IEEE 1914 NGFI

Partial Timing Support (PTS) in NGFI

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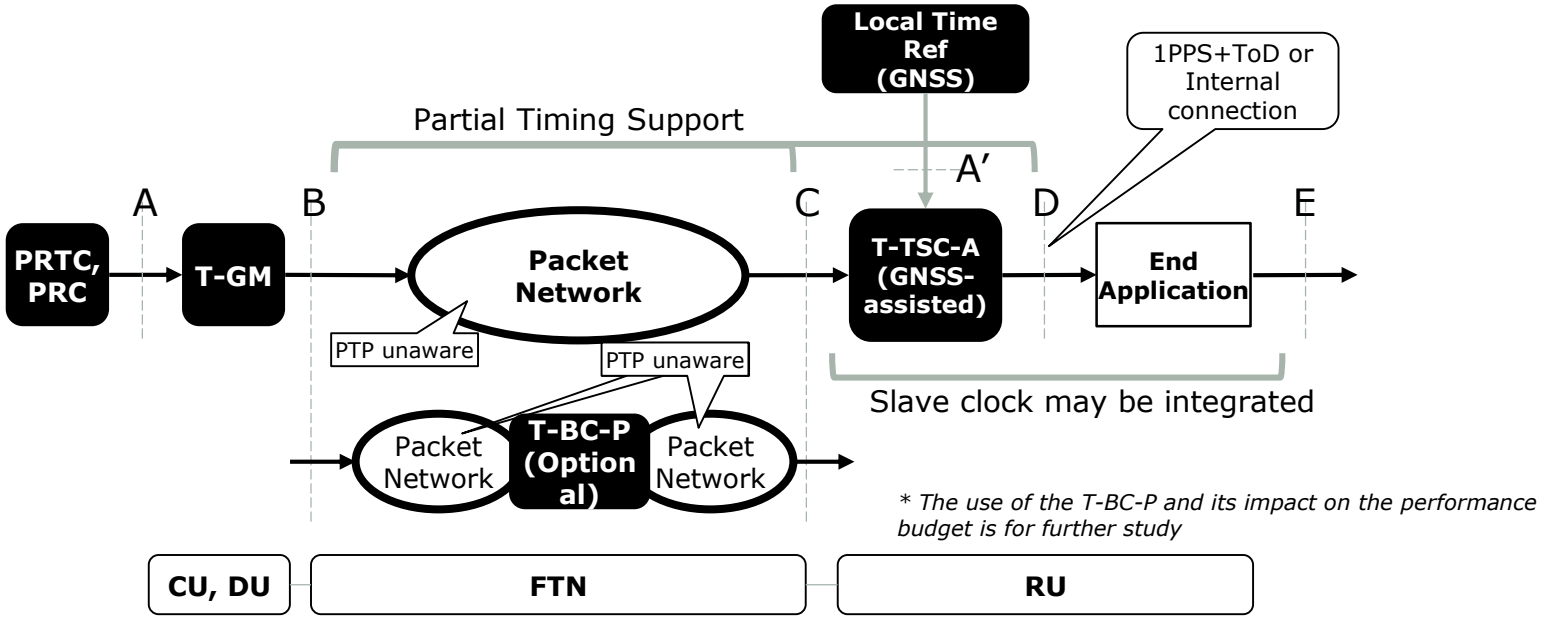
PTS requirements in IEEE P1914.1

- IEEE P1914.1/D3.0 has such requirements in section 8.5.2 and 9.3.1:
  - In section 8.5.2 (NGFI Requirements):
    - *One of the following PTP profiles shall be used for NGFI network time distribution, with the optional exceptions that are listed henceforth:*
      - ***a) ITU-T G.8275.1 PTP Telecom Profile** for Phase/Time Synchronization with Full Timing Support from the Network.*
      - ***b) ITU-T G.8275.2 PTP Telecom Profile** for Phase/Time Synchronization with Partial Timing Support from the Network.*
  - In section 9.3.1 (FTN Requirement):
    - *For packet-based time distribution, an FTN shall support at least one of the following PTP profiles, with the optional exceptions that are listed henceforth:*
      - ***a) ITU-T G.8275.1 PTP Telecom Profile** for Phase/Time Synchronization with Full Timing Support from the Network.*
      - ***b) ITU-T G.8275.2 PTP Telecom Profile** for Phase/Time Synchronization with Partial Timing Support from the Network.*

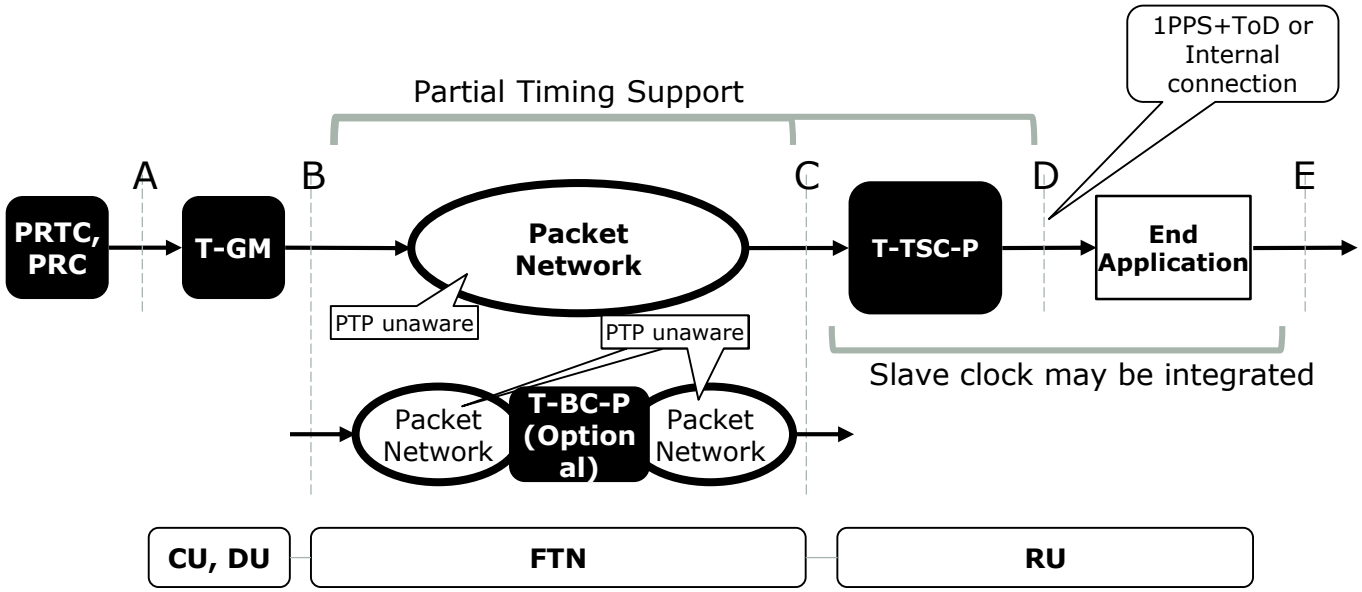
Partial Timing Support (PTS) (1 of 2)

- Per G.8271.2, PTS is composed of two cases:
  - Assisted Partial Timing Support (APTS)
    - PTP is used as a backup timing source to a local timing reference (e.g., PRTC+GNSS) for durations up to 72h. It is not intended to use PTP as the primary timing source



Partial Timing Support (PTS) (2 of 2)

- Partial Timing Support (PTS)
  - PTP is used as the primary source of time to the end application.



** The use of the T-BC-P and its impact on the performance budget is for further study*

Why PTS or APTS?

- Compared with the solution of GNSS populated at every eNB, PTS/APTS can solve GNSS antenna line of sight (LoS) problem, especially for the deployment in “urban canyon”

- Compared with deploying new equipment with T-BC embedded, PTS/APTS can support time/phase distribution in existing packet network without PTP support , which avoids an onerous network investment cycle

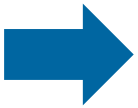
- Compared with deploying distributed (lite) PRTC, APTS can provide higher (holdover) performance when the PRTC loses accurate GNSS connectivity

PTS(APTS) vs. FTS

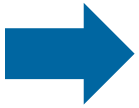
- Compared with the solution of GNSS populated at every eNB, PTS/APTS can solve GNSS antenna line of sight (LoS) problem, especially for the deployment in "urban canyon"

- Compared with deploying new equipment with T-BC embedded, PTS/APTS can support time/phase distribution in existing packet network without , which avoids an onerous network investment cycle

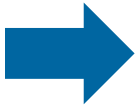
- Compared with deploying distributed (lite) PRTC, APTS can provide higher (holdover) performance when the PRTC loses accurate GNSS connectivity



- FTS can provide same feature to deliver time/phase synchronization over network



- According to G.8271.2, PTS currently only considers the applications corresponding to the class 4 (1.5us)
- FTN is a time-sensitive network. PTS can't provide determinative time sync performance, as its performance heavily relies on the PDV performance of the PTP-unaware Nes
- FTS has well defined noise model in each node (cTE, dTE) and formula to calculate accumulated noise of a FTS clock chain at network limit (RU input). This can provide guarantee performance in time/phase (for all classes) and frequency error.

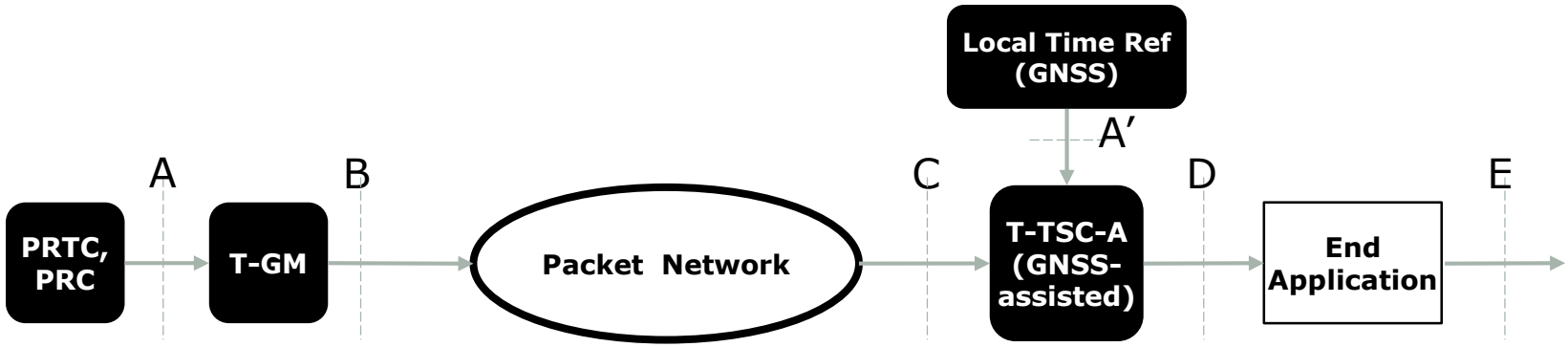


- It also relates to the PRTC design, which supposes to have secondary time reference or freq reference input as backup

Network Limits defined for PTS (G.8271.2) (1 of 2)

- The network limits specified in G.8271.2 are for small, well-controlled networks (e.g., in-building or last-mile network segments), which can guarantee that the stringent PDV and asymmetry network limits are met.
- The necessary clock specifications for PTS are all for further study (G.8273.4 is in development in Q13/SG15), and target for class 4 in backhaul.
- The limits at the refer point C given in G.8271.2 represent the maximum permissible levels of phase/time error and noise, per the applications corresponding to the class 4 listing in Table 1 of [ITU-T G.8271], i.e. +/-1.5us

Network Limits defined for PTS (G.8271.2) (2 of 2)



Reference point A and A':
Reference point B (integrated):

- max|TE| ≤ 100 ns

** The network limit at point A' may not be applicable in all cases*

Reference point C:
APTS (Type I):

- Peak-to-peak pktSelected2wayTE **<1100 ns**
- Selection window = 200 s
- Selection percentage = 0.25%
- Selection method: percentile average packet selection

PTS (Type I):

- max|pktSelected2wayTE| < **1100 ns**
- Selection window = 200 s
- Selection percentage = 0.25%
- Selection method: percentile average packet selection

Reference point D:
APTS (Type I):

- max|TE| ≤ **1350 ns** ⌘

PTS (Type I):

- FFS

⌘ This requirement is only applicable in case of T-TSC-A external to the end application

Conclusions and Proposals

- G.8275.2 is not designed for more stringent time/phase synchronization. Current relevant ITU recommendations are for the applications corresponding to the class 4
- The PTP-unaware part of the network using PTS requires well-controlled low levels of packet delay variation (PDV) and asymmetry
- Lack of specification of PTS clocks leads to indeterminate time/phase performance during the period of network planning
- PTS/APTS would not provide enough accuracy required by Category A+/A/B
- Reconsider the requirement of support of PTS in IEEE 1914.1
- At least to add notes under the requirement to restrict the PTS use case, for example, 3G and 4G backhaul