In Service Synchronization Monitoring and Assurance

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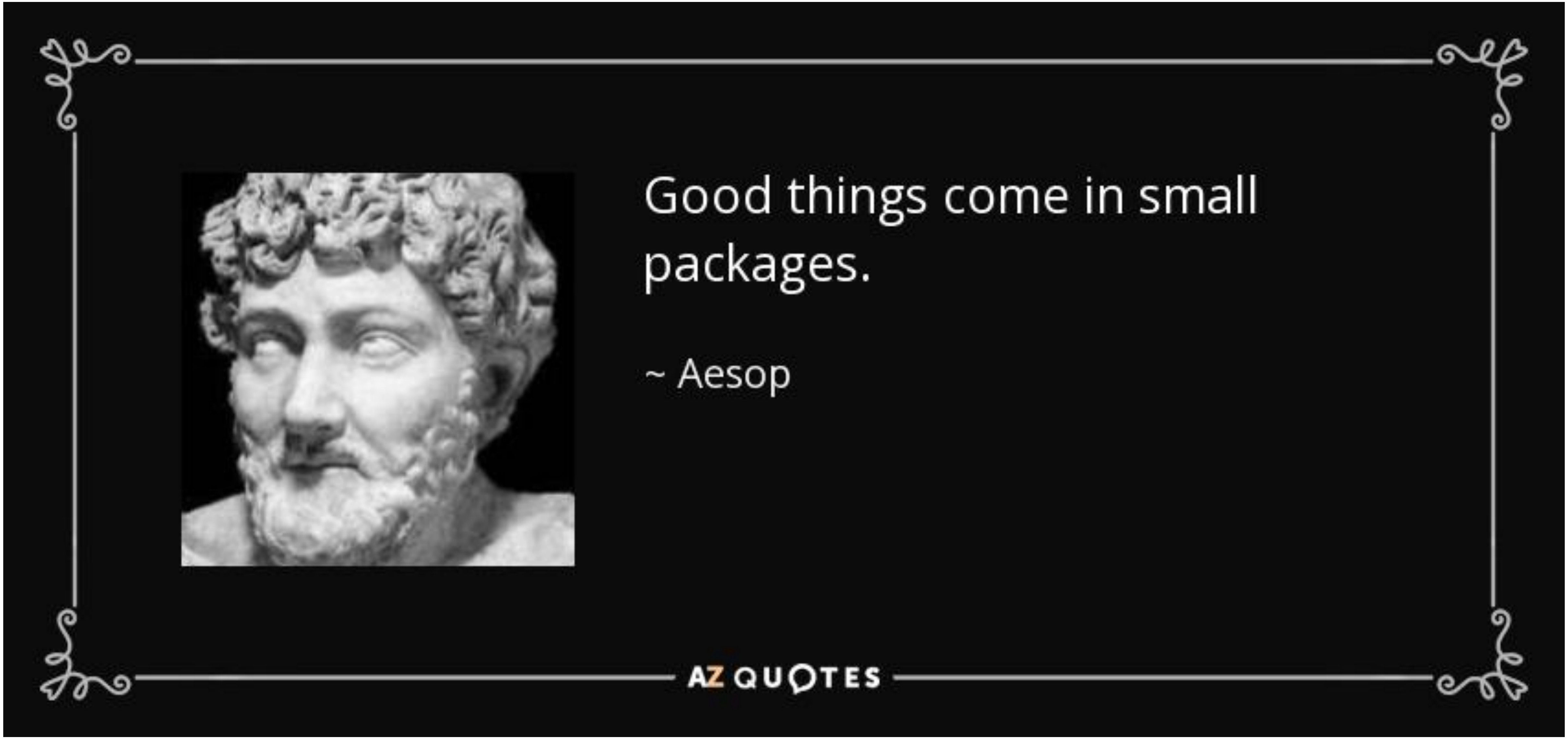
Good things come in small packages.
~ Aesop
AZ QUOTES

Why „In Service“ Sync Assurance is needed ?

Challenges

- Large number of application are highly dependent on accurate synchronization
- Making sure synchronization is working as designed is not trivial task
- Networks are dynamic- PDV, asymmetry and environmental conditions can affect the Synchronization quality
- Ways to ensure proper synchronization should be integrated into Sync distribution/delivery functions or accompanied by cost effective Sync assurance tools
- Lab test equipment is too expansive for “in service” installation in multiple locations $ $ $
- Other aspects such as power consumption and OSS should also be taken into consideration

In service monitoring sync critical component in NG networks

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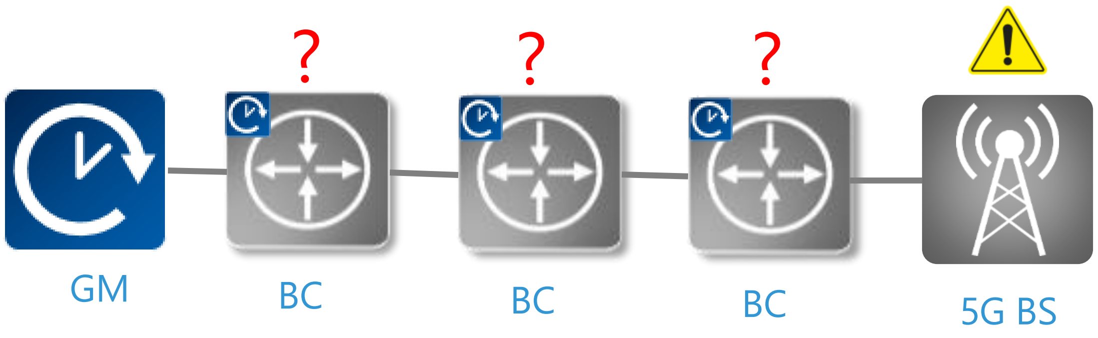
Example from telecom network

Customer use case : 5G TDD BS

- 5G TDD base station is down due to synchronization related issue (alarms in the BS)
- Grandmaster look healthy – seems to be issue in the sync distribution
- Chain of boundary clocks – which one is faulty?



Challenges sending technician on site

- Which site ?
- High cost : $ $ $
  - Cost of labor (technician)
  - Windshield time
  - Cost of test equipment
- The high-cost leads to limited monitoring (limited time/limited coverage)

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The solution – Miniature in service Sync Probe

Accurate	• Nano second accuracy
Cost effective	• Low CAPEX and OPEX
Low power/footprint	• Low power and zero footprint in a rack
Managed remotely	• Managed and operated securely and remotely from centerlized location

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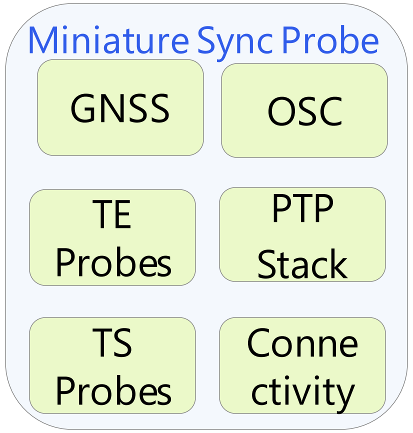
Cost effective sync probe – separation of HW from SW

Minimal HW needed for effective monitoring:

- High accuracy reference (GNSS)
- Time error measurement (both physical layer measurements and PTP timestamping measurements)
- Good oscillator (OCXO)
- PTP stack
- Secured network connectivity (SSH , SCP)



All the rest can be done in the “cloud”

- Measurements aggregation and concatenation
- Analysis and Display (e.g. TE , MTIE , TDEV , two-way packet selection TE , etc.)
- Reporting

Latest SoC technologies enable miniature sync prob

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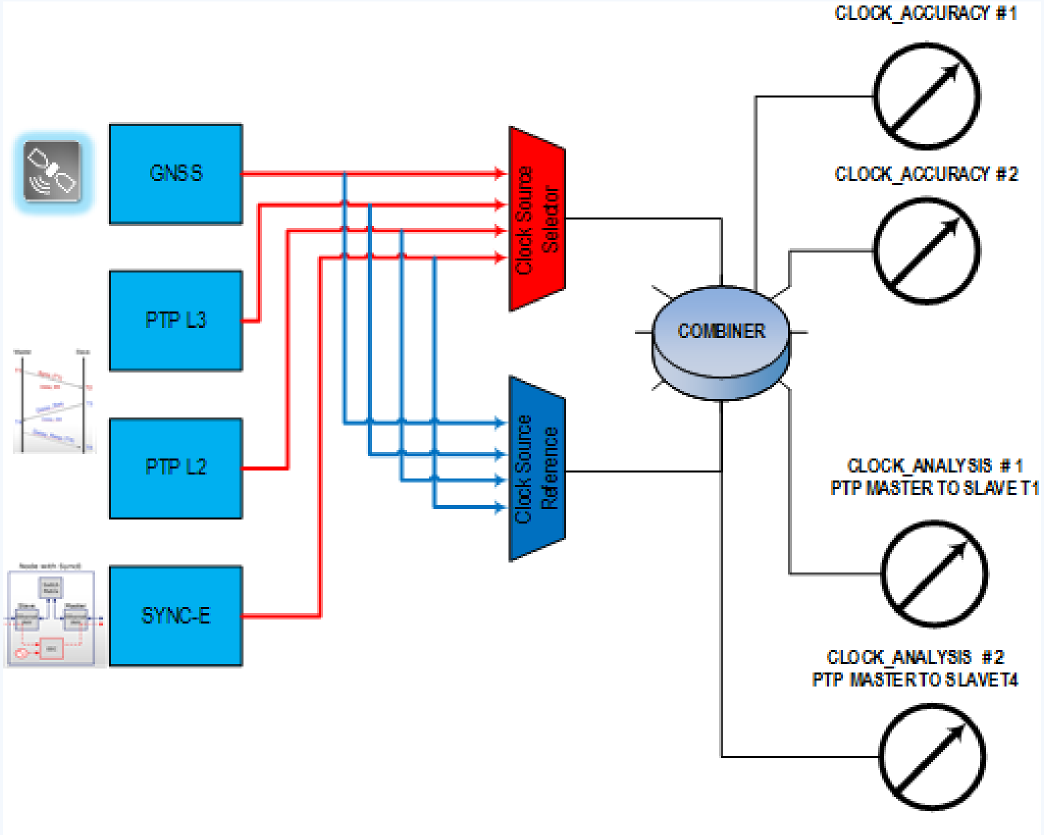
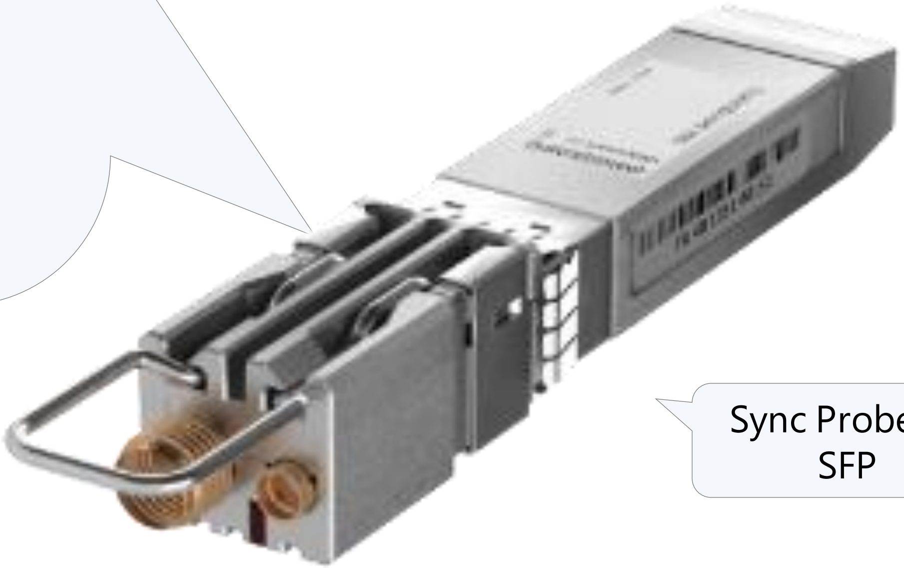
Example: Miniature Sync probe using SoC

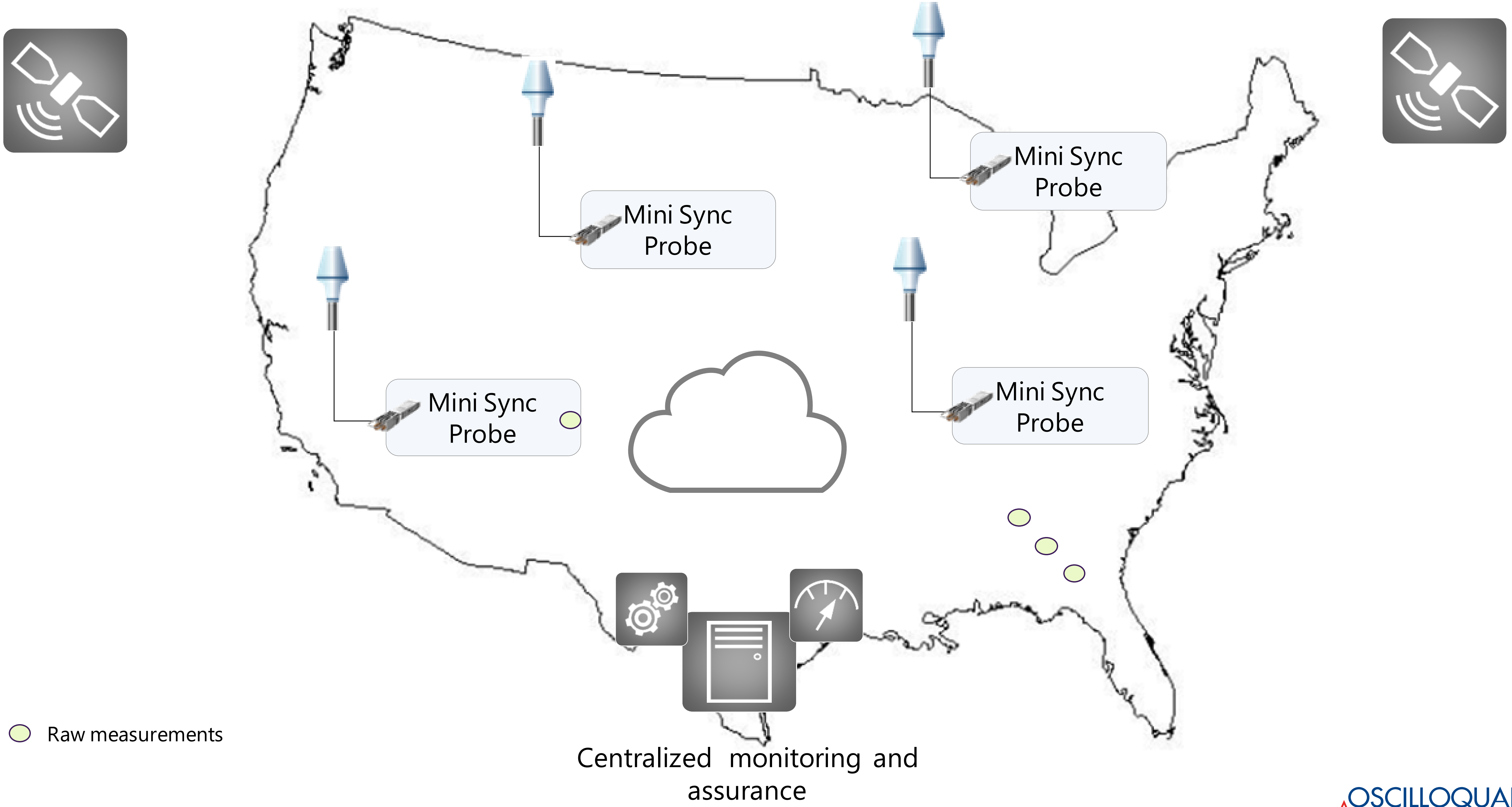




Sync Probe on SFP

GNSS/PTP/SYNC-E/PPS/CLK as source
GNSS/PTP/SYNC-E/PPS/CLK as reference

Centralized in service Sync monitoring and assurance



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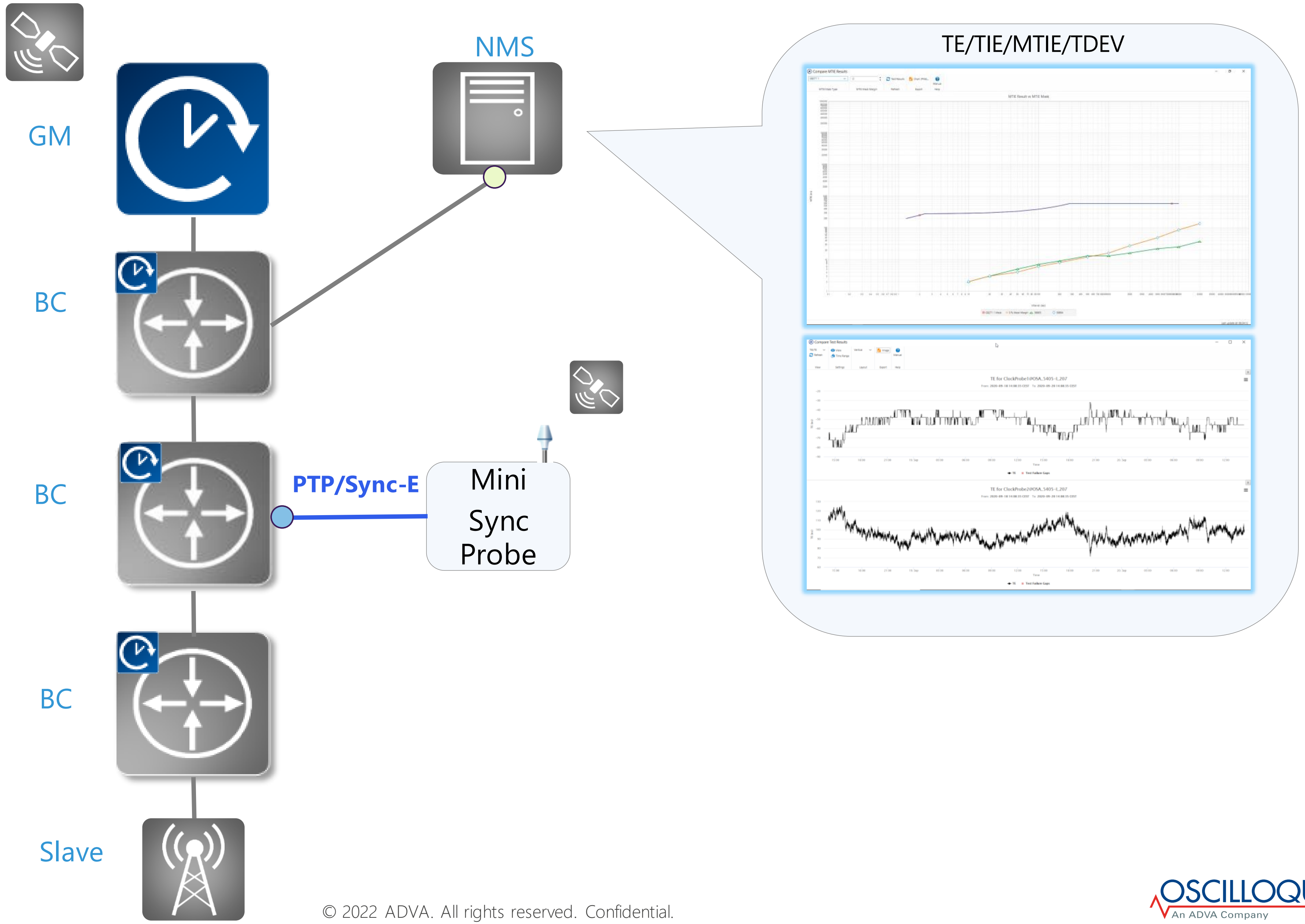
Probing a boundary clock



PTP

Raw measurement

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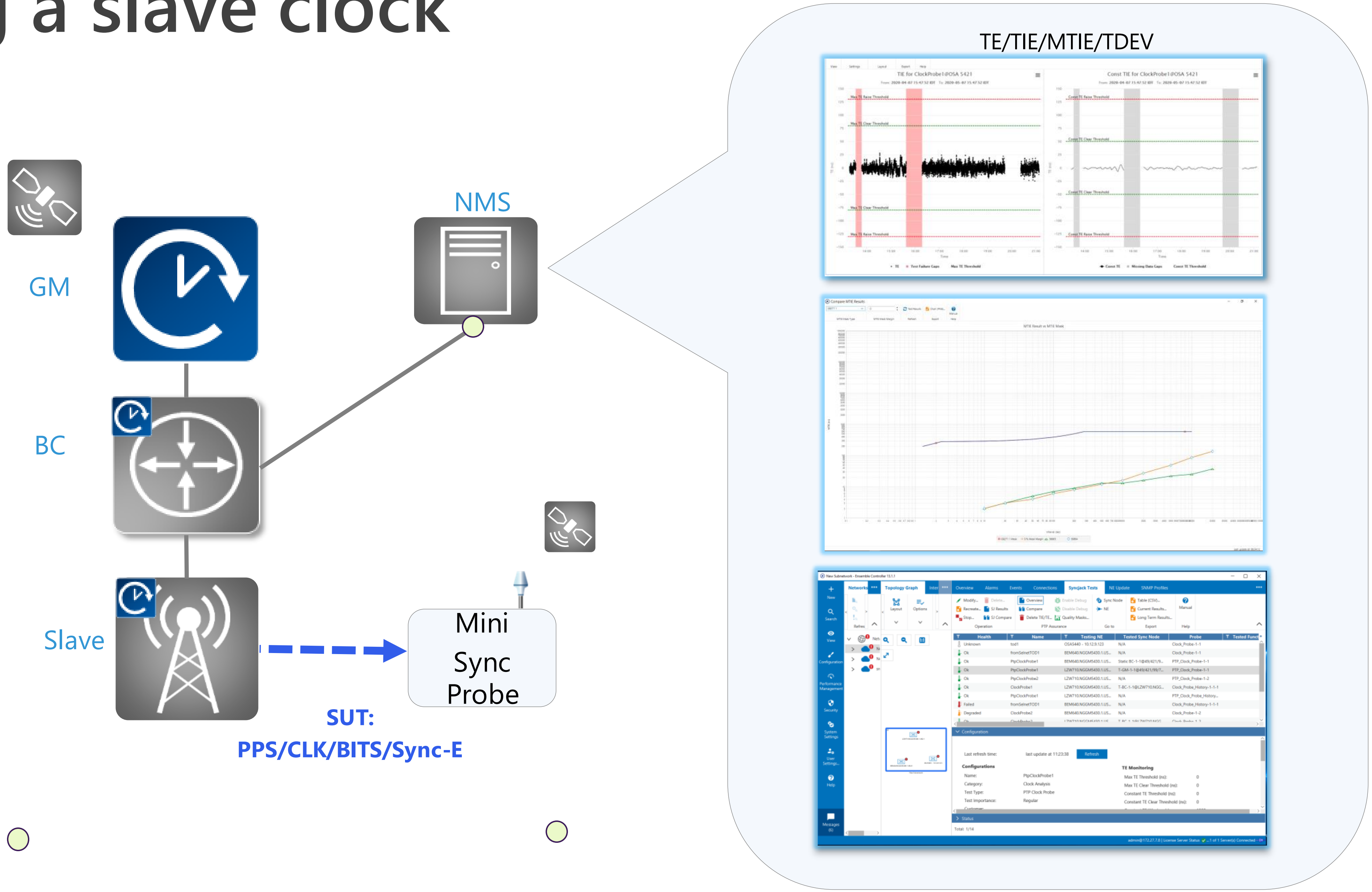
Probing a slave clock



Raw measurement

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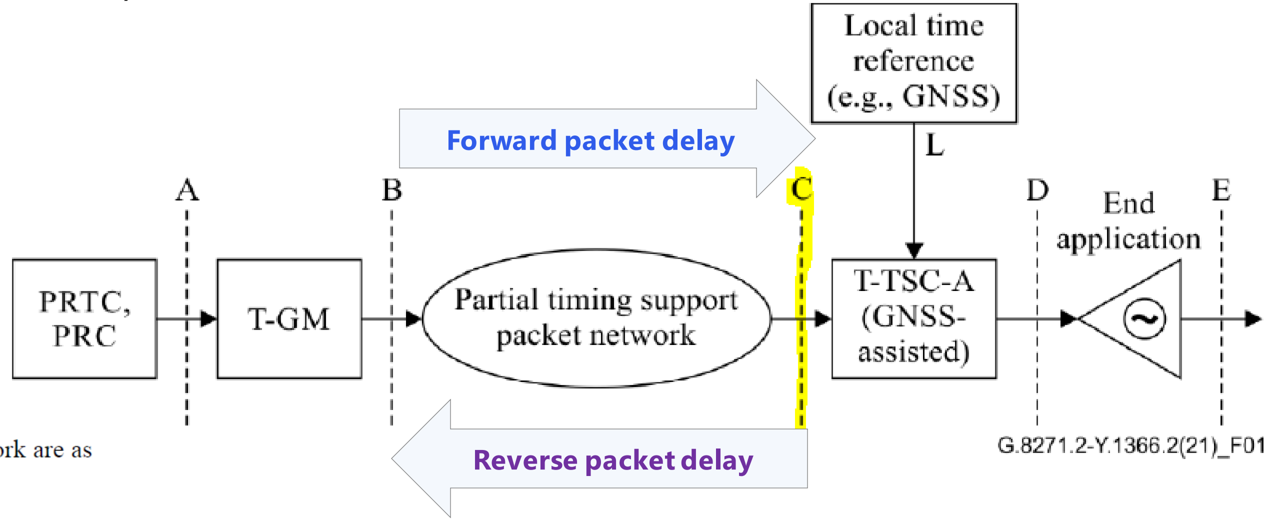
APTS Network limits – ITU-T G.8271.2

Use case

- G.8271.2 specify the maximum permissible levels of phase/time error and noise at interfaces within a packet network in charge of distributing phase/time synchronization per the applications corresponding to the Class 4 :1.5usec (listed in Table 1 of ITU-T G.8271).



7.3.1.1 Type I network limit

The network limit value and the metric processing parameters that apply for a type I network are as follows:

– Peak-to-peak pktSelected2wayTE < 1100 ns
– Selection window = 200 s
– Selection percentage = 0.25%
– Selection method: percentile average packet selection (see clause I.3.2.2 of [ITU-T G.8260])
– Window step size: ≤ 20 s

How to test network limits ongoingly ?

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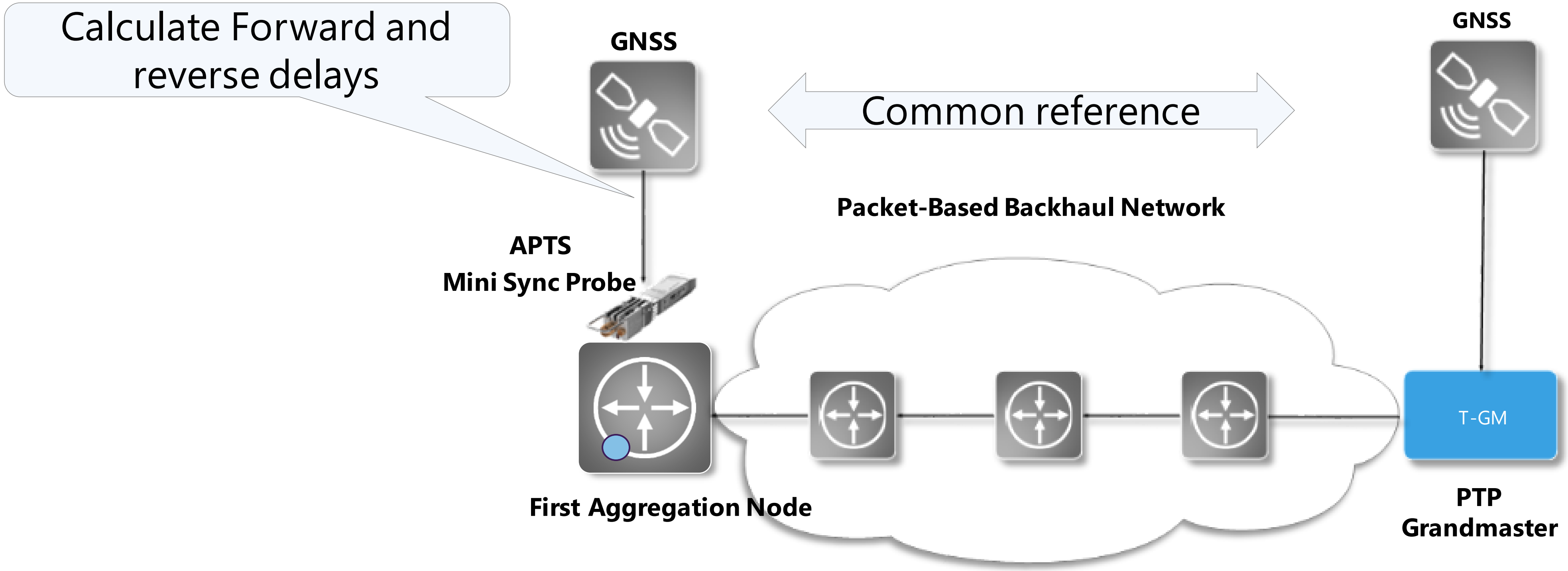
APTS/PTS – checking network limits with Sync probe

- Sync probe measure the network forward and the reverse delays independently
- Delay raw measurements are sent to NMS
- The NMS calculate the pktSelected2wayTE and compare it to the required threshold (e.g. 1100nsec)



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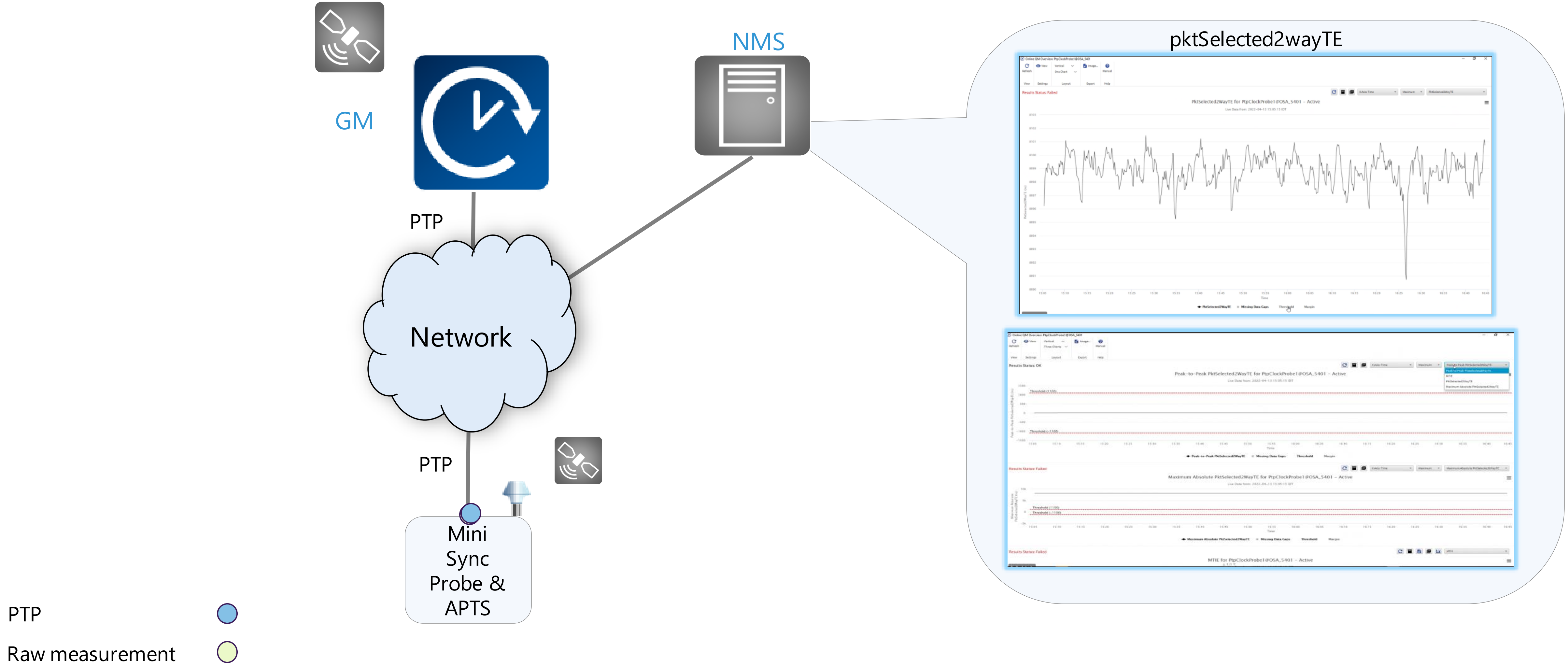
Probing the network



Summary

- In-service sync assurance is critical part of next generation networks which depends on high synchronization accuracy
- Latest SoC technologies enable miniature sync probes
- Cost effective miniature sync probes allow to monitor the network at scale from centralized network management system
- Such probing is critical to identify and troubleshoot sync related problems
- Such solutions are commercially available

Good things do come in small packages!

Thank you

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