

TAE Requirements

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Next Generation Fronthaul Interface
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TAE Requirements

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Outline

- Liaison Updates
- Suggested Network TAE Targets
- Problems Defining Nodal TAE Requirements
- How Can We Define the Nodal Requirements?
- How Can We Get the Values?
- Motions

Liaison from P1914 to ITU-T SG15/Q13

- Next Q13 meeting is in October. Our request to see C-259 will be dealt with at that meeting.
- SG15 member and new P1914 member, Tim Frost (Calnex), indicated that more statistically-significant analyses is to be done for the C-259 scenarios

Liaison Response from 3GPP to ITU

- Sept 2017 liaison response from 3GPP to ITU-T SG15 stated that $\pm 1.5\mu\text{s}$ is still the common TAE requirement for 5G radios. This value is the same as for 4G radios.
- The TAE requirements for Carrier Aggregation and CoMP (and other enhanced communication methods) are still being studied.

Suggested Network TAE Targets

Given:

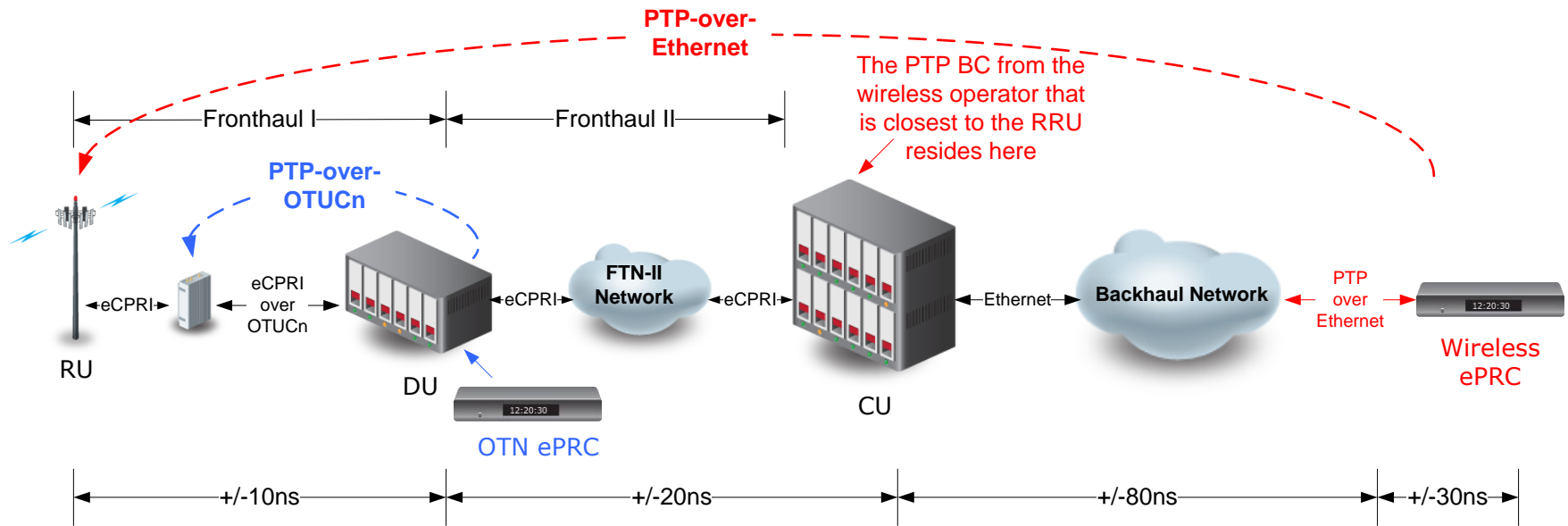
- the lack of new progress in 3GPP
- that all current views for 5G TAE are the same as those for 4G (CPRI, 802.1CM, discussions in ITU)
- that location services have the most stringent requirements we have yet seen

we should work with the following TAE requirements (values given are for the radio):

- $\pm 10\text{ns}$ from closest common BC, for location
- $\pm 32.5\text{ns}$ from closest common BC, for MIMO and Tx diversity
- $\pm 65\text{ns}$ from closest common BC, for intra-band contiguous carrier aggregation
- $\pm 130\text{ns}$ from closest common BC¹, for intra-band non-contiguous and inter-band carrier aggregation
- $\pm 1500\text{ns}$ from any PRTC or ePRTC, for generic services

¹ As specified by CPRI org. However, some standard bodies indicate that this TAE is relative to a common PRTC/ePRTC.

Stressful Timing Distribution Example



Timing Path:

1. Wireless operator's ePRTC provides ToD using PTP-over-Ethernet
2. Wireless operator's frequency is carried by SyncE
3. In this example, FTN-II Network uses PTP Transparent Clocks
4. Wireless operator's PTP and its SyncE are tunneled through OTN transport network with little effect on its performance
5. The RU's ToD is derived from PTP messages and the clock is derived from SyncE
6. Radio data is given to RU at the specified "presentation time"

Problems Defining Nodal TAE Requirements

- Many factors affect system performance:
 - ePRTC vs PRTC
 - Number of hops
 - Fiber asymmetry (unidir vs bidir, wavelengths) and compensation
 - Availability of SyncE or eSyncE
 - Full or partial network support for PTP
 - Static and dynamic timestamping errors
- Carriers build their networks differently
- Specifying nodal/device performance requirements may be incompatible to or overly-stringent for each network implementation

How Can We Define Nodal Requirements?

- Not too difficult for single-hop scenarios:
 - Fiber asymmetry (unidir vs bidir, wavelengths) and compensation
 - Model single-hop SyncE or eSyncE wander
 - Static and dynamic timestamping errors
- Need to limit options for multi-hop scenarios:
 - Only 10 hops and 20 hops?
 - All have eSyncE?
 - Full network support for PTP? Definitely
 - Partial network support for PTP (i.e. use GNSS)? Probably

How Can We Get the Values?

- Use ITU-T SG15/Q13:
 - Continuation of C-259 simulations
 - Request C-259-like simulations with our selected scenarios
 - Request ITU-T define a clock class with appropriate performance for 1914.1 network
- Run our own simulations or thought-experiments:
 - Accurately modeling the behaviour of SyncE/eSyncE wander through many hops may be difficult. This is something the ITU-T has in their portfolio.
 - Model ToD recovery without SyncE/eSyncE, with full network support for PTP, with a simple ToD recovery algorithm using appropriate bandwidth (e.g. 0.1Hz), and with $\pm 1\text{ns}$ timestamping uncertainty

Motion # _____

- Limit multi-hop scenarios to the following:
 - 10 hops and 20 hops
 - All have eSyncE
 - Full network support for PTP
 - Partial network support for PTP (i.e. use GNSS)
- Mover: Richard Tse
- Secunder:
- Yes:___ No:___ Abstain:___

Motion # _____

- Request ITU-T to run statistically significant simulations (as per C-259) for our selected multi-hop scenarios.
- Mover: Richard Tse
- Seconder:
- Yes:___ No:___ Abstain:___

Motion # _____

- Perform our own simple modeling, assuming there is full network support for PTP and no SyncE/eSyncE
- Mover: Richard Tse
- Secunder:
- Yes:___ No:___ Abstain:___