

IEEE 802.1AS REV D5.0 Review Comments

Date: 2017-07-10

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Motivation/Background

- **IEEE 802.1AS REV project includes use of IEEE 802.11-2016 Fine Timing Measurement as an additional 802.11 protocol to generate timestamps that 802.1AS would use for clock synchronization**
- **IEEE 802.1AS REV project includes use of IEEE 802.11ak General Links for interfacing 802.11 MAC SAP to IEEE 802.1AC**
- **802.1AS Rev D5.0 WG Ballot is currently open and closes July 13th, 2017.**

Summary of comments

	Type	Count	
1	Editorial	4	
2	Technical	2	Needs discussion with ARC (REJECT)
		8	Needs discussion with 802.1AS
		1	Needs discussion with 802.11md amd 802.11az

Comments that need discussion with 802.11 ARC

- **802.11 MAC interfacing with ISS without support for 802.11ak**
- **Figures 7.8 and 8.2 in IEEE 802.1AS D5.0**
- **Open Issues:**
 - Should 802.1AS over 802.11 require 802.11ak?
 - If 802.11ak is required how would current implementations of 802.11 and 802.1AS-2011 be addressed?
- **ISS layer sits atop 802.11. Bridging of 802.11 to/from the ISS layer depends on if 802.11 supports 802.11ak or not. Hence these comments are Rejected.**

Comments that requires discussion in 802.11md and/or 802.11az

- **What is the “disconnect” between IEEE 802.11-2016 and IEEE 802.1AS REV D5.0?**
 - IEEE 802.1AS D5.0
 - Use FTM with the following parameters
 - ASAP=1
 - Single Burst (Burst Exponent = 0)
 - FTMs per Burst – infinite number of FTMs (not explicit in D5.0)
 - IEEE 802.11-2016 Fine Timing Measurement
 - Does not have a mechanism to indicate “infinite” for FTMs per Burst

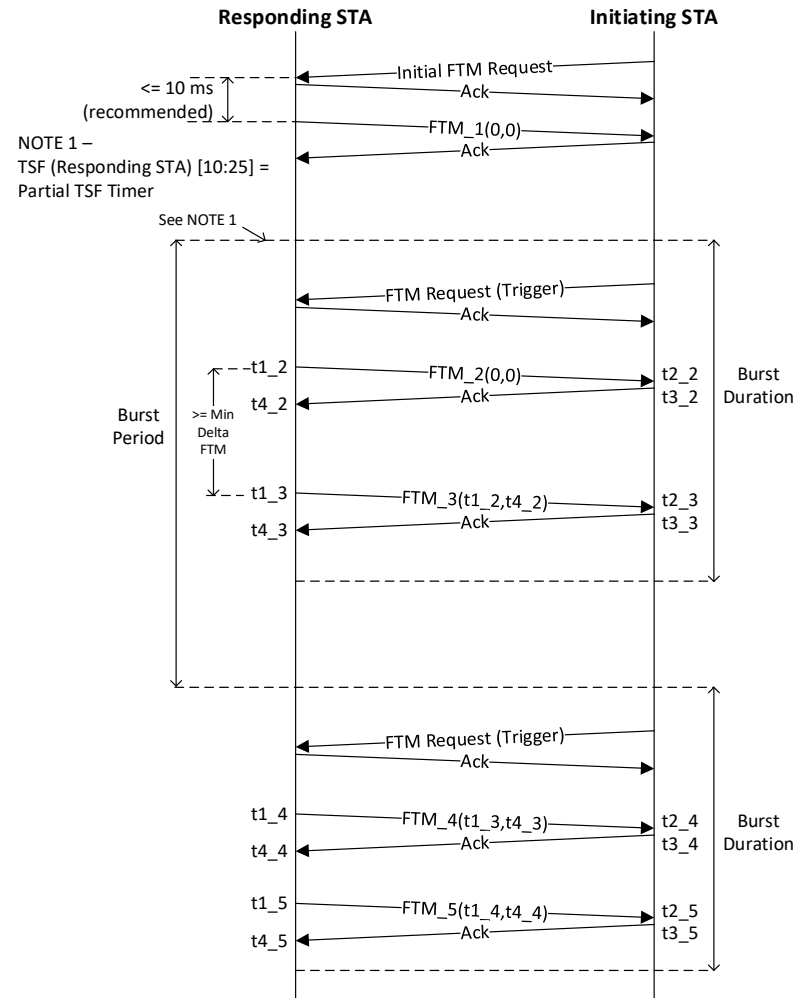
Requirements

- **Simple Change**
- **Must not break existing IEEE 802.11-2016 implementations of Fine Timing Measurement**

Proposed Solution-A

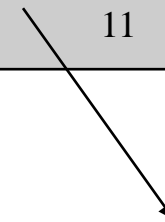
- **Amend 802.1AS REV D5.0 to use multiple burst instead of single burst**
 - Each burst has up to 32 FTM frames
- **Issues**
 - Still does not allow for “infinite” number of FTM frames to be sent; as the maximum number of bursts is limited to 2^{15}
 - May cause discontinuity in the flow of time information from the top of the network to the leaf
 - This is because all burst excepting the first one needs to be started with a FTM Request frame from the Slave to the Master
 - This discontinuity may not be an issue if the slave transmits the FTM Request to trigger a new burst in a timely manner

Recap of Multiburst FTM Session



Fine Timing Measurement Parameters Element

	Category	Public Action	Trigger	LCI Measurement Request (optional)	Location Civic Measurement Request (optional)	Fine Timing Measurement Parameters (Mandatory)
Octets	1	1	1	variable	variable	11



	Status Indication	Value	Reserved	Number of Bursts Exponent	Burst Duration	Min Delta FTM	Partial TSF Timer
Bits	2	5	1	4	4	8	16
	Partial TSF Timer No Preference	ASAP Capable	ASAP	FTMs per Burst	Reserved	Format and Bandwidth	Burst Period
bits	1	1	1	5	2	6	16

Burst Duration Field

Value	Represents
0-1	Reserved
2	250 us
3	500 us
4	1 ms
5	2 ms
6	4 ms
7	8 ,ms
8	16 ms
9	32 ms
10	64 ms
11	128 ms
12-14	Reserved
15	No Preference

Initiator: Burst Duration field set to 15 (no preference) and FTMs per Burst set to 0 (no preference)

Responder: **Burst Duration field set to 12 (forever) and FTMs per Burst set to 0 (infinite)**

12	forever
13-14	Reserved



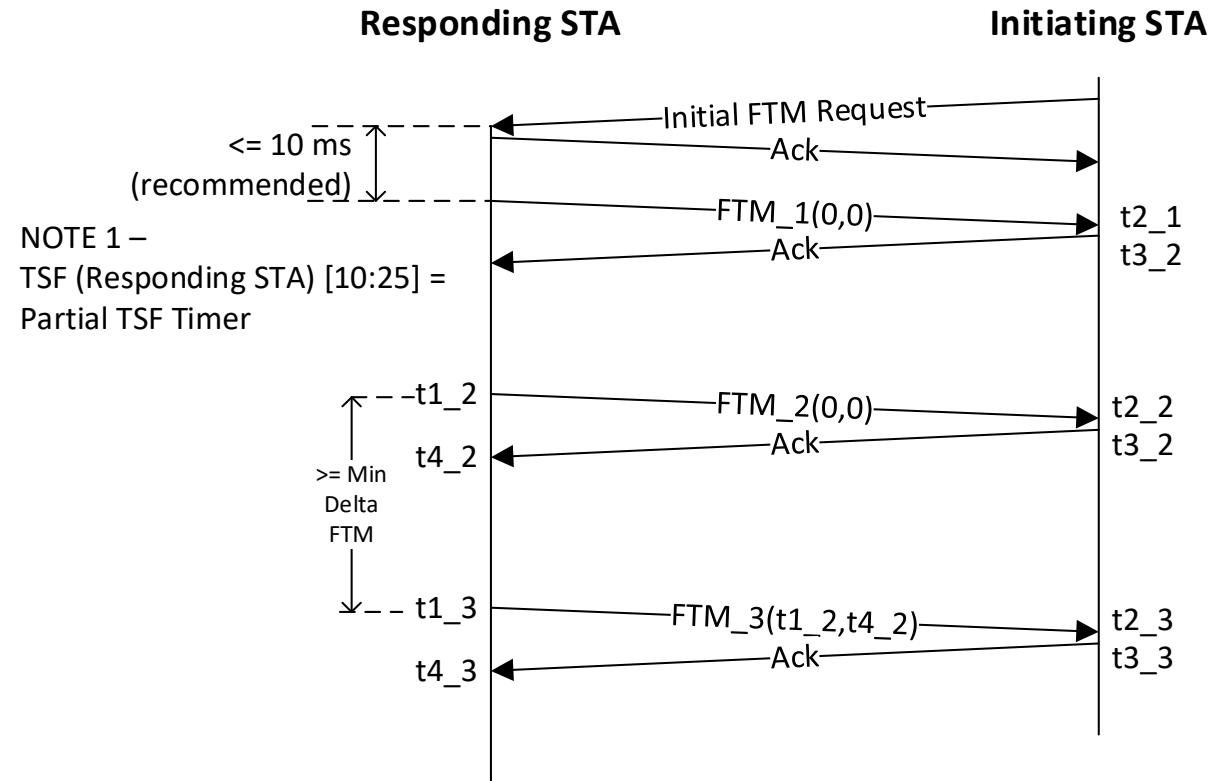
Proposed Solution-B

- **Amend IEEE 802.11-2016 to allow for a new choice for the number of FTMs per Burst**
 - Use one of the reserved values from the possible values for Burst Duration (values 12-14 are reserved in IEEE 802.11-2016)
 - Initiator sets FTMs per burst to 0 (indicating no preference) and sets Burst Exponent to 0 (Single Burst)
 - Responder sets Burst Duration to 12 (indicating “Forever”) and sets Burst Exponent to 0 (Single Burst)
 - Responder sets FTMs per Burst to 0 (currently disallowed in IEEE 802.11-2016) indicating “infinite” FTMs (new behavior)
- **How does one enable both Location Services and 802.1AS between two peers?**
 - Only one FTM Session can exist at any one time between two peers.

Proposed Solution-C

- **Move to multiburst – supports up to 2^{15} bursts. The FTM Session needs to be renegotiated and restarted after that for the next 2^{15} bursts.**
- **Set FTMs Per Burst to 1, 2 or 3**
- **Allows for the Slave to go to sleep, move to another channel, etc., between bursts**
- **If in the middle of the session, a need to start an FTM Session for non-802.1AS use arises, the current 802.1AS FTM Session can be terminated by sending an FTM frame with the Dialog Token set to 0 and restarted later at a later time with an FTM negotiation**
- **See Slide #8 for the message flow**
- **No changes needed in 802.11-2016**

FTM Session for Proposed Solution - D



Proposed Solution-D

- **See Slide #13 for the message flow**
- **No changes needed in 802.11-2016**
- **Use Single Burst ASAP=1 (unchanged from D5.0)**
- **FTM Parameters element field values:**
 - FTMs Per Burst to 1, 2 or 3; Number of Bursts Exponent set to 0
 - Choose Min Delta FTM and Burst Duration as needed to allow for FTM Sessions to be started every 125 milliseconds
- **Allows for the Slave to go to sleep, move to another channel, etc., between bursts; Allows for co-existence of applications using FTM for Time Synchronization (802.1AS) and Location Services**
- **The Slave renegotiates a new FTM Session after collecting a set of t1, t2, t3 and t4. The Slave and Master state machines restarts as a result. t1 and t2 are zero when the first FTM frame is received within an FTM Session**
 - One could envisage running TM in this mode as well (each pair of TM frame exchange will reset the Master and Slave state machines)

Proposal-E

- **Move to multiburst – Define a mechanism to indicate “infinite” bursts in the FTM Parameters element (use Reserved bit-7?)**
- **Set FTMs Per Burst to 1, 2 or 3**
- **Allows for the Slave to go to sleep, move to another channel, etc., between bursts**
- **If in the middle of the session, a need to start an FTM Session for non-802.1AS use arises, the current 802.1AS FTM Session can be terminated by sending an FTM frame with the Dialog Token set to 0 and restarted later at a later time with an FTM negotiation**
- **See Slide #8 for the message flow**
- **IEEE 802.11-2016 needs to be amended to include a definition for “infinite” bursts**

Comments to discuss with 802.1AS

- **Mandatory and optional support for Timing Measurement and Fine Timing Measurement protocols in Bridges and end-points**
 - Timing Measurement should be mandated to ensure interoperability
- **Some sub-sections of 802.1AS REV D5.0 need to be updated to address support for Fine Timing Measurement**
- **Determination of asCapable**
- **Fallback to Timing Measurement if FTM negotiation fails**