

Update on legacy trigger padding

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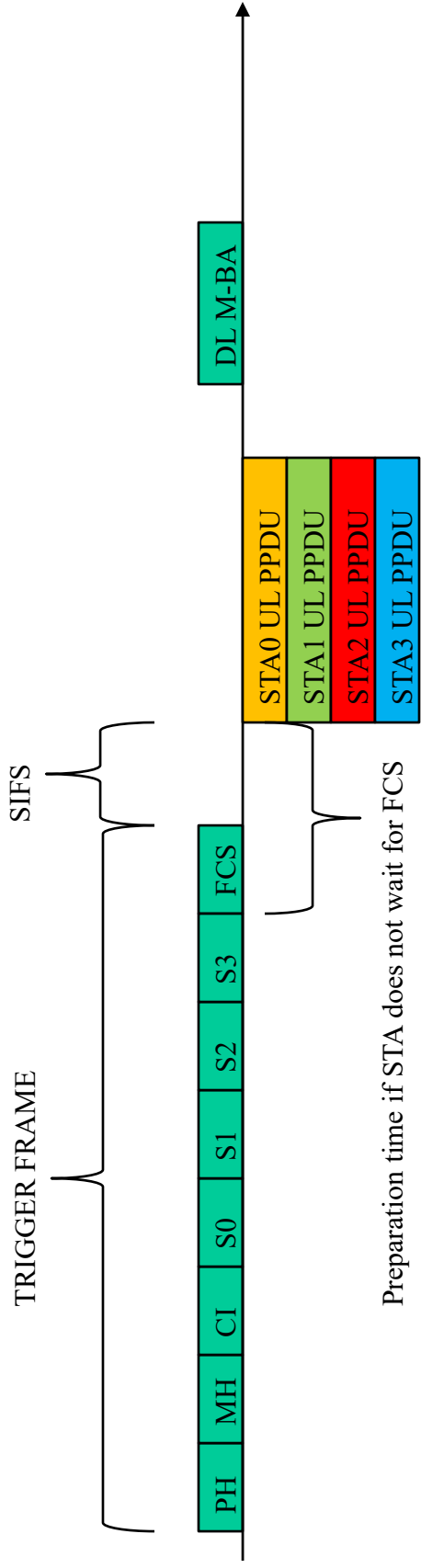
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Introduction

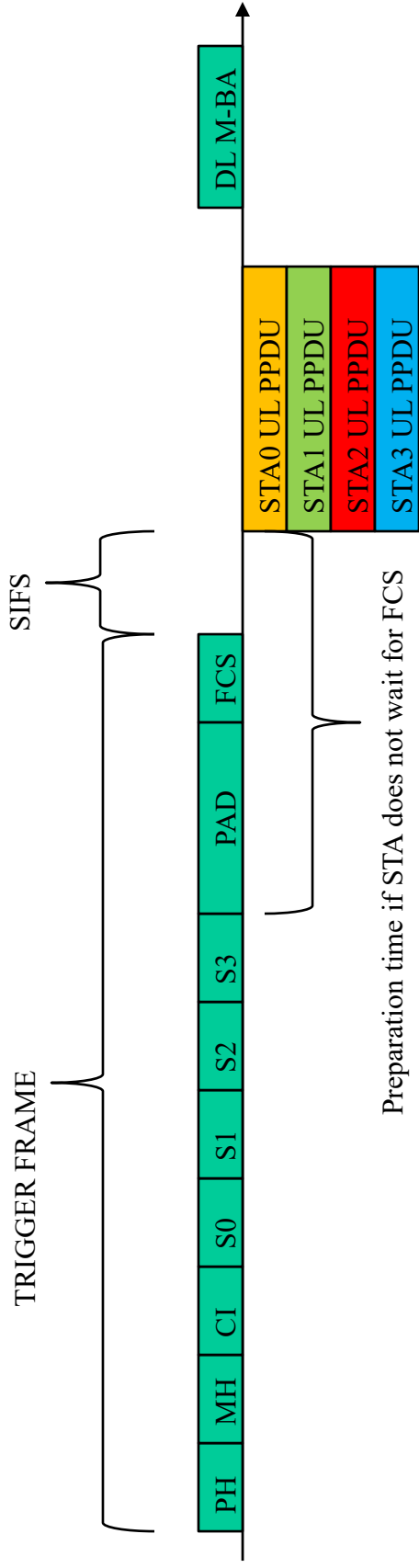
- According to the current 11ax SFD, after receiving a trigger frame from the access point, there is a SIFS waiting time for a STA to prepare data and start UL MU transmission
- However, after receiving a trigger frame that is designed to initiate simultaneous transmissions from multiple STAs within a given window of time, some slow STAs may not be capable of starting transmission after SIFS
 - E.g. a slow STA is one that needs a longer processing time (i.e. $> \text{SIFS}$) to prepare a frame that will fit into the resource allocation
 - Resource Allocation for UL OFDMA is not known until the arrival of the trigger frame, so that preparation before the arrival of the trigger frame is not possible
- Padding is needed to allow slower STA to prepare their PPDU

Trigger UL OFDMA Timing Example



- Each STA uses per-STA information to begin preparation of UL PPDU transmission at end of Trigger reception
- Available time for UL preparation is actually $< \text{SIFS}$ due to decoding delay at receiver
- STA could begin preparation of UL PPDU at end of reception of its individual per-STA Info, i.e. not wait for FCS
 - Possible need to abort TX if FCS is bad
- AP puts slowest preparers toward front of per-STA list
- But if all STAs are slow, there will be a slow STA in the last position

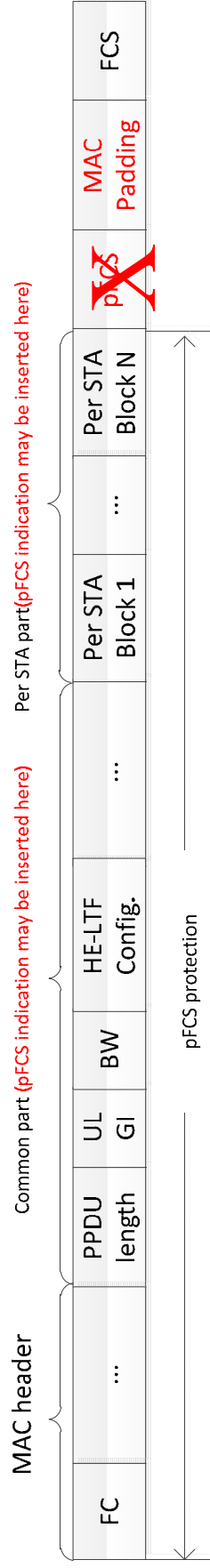
With Padding



- PAD field increases preparation time
- Might need to abort if FCS is bad
 - Note that TX abort condition is always a possibility anyway, due to the need for CCA check between end of Trigger PPDU and start of UL OFDMA PPDU in some cases, even when FCS is GOOD!
 - I.e. if CCA = BUSY, TX must be cancelled

MAC Padding contents

- Could consider adding a second, pFCS (prior FCS) right after the RU allocation information followed by MAC padding and the normal FCS
 - STAs upon validating the pFCS may start to prepare the UL transmissions
 - L-SIG indicates the end of the frame including the normal FCS
 - Legacy devices use the duration in the MAC header to set the NAV
- Also indicate the location of the pFCS in Common part or Per STA or MAC header
 - Include RU Info boundary field indicates the location of the pFCS (1-2 Octets)
 - Or include last Per STA bit in the Per STA info
 - It is almost equivalent to put the RU info boundary indication in MAC header or in the common part of payload because they will be protected by the pFCS
- Is this necessary?
 - NO – see next slide



Further Discussion on Padding

- Padding does not need a pFCS as the TX might need to be aborted anyway due to CCA check result of BUSY
 - I.e. cannot prevent the need for TX abort in device state flow
- pFCS might protect against incorrect decode (false start due to bit error), but this is not very likely due to:
 - Trigger frames will use LCD MCS to be highly reliable because loss of a trigger is catastrophic for performance
 - Therefore Trigger frames are likely to be sent at easily decodable MCS for all intended recipients i.e. BER should be low
- Even if BER occurs, odds of matching BER per-STA ID are low
- Even if false TX preparation occurs and is aborted, the additional power consumed is minimal, since PHY decode continues and MAC is running anyway to compute the FCS

Proposal

- The draft specification shall specify that when a Trigger needs to be padded, the padding shall be at the MAC layer and the padding shall not include an FCS.

SP

Do you support to add to the SFD that the draft specification shall specify that when a Trigger needs to be padded to allow sufficient UL PPDU transmission preparation time, the padding shall be at the MAC layer and the padding shall not include an FCS?

Yes

No

Abs