802.1AS Synchronization Services for 802.11ak Links

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Aug 2013

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802.1AS for 802.11 Links (1)

- Specified in IEEE Std 802.11AS-2011 Clause 12

- Path Delay measurement
  - Peer delay mechanism
  - Use the Timing measurement procedure defined in IEEE 802.11v specified in IEEE 802.11-2012 Section 10.23.5
    - MLME-TIMINGMSMT Primitives
    - Messages are the "timing measurement action frame" and its corresponding "ACK"
    - Vendor Specific information element contains various time-synchronization parameters, including an entire Follow_Up message

802.1AS for 802.11 Links (2)

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- **Messages**
  - All media-dependent frames are generated and consumed by the lower-layer 802.11 MLME
  - Messages are timestamped by the MAC/PHY

- **Determination of asCapable**
  - Per-port global variable
  - Set to FALSE if the timing measurement bit in the ExtendedCapabilities information element indicates that the peer IEEE 802.11 station is incapable of participating in the timing measurement protocol
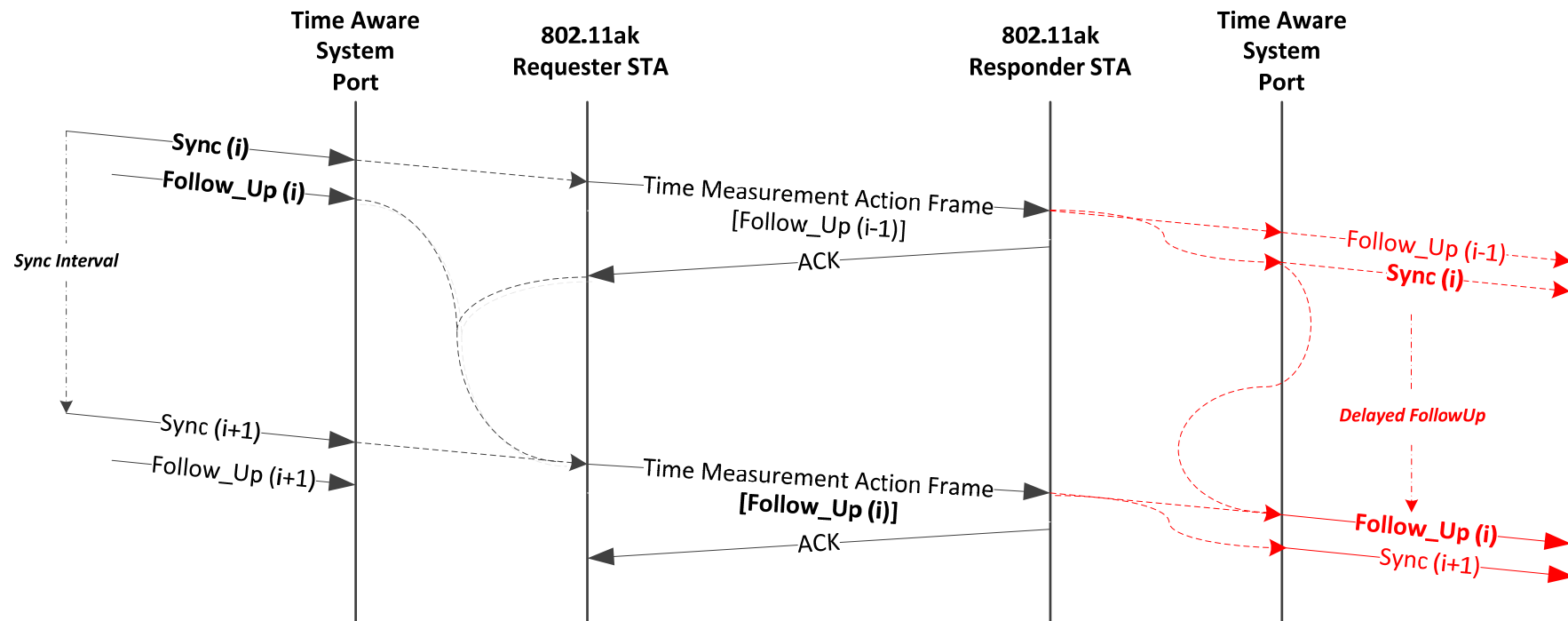 - Otherwise, may be set to TRUE
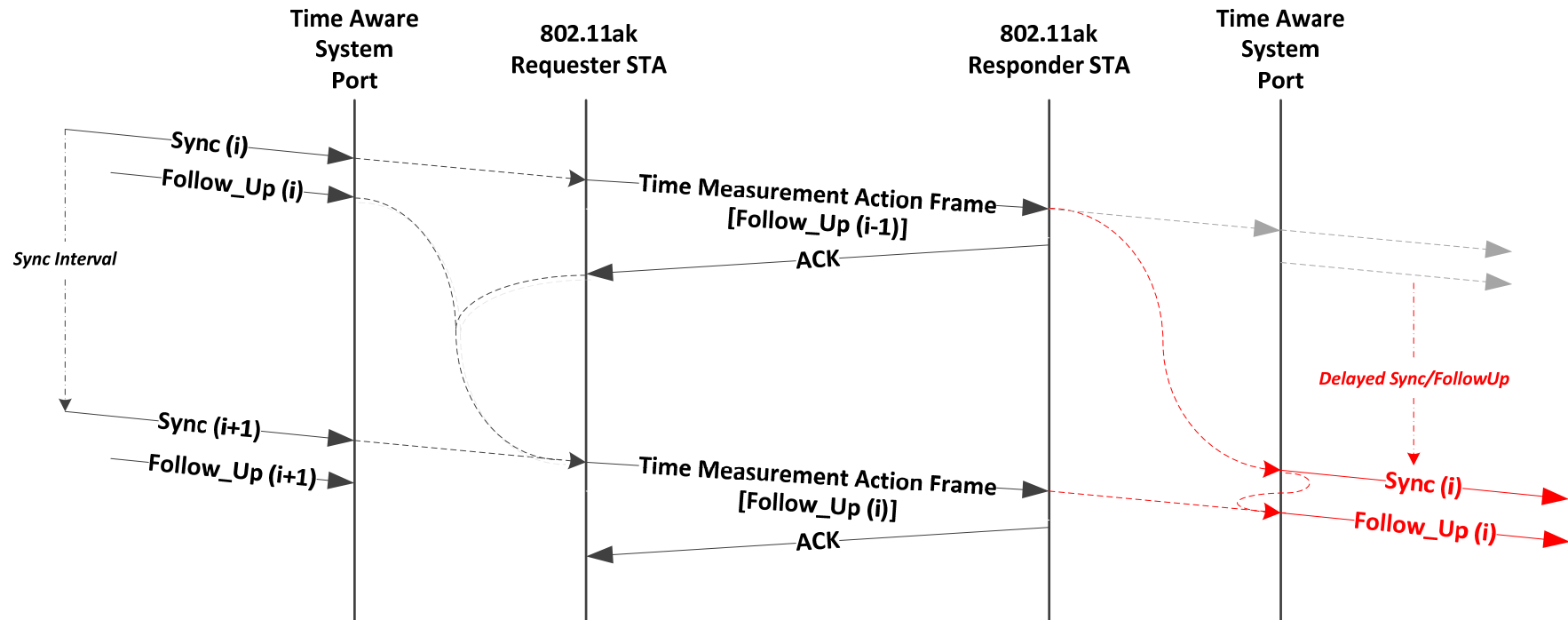
Timing Measurement Procedure for 802.11 Links
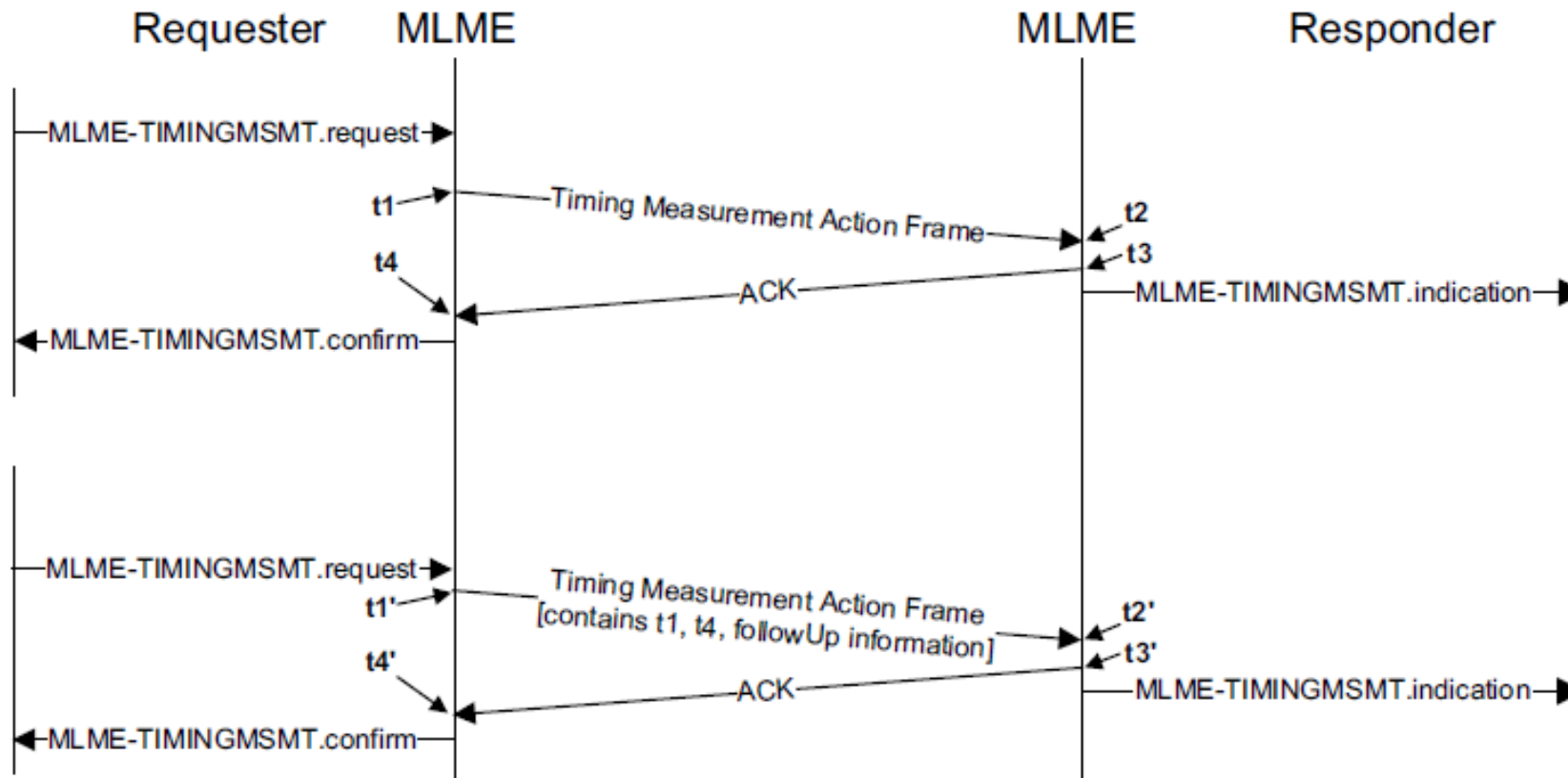
Propagation of Sync and Follow_Up Messages on 802.11ak Links (1)

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- Timing measurement procedure for 802.11 links introduces a one Sync_interval delay per 802.11ak link

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Propagation of Sync and Follow_Up Messages on 802.11ak Links (2)

Sync Msg Propagation for .11ak Links

Option #1

- Same procedure that .11 links

- Pros:
  - No change to 802.1AS

- Cons:
  - Sync msg propagation is delayed by one Synch_interval per .11ak link (default Synch_interval for 802.11 link is 1/8 sec)
  - This delay is accumulative per 802.11ak hop
  - An AVB path could be up to 8 hops. Which max delay value could the sync msg propagation sustain?

Sync Msg Propagation for .11ak Links

Option #2

- For .11 links, two consecutive Time Measurement Action Frames are generated for the Sync and Follow_Up messages

- Pros:
  - Eliminates the one Sync_interval delay

- Cons:
  - Makes the protocol more "chatty"
  - Requires a Modification of the MD State Machine (and the 802.1AS Specs for .11ak links)

Fine Timing Measurement 802.11mc (1)

- New MLME primitive MLME-FINETIMINGMSMTRQ to provide improved timing measurement accuracy included in IEEE P802.11-REVmc/D1.5, June 2013
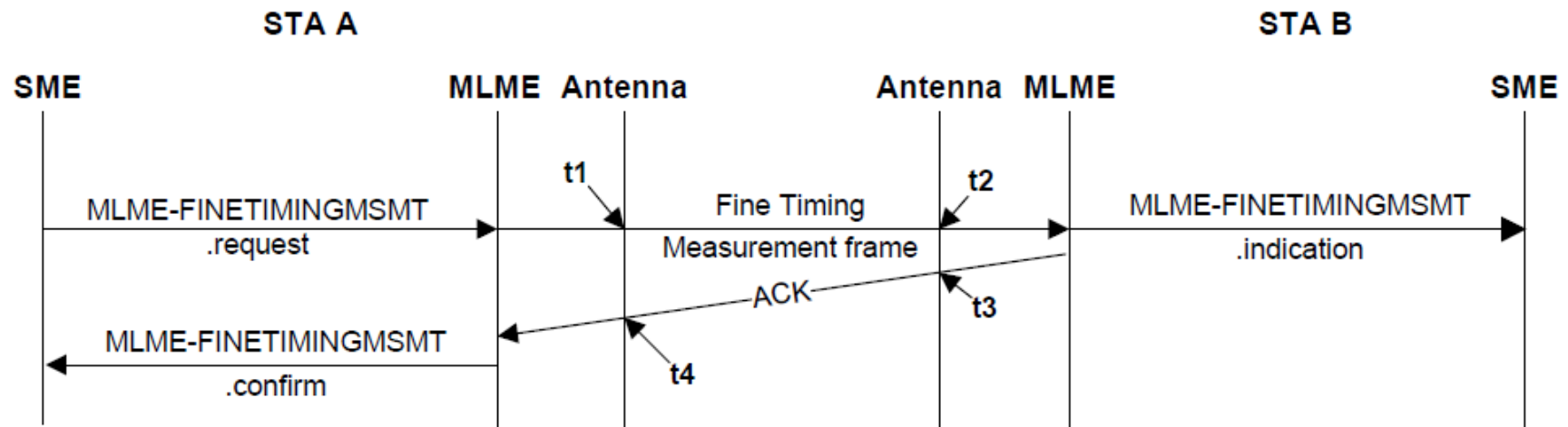
Figure 6-17—Fine timing measurement primitives and timestamps capture

Fine Timing Measurement 802.11mc (2)

- Almost the same syntax as MLME-TIMINGMSMTRQ

- Q: Shall a STA supporting MLME-FINETIMINGMSMTRQ, support MLME-TIMINGMSMTRQ as well ?
  - not explicitly required in the draft*

- Might require additional description to 802.1ASbt
  - as IEEE Std 802.1AS describes the .11v's MLME-TIMINGMSMTRQ primitive only

  no PICs section for fine timing measurement in the current draft

Timestamping of 802.1AS Sync Messages over 802.1Qbz Bridge and 802.11ak Link (informative)
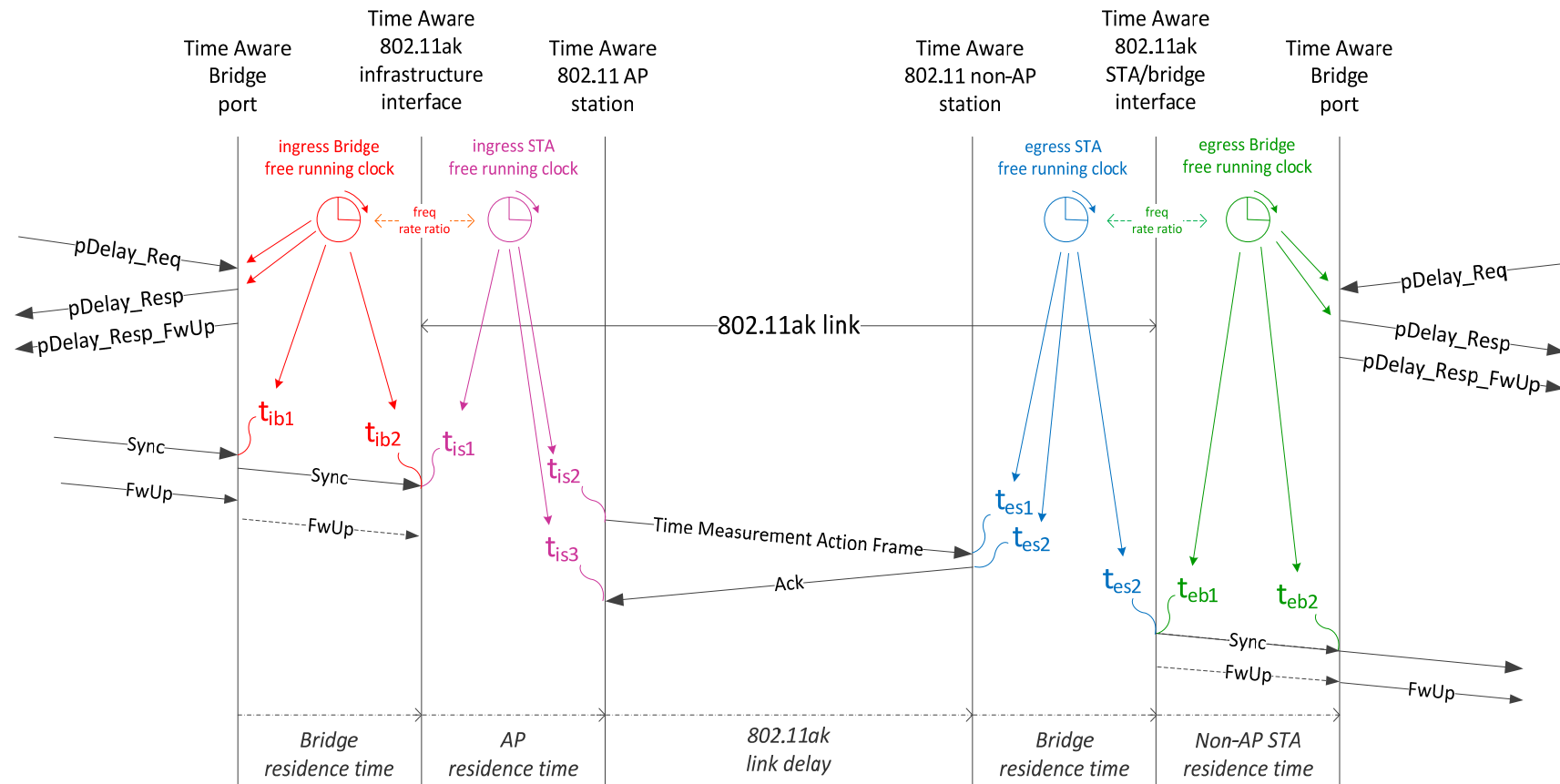
- Residence time of the 802.1Qbz bridge includes 2 time domains: 802.1Qbz bridge and 802.11

- Option 1: Bridge and STA clocks are synchronized

- Option 2: Bridge and STA clocks are independent free running clocks:
  - Sync messages must be timestamped at the "Infrastructure" and "STA/Bridge" interfaces
  - Timestamping is identical to the timestamping at the portal interface
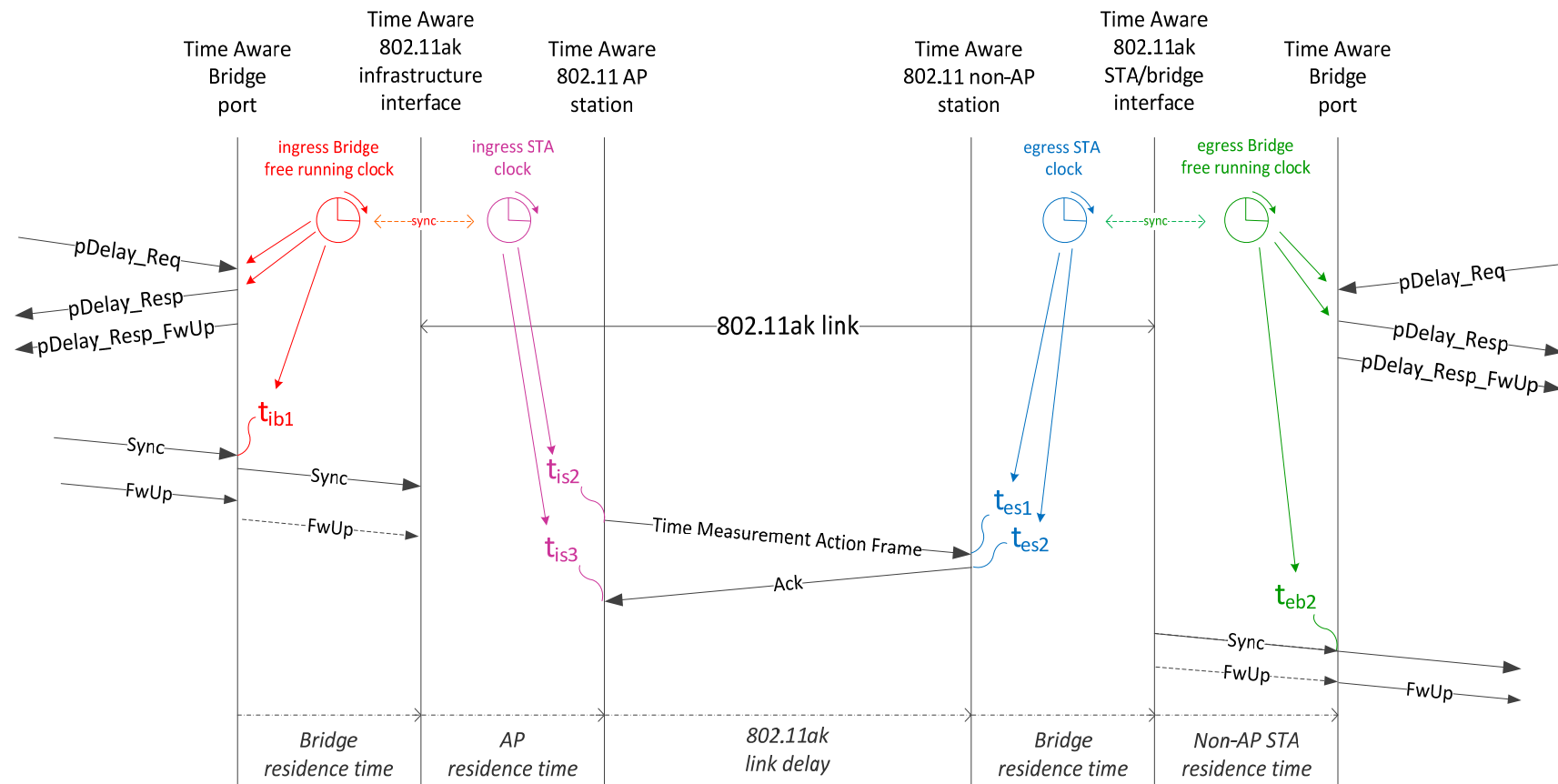
802.1Qbz / 802.11ak Sync Msg Timestamping (1)

- Case #1 : Bridge & STA free running clocks

- Case #2 : Bridge & STA clocks are synchronized

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Thank You

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