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

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| Max Channel Switch Time Harmonization | | | | |
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**Abstract**

No available CID; but soliciting the following change regardless.

**Revisions:**

* Rev 0: Initial version of the document.

***TGme editor: Please note Baseline is 11me D7.0. Edits are expressed via Word track changes:***

***Comment:***

The definition of Max Channel Switch Time (“MCST element”; which*, for avoidance of doubt,* does not signify multicast) is inconsistent in many ways. It is the time between a start event and an end event, but how are each defined (and are they the most useful definitions?):

* Is the start time
  + a) the TBTT of the last beacon frame or
  + b) the actual transmit time of the last beacon?
* Is the end time
  + 1) when the AP is first ready to communicate on the new channel,
  + 2) the TBTT of the first beacon on the new channel or
  + 3) the actual time of the first beacon transmitted on the new channel (which may be later due to channel access delays)?

From below, we see a mix of “a” and “b” and a mix of “2” and “3”.

Meanwhile, if the AP is ready to transmit on the new channel but (say) half a Beacon Interval before the next TBTT, the general intent of the protocol seems suboptimal:

* Communication has to wait until for that half a BI the next TBTT (which is bad for QoS traffic), and/or
* The AP should send an extra beacon at half a BI before its normal beacon, with undefined expectations in terms of countdown timers (e.g., for Quiet element), and/or
* The AP should disrupt its TSF: it should advance the TSF by half a BI so that the TBTT is aligned with the AP’s readiness to transmit on the new channel. However, dozing STAs might take an extended time to detect these time-translated beacons.

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| 9.4.2.216 Max Channel Switch Time element  The Max Channel Switch Time element indicates the time delta between the **time** **the last beacon is transmitted by the AP in the current channel** and the **expected time of the first beacon** transmitted by the AP in the new channel. The format of the element is defined in Figure 9-835 (Max Channel Switch Time element format).  …  The Switch Time field indicates(#2047) the maximum time delta between the **TBTT of** **the last Beacon frame transmitted by the AP** in the current channel and **the TBTT of the first Beacon frame** in the new channel, expressed in TUs.(#3420) |
| 11.8.8.2 Selecting and advertising a new channel in a non-DMG infrastructure BSS  … When the AP includes the Max Channel Switch Time element(#6), the AP shall **transmit the first Beacon frame in the new channel no later than the time indicated in the Switch Time field of the Max Channel Switch Time element** after the **last Beacon frame transmitted in the current channel**, unless the AP determines that it is unable to operate on the new channel.(#1812)  … A STA that receives a Max Channel Switch Time element from its associated AP should not transmit a frame to the AP on the new channel until it receives a frame on the new channel from the AP. |
| 11.9.3.2 Selecting and advertising a new channel in an infrastructure BSS  … When the AP includes the Max Channel Switch Time element(#6), the AP shall transmit the first Beacon frame in the new channel no later than the time indicated in the Switch Time field of the Max Channel Switch Time element after the last Beacon frame transmitted in the current channel, unless the AP determines that it is unable to operate on the new channel(#7160).  … (#6)A STA that receives a Max Channel Switch Time element from its associated AP should not transmit a frame to the AP on the new channel until it receives a frame on the new channel from the AP. |

What seems to make better sense is:

* Start time for Switch Time should be a stable, well-defined time – i.e., TBTT of last beacon on the old channel aka “a”
* End time for Switch Time should a) be stable and well-defined (i.e., when frames are scheduled for transmission, not when actually transmitted) and b) be as early as possible, which might be between TBTTs. If the end time is between TBTTs, the AP should just schedule for transmission a broadcast unsolicited Probe Response (UPR).

In terms of conformance and interop:

* The spec has internally inconsistent requirement, so conformance is not possible by definition
* *De minimis* industry testing of the MCST element
* The author is aware of an implementation that doesn’t follow 2) or 3) and can indicate much later than 1) (and so the question of whether the AP follows a) or b) is moot). Non-AP STAs waking up at TBTT + MCST will find that the AP is (already) available but might not receive a beacon (or UPR), so might need to wait for up to a BI to get a beacon (or might actively scan the AP, leading to an unfortunate synchronized burst of probe requests)
  + Thus there does not seem to be a likely impact on interop in regards to creating internal consistency in regards to the definition of this element
  + There might be a benefit for including an extra field “11mf-era Max Channel Switch Time” or similar, but it is not trivial to add and does not seem to be required – if a STA wakes up at last TBTT + MCST it will find its AP to be available for communication; and if the client wakes up later and needs a UPR or Beacon before transmitting then the Beacon will come at the next TBTT (and the client will have ot wait, just like existing deployed behavior)

***Accordingly, REVmf editor, please make the following changes indicated via Word track changes:***

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| 9.4.2.216 Max Channel Switch Time element  The Max Channel Switch Time element indicates the time delta between the TBTT of the AP’s last beacon in the current channel and the time at which the AP intends to schedule its first frame for transmission in the new channel. The format of the element is defined in Figure 9-835 (Max Channel Switch Time element format).  …  The Switch Time field indicates(#2047) the maximum time delta between the TBTT of the last Beacon frame transmitted by the AP in the current channel and the time at which the AP intends to schedule its first frame for transmission in the new channel, expressed in TUs.(#3420)  A diagram of a channel switch  Description automatically generated |
| 11.8.8.2 Selecting and advertising a new channel in a non-DMG infrastructure BSS  … When the AP includes the Max Channel Switch Time element(#6), the AP shall first schedule for transmission, in the new channel, a Beacon or unsolicited broadcast Probe Request frame at the time indicated in the Switch Time field of the Max Channel Switch Time element after the TBTT of the last Beacon frame transmitted in the current channel, unless the AP determines that it is unable to operate on the new channel.(#1812)  … A STA that receives a Max Channel Switch Time element from its associated AP should not transmit a frame to the AP on the new channel until it receives a frame on the new channel from the AP. |
| 11.9.3.2 Selecting and advertising a new channel in an infrastructure BSS  … When the AP includes the Max Channel Switch Time element(#6), the AP shall first schedule for transmission, in the new channel, a Beacon or unsolicited broadcast Probe Request frame at the time indicated in the Switch Time field of the Max Channel Switch Time element after the TBTT of the last Beacon frame transmitted in the current channel, unless the AP determines that it is unable to operate on the new channel(#7160).  … (#6)A STA that receives a Max Channel Switch Time element from its associated AP should not transmit a frame to the AP on the new channel until it receives a frame on the new channel from the AP. |