### **IEEE P802.11 Wireless LANs**

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| Channel Usage Resolutions | | | | |
| Date: 2023-10-30 | | | | |
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**Abstract**

CIDs resolved 6070, 6071, 6072, 6073, 6075

CIDs for discussion: 6074

**Revisions:**

* Rev 0: Initial version of the document.

***TGme editor: Please note Baseline is 11me D4.0. Edits are expressed via Word track changes:***

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| 6070 | 3.1 | 189 | 28 | No definition for "infrastructure BSS" (yet "noninfrastructure BSS" is defined in terms of "infrastructure BSS") | Add a definition for infrastructure BSS - e.g. a BSS with an AP. | Revised; in general agreement with commenter; see changes under 6070 in doc 23/1924<motionedRevision>. |

***Discussion***

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| 3.1 Definitions  **infrastructure**: An infrastructure comprises a distribution system (DS), one or more access points (APs), zero or one portals, and zero or more mesh gates. It is also the logical location of distribution and integration service functions of an extended service set (ESS).(#238)  4.3.5 Distribution system (DS) concepts  4.3.5.1 Overview  Instead of existing independently, an infrastructure BSS **might** also form a component of an extended form of network that is built with multiple BSSs.  An access point (AP) is any entity that has STA functionality and a distribution system access function (DSAF), which enables access to the DS, via the WM for associated STAs. |

Since an AP has access to the DS, therefore the existence of an AP requires the presence of a DS. Therefore, if a BSS has an AP, then infrastructure is present (i.e., a distribution system (DS), one or more access points (APs), zero or one portals, and zero or more mesh gates). Use this direction to define an infrastructure BSS.

***Changes for CID 6070***

3.1 Definitions

infrastructure Basic Service Set (BSS): [infrastructure BSS] A BSS with an access point.

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| 6071 | 9.4.2.84 | 1125 | 43 | Especially for Channel Usage, what is really meant by "noninfrastructure BSS" since Wi-Fi Direct group, Wi-Fi tethering are both in this P2P bucket but both are BSSes with an AP (or similar) | Try "A BSS whose AP has connectivity to a DS and thence a portal BSS and where the AP of the BSS either is a non-mobile AP or is a mobile AP in the ongoing absence of non-mobile APs." | Revised; in general agreement with commenter; see changes under 6071 in doc 23/1924<motionedRevision>. |

***Discussion***

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| noninfrastructure basic service set (BSS): [noninfrastructure BSS](M118) A BSS that is not an infrastructure BSS.(#3349) |

Given the preceding definition of an infrastructure BSS, this definition doesn’t really work for the Channel Usage feature.

Since the channel assignment portion of radio resource management is a slow process (to minimize disruption to clients), the Channel Usage feature was designed to be consumed by the classes of devices that are marked as AP in “noninfrastructure BSS” (below) and not by the other classes of devices. Certain cells are highlighted, to denote that they make it more difficult to establish a general rule.

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| Example device | Preferred outcome | Has connectivity to a portal | Mobile | Mobile while within the BSA of non-mobile APs | C, Power from external device required during operation |
| Smartphone tethering | AP in “noninfrastructure BSS” | Y | Y | Y | N |
| Windows/Linux/macOS laptop operating as a Wi-Fi Direct Group Owner or similar | AP in “noninfrastructure BSS” | Only when bridging from 802.11 to another LAN technology (e.g., 802.3) | Y | Y | N |
| AP in a car | AP in “noninfrastructure BSS” | Y (quite likely) | Y | Y | Y |
| Printer / projector with P2P connectivity | AP in “noninfrastructure BSS” | N | N | N | Y |
| IBSS | STA in an independent BSS | N | Y and N | Y and N | Y and N |
| Enterprise AP on a bus/train | Could go either way but lean to AP in “noninfrastructure BSS” just because AP in infrastructure BSS creates bigger problems | Y | Y | Y | Y |
| Enterprise AP on an isolated cruise ship out at sea | AP in an infrastructure BSS | Y | Y | N | Y |
| Wired home AP | AP in an infrastructure BSS | Y | N | N | Y |
| Wired mesh enterprise AP | AP in an infrastructure BSS | Y | N | N | Y |
| Wired classic enterprise AP | AP in an infrastructure BSS | Y | N | N | Y |
| Proposal | AP in “noninfrastructure BSS” = | (NOT this) |  | OR (this) |  |

A potentially workable definition for all these cases is:

noninfrastructure BSS: “A BSS whose DS is not connected to a Portal or whose AP is mobile while within the BSA of non-mobile APs.”

However, the “noninfrastructure BSS” term is no longer correct term since is not a simple negation of an infrastructure BSS. We need a replacement term here.

At the same time, the existing term noninfrastructure BSS is used (and should continue to be used) in the following:

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| peer-to-peer (PTP) link: [PTP link] (M118)(#1752)A station-to-station (STA-to-STA) link between tunneled direct link(#2154) setup (TDLS) peer STAs in an infrastructure basic service set (BSS) or between STAs in a noninfrastructure BSS.(#3349)  service set identifier: [SSID] A string used to identify the infrastructure basic service sets (BSSs) that comprise an extended service set (ESS), or to identify a noninfrastructure BSS(#3349). |

Therefore introduce a new term and use it.

***Changes for CID 6071***

3.2 Definitions specific to IEEE Std 802.11

Infrastructure-aidable Basic Service Set (BSS): [Infrastructure-helpable BSS] “A BSS whose DS is not connected to a Portal or whose AP is mobile while within the BSA of non-mobile APs.”

***REVme editor: in sections 9.4.2.84 (Channel Usage element) and 11.21.15 (Channel usage procedures), please change all instances of “noninfrastructure BSS” to “infrastructure-aidable BSS” and all instances of “Noninfrastructure BSS” to “Infrastructure-aidable BSS”.***

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| 6072 | 9.3.3.9 | 729 | 36 | A single Channel Usage element ("The Channel Usage element ...") is listed but text at P2613L23 refers to "Channel Usage elements" | Try "One or more Channel Usage elements ..." | Revised; in general agreement with commenter; see changes under 6072 in doc 23/1924<motionedRevision>. |

***Discussion***

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| 11.21.15 Channel usage procedures  A non-AP STA that supports (#3311)channel usage and is not associated to an AP prior to using a noninfrastructure BSS(#3349) or an off channel TDLS direct link may transmit a Probe Request frame including both Supported Operating Classes and Channel Usage elements.  Upon receipt of a Channel Usage element in the Probe Request frame, the AP supporting (#3311)channel usage shall send a Probe Response frame including one or more Channel Usage elements. |

Sending multiple Channel Usage elements in parallel makes sense since there are different flavors of them, identified by Usage Mode.

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| 9.4.2.84 Channel Usage element |

***Changes for CID 6072***

3.2 Definitions specific to IEEE Std 802.11

Table 9-66—Probe Request frame body

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| Order | Information | Notes |
| 11 | Channel Usage | One or more Channel Usage element are optionally present if dot11ChannelUsageActivated is true. |

Table 9-67—Probe Response frame body

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| Order | Information | Notes |
| 37 | Channel Usage | One or more Channel Usage elements are present if at least one Channel Usage element is present in the Probe Request frame and dot11ChannelUsageActivated is true. |

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| 6073 | 11.21.15 | 2614 | 21 | Peer-to-peer TWT scheduling is complicated for the AP and in general APs are unlikely to be able to support an infinite number of Peer-to-peer TWT schedules. However, current language seems to force the AP to accept a Peer-to-peer TWT scheduling request without any consideration of AP overload etc. | Make this protocol more realistic: AP can accept / deny. A TWT Setup Command of Reject TWT (and arguably Alternate) is unavoidable so explicitly allow that. | Revised; in general agreement with commenter; see changes under 6073 in doc 23/1924<motionedRevision>. |

***Discussion (open, but one way forward is proposed below)***

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| 11.21.15 Channel usage procedures  (#3145)Upon receiving a Channel Usage Request frame with a TWT element configured as a TWT request and a Channel Usage element with the Usage Mode field set to 3 (Peer-to-peer link) that does not carry a Channel Entry field, **an AP that supports peer-to-peer TWT scheduling shall transmit a Channel Usage Response frame that includes** a Channel Usage element without a Channel Entry field and **a TWT element configured as a TWT response (i.e., TWT Request field set to 0) with a TWT Setup Command field indicating Accept TWT** and all other fields of that TWT element set to the same value as the fields of the TWT element carried in the Channel Usage Request frame. In this case, the Timeout Interval Value field of the TIE, if any, in the Channel Usage Response frame includes the same value as that of the Channel Usage Request frame. |

For all circumstances when this feature is disabled, clients can assert and de-assert the PM field at any time yet these transitions are intrinsically rate-limited – it is one parameter change per client and this parameter change happens at a maximum rate of say dozens of clients (OFDMA) every “300us” at most. With P2P TWT schedules, intermittently the AP would have to allow for all schedules lining up such that then the AP would need to do 8\*300 parameter changes in “1usec”. This is 24000x more processing than previously defined. As an example, each P2P flow could be synchronized to a codec that uses a client’s undisciplined oscillator for a timing reference, so the AP has to allow for a panoply of P2P TWT schedules at say 55.9998/59.9999/60.0000/60.0001/etc Hz. Such schedules need a lot of maintenance and can pile up on each other periodically.

Then, with this force-accept language, if an AP were to become overloaded, it has no choice but to completely disable its support for peer-to-peer TWT scheduling. This doesn’t affect just the new client requests, but also *all previously accepted requests*. It makes it less likely that the AP would even enable support for peer-to-peer TWT scheduling. It enables a new DoS attack, whereby the attacker creates multiple virtual clients each seeking multiple P2P TWT agreements.

Elsewhere we always allow an AP to reject a request when it runs out of resources, and that is the better template here. This behavior is already the default behavior for P2P TWT agreements, so we no longer need special-case language.

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| (#3148)The outcome of the TWT setup when negotiating a peer-to-peer TWT agreement initiated by the exchange of Channel Usage Request and Channel Usage Response frames that carry a TWT element as described in this clause is the same as that defined in Table 10-40 (TWT setup exchange command interpretation(11ax)). |

Also, the AP might attempt to prioritize accepting requests based on the channel selected for P2P operations, so allow the client to report its P2P channel even if already selected.

***Changes for CID 6073***

11.21.15 Channel usage procedures

(#3145)A non-AP STA that has already selected a Channel for peer-to-peer communication may transmit a Channel Usage Request frame with the Usage Mode field of the Channel Usage element set to 3, with or without a Channel Entry field, to inform the AP about its unavailability during the peer-to-peer TWT agreement. Otherwise, the non-AP STA (#4337)shall set the Usage Mode field to 0, 1 or 2.

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| 6074 | 11.21.15 | 2611 | 33 | There are concerns that the Channel Usage procedures mix trusted and untrusted info | Clearly delineate trusted and untrusted information |  |

***Discussion (open)***

This has been addressed already in 11be; however it makes some sense to backport that work to 11me, for the benefit of CID 6075. Thoughts?.

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| 6075 | 11.21.15 | 2614 | 52 | The channel usage recommendation only applies at the time the STA “starts” a non-infra BSS / TDLS but if it’s already started and then the AP sends a recommendation later, there is no normative text (not even a “may”, although it’s clearly not forbidden in practice) for the STA to change the channel of the non-infra BSS / TDLS if it is able. This is overly limiting. | For when and if (and maybe never) if the non-infraBSS/off-ch TDLS chooses to switch channel, allow this ch usage info as a consideration. Try "- The channel usage information as part of channel selection processing to start a noninfrastructure BSS or an off-channel TDLS direct link, \*or when switching the channel of a pre-existing noninfrastructure BSS or off-channel TDLS direct link\*" | Revised; in general agreement with commenter; see changes under 6075 in doc 23/1924<motionedRevision>. |

***Discussion***

Makes sense.

***Changes for CID 6075***

Upon receipt of a Channel Usage element in the Probe Response or Channel Usage Response frame, the receiving STA may use the following:

* The channel usage information as part of channel selection processing
  + to start a (#3349)noninfrastructure BSS or an off-channel TDLS direct link, or
  + when switching the channel of a pre-existing noninfrastructure BSS or off-channel TDLS direct link
* The Power Constraint element, if present, as part of determining its maximum transmit power for transmissions for the (#3349)noninfrastructure BSS or an off-channel TDLS direct link
* The EDCA Parameter Set element, if present, as part of determining its EDCA parameters for transmissions for the noninfrastructure BSS(#3349) or an off-channel TDLS direct link
* The QMF Policy element, if present and dot11QMFActivated is true, as part of determining its classification of Management frames for transmissions for the noninfrastructure BSS(#3349) or an off-channel TDLS direct link