The definition of the Scan Para TLV is as follows:

```
0                   1                   2                   3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|            Element ID          |            Length             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Radio ID |   AP oper mode              |    Scan Type   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Reserved                             |
+--------------------------------------------------------------+
|          Report Time          |       PrimeChlSrvTime         |
+--------------------------------------------------------------+
| On Channel ScanTIme           |   Off Channel ScanTime        |
+--------------------------------------------------------------+
|L|D|        Flag               |                               |
+--------------------------------------------------------------+
```

Element ID: TBD; Length:18

AP oper mode: the work mode of the AP. 0x01:normal mode. 0x02: monitor only mode.

Scan Type: 0x01: active scan; 0x02: passive scan.

Report Time: Channel quality report time.

PrimeChlSrvTime: Service time on the working scan channel. This segment is invalid(set to 0) when AP oper mode is set to 2. The maximum value of this segment is 10000, the minimum value of this

segment is 5000, the default value is 5000.

On Channle ScanTime: The scan time of the working channel. When the
AP oper mode is set to 2, this segment is invalid(set to 0). The
maximum value of thi segment is 120, the minimum value of this
segment is 60, the default value is 60.

L=1: Open Load Balance Scan. D=1: Open Rogue AP detection scan.
Flag: Bitmap, resered for furture use.

The definition of the Channel Bind TLV is as follows:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|             Element ID         |              Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Radio ID |                    Flag                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Max Cycles  |      Reserved         |   Channel Count      |
+--------------------------------------------------------------+
|                   Scan Channel Set...                        |
+--------------------------------------------------------------+
```

Element ID: TBD. Length>=12

Flag: bitmap, reserved.

Scan Src: the trigger of the scan event. not defined in this version
of the document. set to 0.

Device Type: the scope of the scan. not defined is this version of
the document. set to 0.

Max Cycles: Scan repeat times. 255 means continuous scan.

Scan Channel Set: the channle information. the format is as follows:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|             Channel ID         |              Flag            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Channel ID: the channel ID of the channel which will be scanned.

Flag: bitmap, reserved for future use.

The channle scan procedure:

The AP has two work mode: the first one is normal mode. In this
mode, the AP can provide service for the STA access and scan the
channel at the same time. Whether the AP will scan the channel is
determined by the Max Cycles segment in the Channle Bind TLV. When
this segment is set to 0, the AP will not scan the channle. If this
segment is set to 255, the AP will continuous scan the channel. The
type of the scan is determined by the Sacn Type segment. In the
passive scan type, the AP monitor the airinterface, based on the
received beacon frame to determine the nearby APs. In the active
scan type, the AP will send probe message and receive the probe
response message. In the normal scan mode, the AP will use 3
parameters: PrimeChlSrvTime, OnChannelScanTIme, OffChannelScnTIme.
The AP will provide access service for the STAs for PrimeChlSrvTime
duration and then start to scan the channel for On Channel ScnTime
duration. Back to the working channel, provide STA access service
for PrimeChlSrvTime, then leave the working channel, start to scan
the next channel for Off Channel ScanTime duration. This process
will be repeated until all the channel is scanned.

When the AP work in the scan only mode, there is no difference
between the working channel and scan channel. Every channel's scan
duration will be OffChannelScnTime and the PrimeChlSrvTime and
OnChannelScanTime is set to 0.

Scan Report. THe AP send the scan report to the AC through WTP Event
Request message. The information element that used to carry the scan
report is Channel Scan Report TLV and Neighbor AP Report TLV. The
definition of the Channel Scan Report TLV is as follows:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|            Element ID          |            Length             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Radio ID     | Report Count    | Channel Scan Report          |
+--------------------------------------------------------------+
```

Element ID: 133; Length: >= 20.

Report Count: the channle number will be reported. The definition of

the channel scan report is as follows:

```
0                   1                   2                   3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Channel Number    |     Radar Statistics    | Mean      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Time    | Mean RSSI   | Screen Packet Count           |
+---------------------------------------------------------------+
| NeighborCount| Mean Noise  | Interference | Self Tx Occp    |
+---------------------------------------------------------------+
| SelfStaOccp  | Unknown Occp |  CRC Err Cnt  | Decrypt Err Cnt |
+---------------------------------------------------------------+
|Phy Err Cnt   | Retrans Cnt  |
+----------------------------+
```

Channel Number: The channel number.

Radar Statistics: Whether detect radar signal in this channel. 0x00: detect radar signal. 0x01: no radar signal is detected.

Mean Time: Channel measurement duration.

Mean RSSI: The signal strength of the scanned channel.

Screen Packet Count: Received packet number.

Neighbor Count: The neighbor number of this channel.

Mean Noise: the average noise on this channel.

Interference: The interference of the channel.

Self Tx Occp: The time duration for transmission.

Unknown Occp: TBD.

CRC Err Cnt: CRC err packet number.

Decrypt Err Cnt: Decryption err packet number.

Phy Err Cnt: Physical err packet number.

Retrans Cnt: Retransmission packet number.

The definition of neighbor AP report TLV is as follows:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Element ID             |              Length       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Radio ID    | Reserved     | Number of Neighbor Report    |
+---------------------------------------------------------------+
| Neighbor Infor...                                             |
+---------------------------------------------------------------+
```

Element ID: 134; Length:>=16

The definition of Neighbor info is as follows:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            BSSID                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          BSSID            |          Channel Number           |
+---------------------------------------------------------------+
| 2rd Offset   | Mean RSSI   | Sta Intf     | AP Intf    |
+---------------------------------------------------------------+
```

BSSID: The BSSID of this neighbor channel.

Channel Number: The channel number of this neighbor channel.

2rd channel offset: TBD.

Mean RSSI: The average signal strength of the channel.

Sta Intf: TBD.

AP Intf: TBD.

6. Security Considerations

TBD

7. IANA Considerations

None

8. Contributors

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   their usefull suggestions.

10. Normative References

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119, March 1997.

   [RFC4564] Govindan, S., Cheng, H., Yao, ZH., Zhou, WH., and L. Yang,
              "Objectives for Control and Provisioning of Wireless
              Access Points (CAPWAP)", RFC 4564, July 2006.

   [RFC5415] Calhoun, P., Montemurro, M., and D. Stanley, "Control And
              Provisioning of Wireless Access Points (CAPWAP) Protocol
              Specification", RFC 5415, March 2009.

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