

Standardization in ITU-T Study Group 15 and Q13/15

Networks, Technologies and Infrastructures for Transport,
Access and Home:
Network synchronization and time distribution performance

Stefano Ruffini (Q13 Rapporteur)
Silvana Rodrigues (Q13 Associate Rapporteur)

WSTS 2022 (9-12 May 2022), Denver (Colorado)



Study Group 15 (SG15) mandate

Confirmed at the last WTSA-20 (1-9 March 2022) as Lead Study Group on :

- access network transport
- home networking
- optical technology

✓ The **LARGEST** and **MOST PRODUCTIVE** group in ITU-T with broad, global industry participation

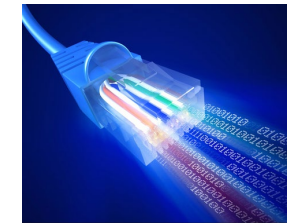


Home Networking



Smart Grid

High Speed Access



Transport Technologies

The Optical Transport Network



SG15 Working Parties (WPs)

- **WP1/15**: Transport aspects of access, home and smart grid networks
- **WP2/15**: Optical technologies and physical infrastructures
- **WP3/15**: Transport network characteristics

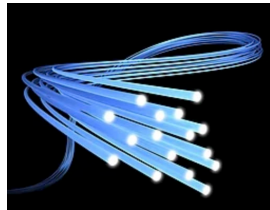
WP1 – Broadband Access

G.fastback

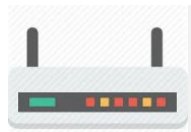
Multi-Gigabit copper backhaul

MGfast

Next generation
copper access 5-10 Gbps



Optical systems for access networks
Bidirectional P2P
XGS-PON, NG-PON2
50G-PON, WDM-PON



Continue collaboration with



G.RoF

PON support for mobile
front/backhaul, Radio over fiber

G.Hn

G.hn and G.hn2 home
networking over indoor
phone, power, and coax
wires >2 Gbps

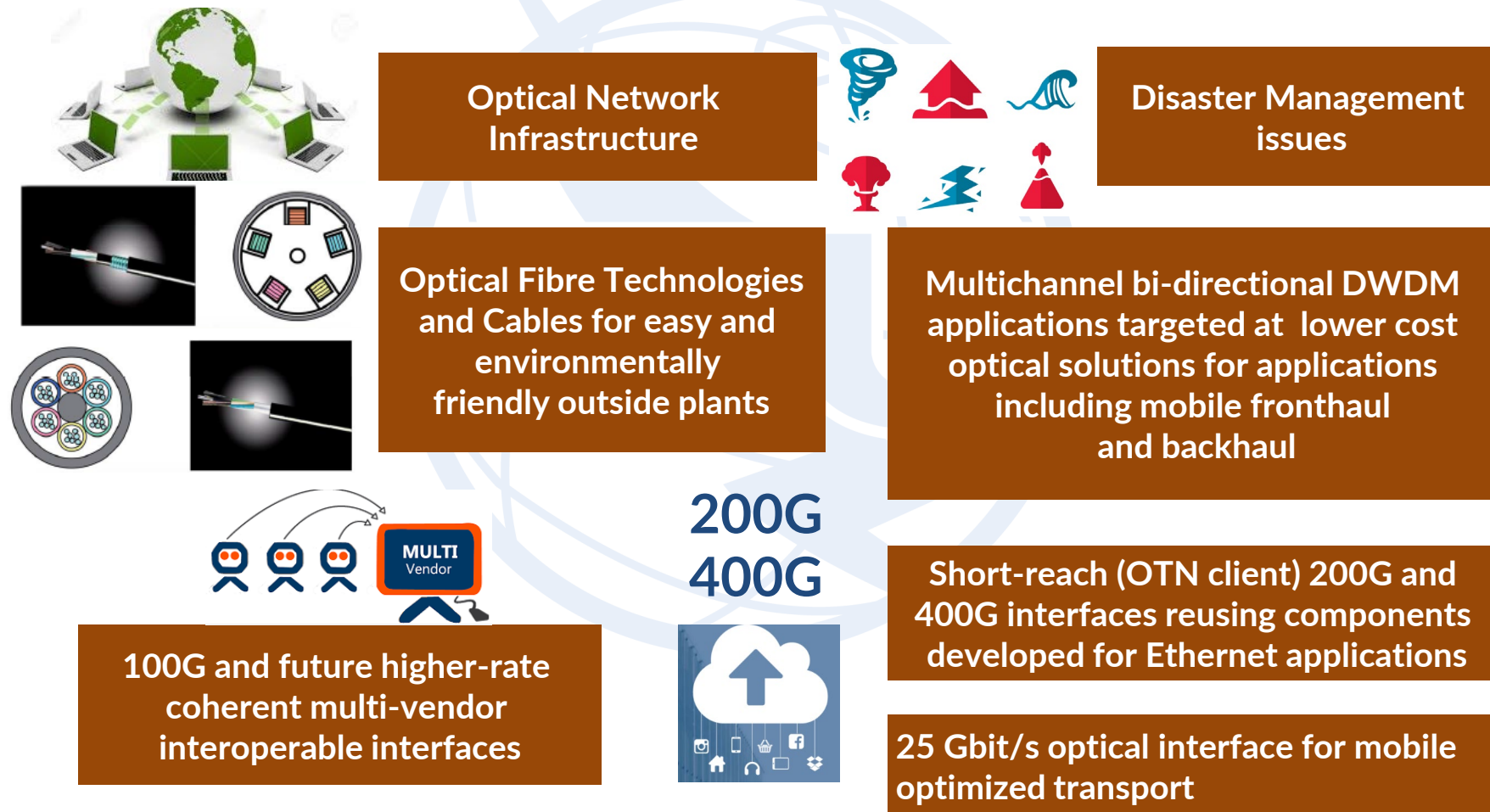
Fiber networking inside
the premises

Free space optical
home networking

Powerline
communication
(PLC)



WP2 – Optical Technologies



WP3 – Optical Transport Networks

5G

Transport and synchronization supporting 5G mobile fronthaul and backhaul

MTN

G.83xx (metro transport network) for 5G optimized transport



Architecture and other Transport SDN Aspects

BEYOND 400G

New “B400G” OTN interfaces, including the use of coherent G.698.2 interfaces



Equipment & management specifications for OTN, Ethernet and MPLS-TP

Optical Transport Networks

Synchronization of packet Networks, MTN and future OTN networks, e.g., beyond 400G



Network survivability (protection and restoration)



Management aspects of control and transport planes



Core Information model enhancement for management of synchronization and optical media

List of Questions

Question Number	Question title	Status
1/15 (A/15)	Coordination of Access and Home Network Transport Standards	Continued
2/15 (B/15)	Optical systems for fibre access networks	Continued
3/15 (C/15) (former 18/15)	Technologies for in-premises networking and related access applications	Continued
4/15 (D/15)	Broadband access over metallic conductors	Continued
5/15 (E/15)	Characteristics and test methods of optical fibres and cables, and installation guidance	Continuation of Question 5/15 and part of Question 16/15
6/15 (F/15)	Characteristics of optical components, subsystems and systems for optical transport networks	Continued
7/15 (G/15) (former 16/5)	Connectivity, Operation and Maintenance of optical physical infrastructures	Continuation of part of Question 16/15 and Question 17/15
8/15 (H/15)	Characteristics of optical fibre submarine cable systems	Continued
10/15 (I/15)	Interfaces, interworking, OAM, protection and equipment specifications for packet-based transport networks	Continued
11/15 (J/15)	Signal structures, interfaces, equipment functions, protection and interworking for optical transport networks	Continued
12/15 (K/15)	Transport network architectures	Continued
13/15 (L/15)	Network synchronization and time distribution performance	Continued
14/15 (M/15)	Management and control of transport systems and equipment	Continued

WP 3



SG15 Meetings

- 2017-2021 Study Period
 - Geneva, 19 – 30 June 2017
 - Geneva, 29 January – 9 February 2018
 - Geneva, 8-19 October 2018
 - Geneva, 1 – 12 July 2019
 - Geneva, 27 January – 7 February 2020
 - “e-meeting”, 7-18 September 2020
 - “e-meeting”, 12-23 April 2021
 - “e-meeting”, 6-17 December 2021
- 2022-2024 Study Period*
 - Geneva, 19-30 September 2022
 - ...
- Interim Meetings, Correspondence activities, arranged by the Questions



Q13: Scope of the Question

- Network synchronization and time distribution performance

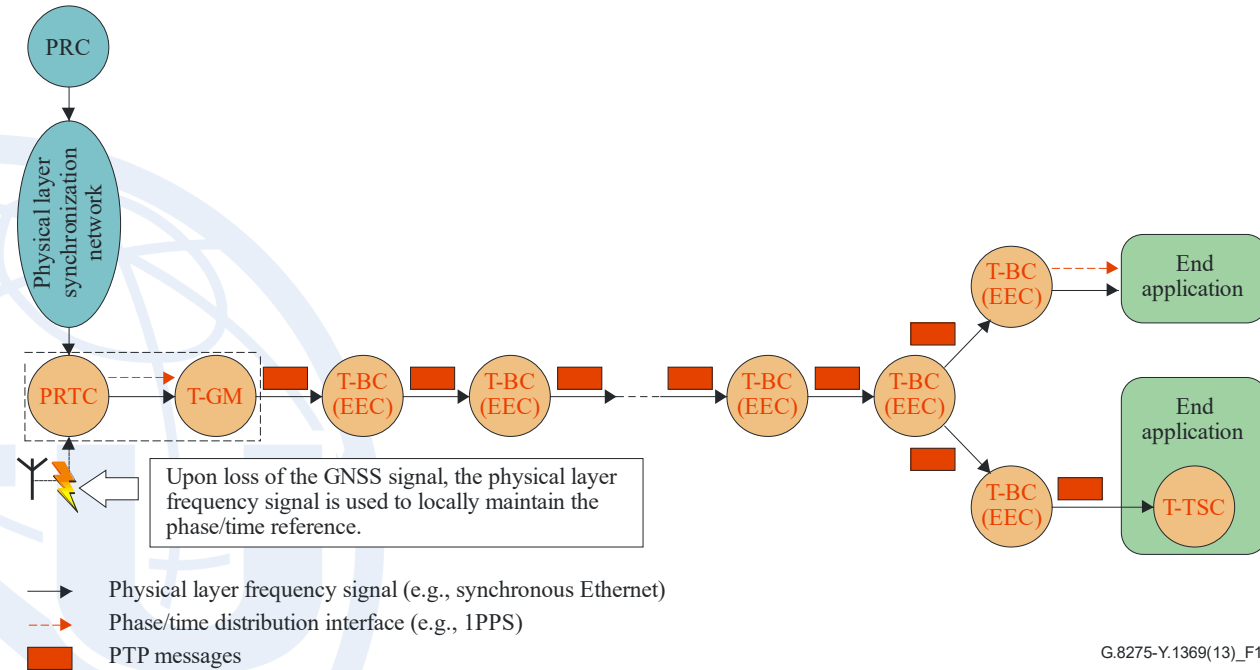
- Active since the 90s (when work on sync for SDH started in SG13)
- Networks Timing Needs (e.g., OTN, MTN)
- End Applications Timing Needs (e.g., 5G Base Stations)

- Distribution of Time-Phase and Frequency

- Methods (e.g., over physical layer, via packets, GNSS)
- Architectures
- Clocks
- PTP (IEEE 1588) profiles
- Performance, Redundancy, Reliability, etc.

- Networks

- Ethernet, IP-MPLS, OTN, xPON, MTN ...



G.8275-Y.1369(13)_F10

Cooperating with other Questions in SG15

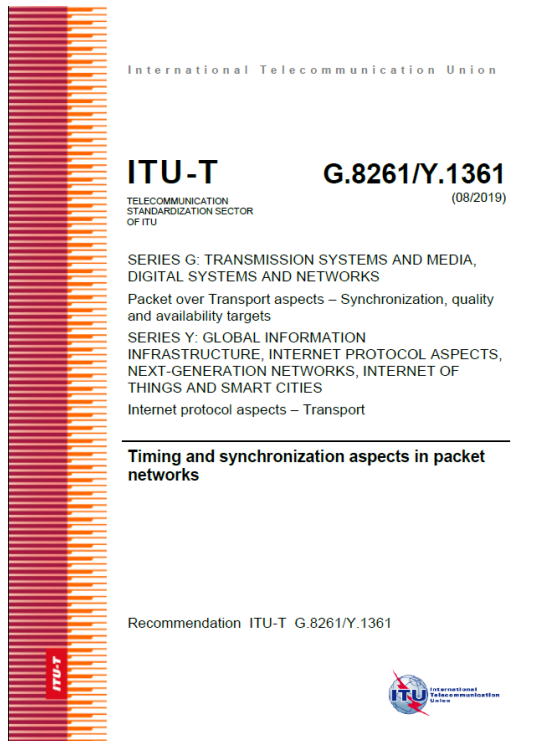
- Q11: sync for/over OTN , MTN;
- Q14: Sync Management;
- Q2, Q4: Sync in the access

.. and other SDOs (IEEE1588, 3GPP, O-RAN, etc.)



Outputs from Q13

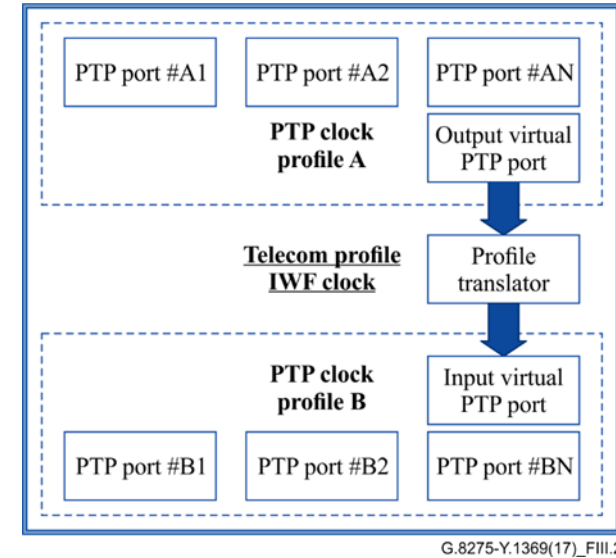
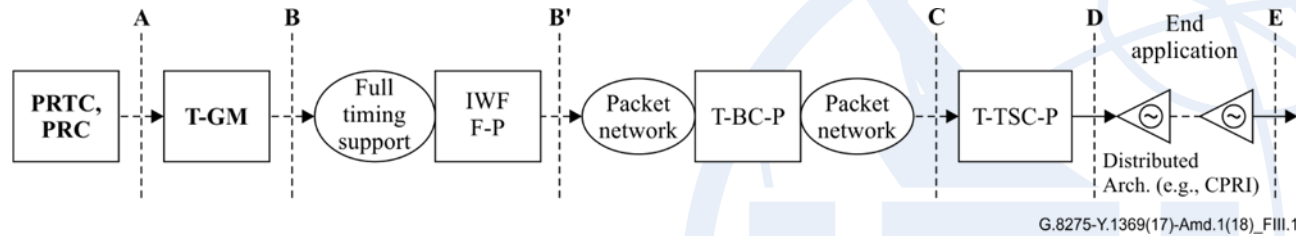
- «Historical» (G.803, G.810, G.811, G.812, G.813, G.823, G.824, G.825...);
- G.811.1 , enhanced PRC, recently released
- G.781, G.781.1 (Sync Layer Functions)



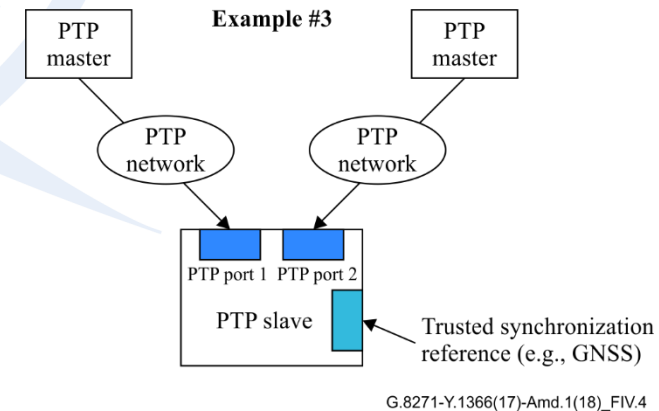
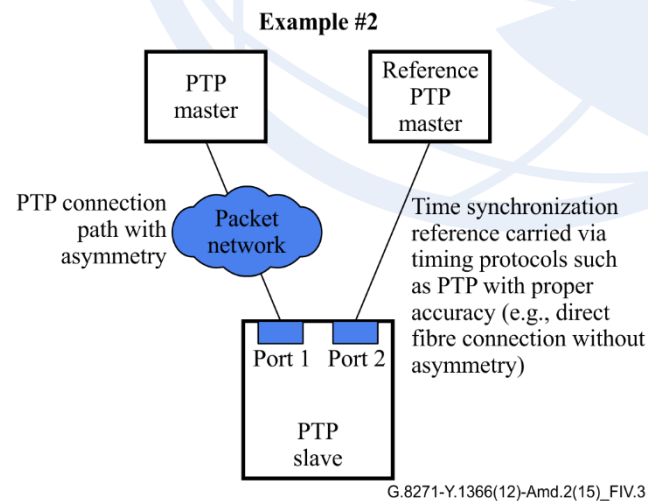
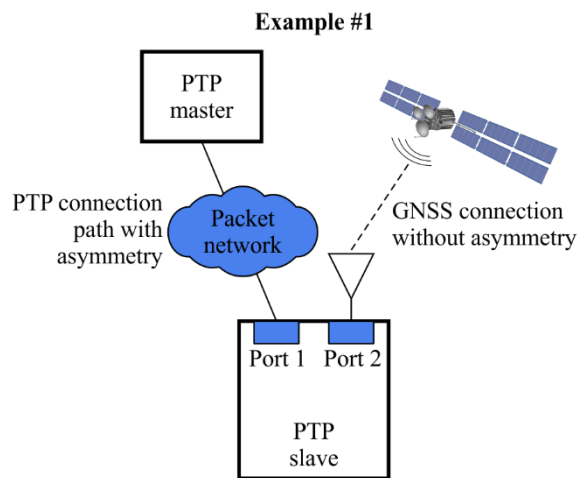
- G.826x series (distribution of **frequency synchronization**): *Network requirements, Clocks, PTP Profiles*
- G.827x series (distribution of **time synchronization**): *Network Requirements, Clocks, PTP Profiles*
- Supplements : G.Suppl65, G.Suppl68
- Technical Report: GSTR-GNSS

Ongoing Studies: PTP Profiles evolution

- PTP Profile evolution (e.g., IEEE1588-2019 added last year)
- Profile Interworking details recently added (G.8275)

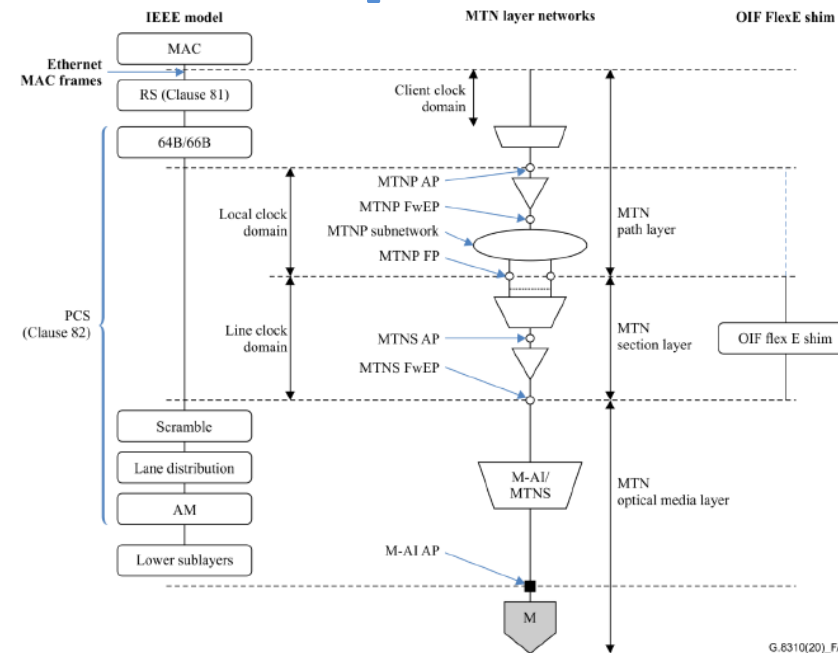
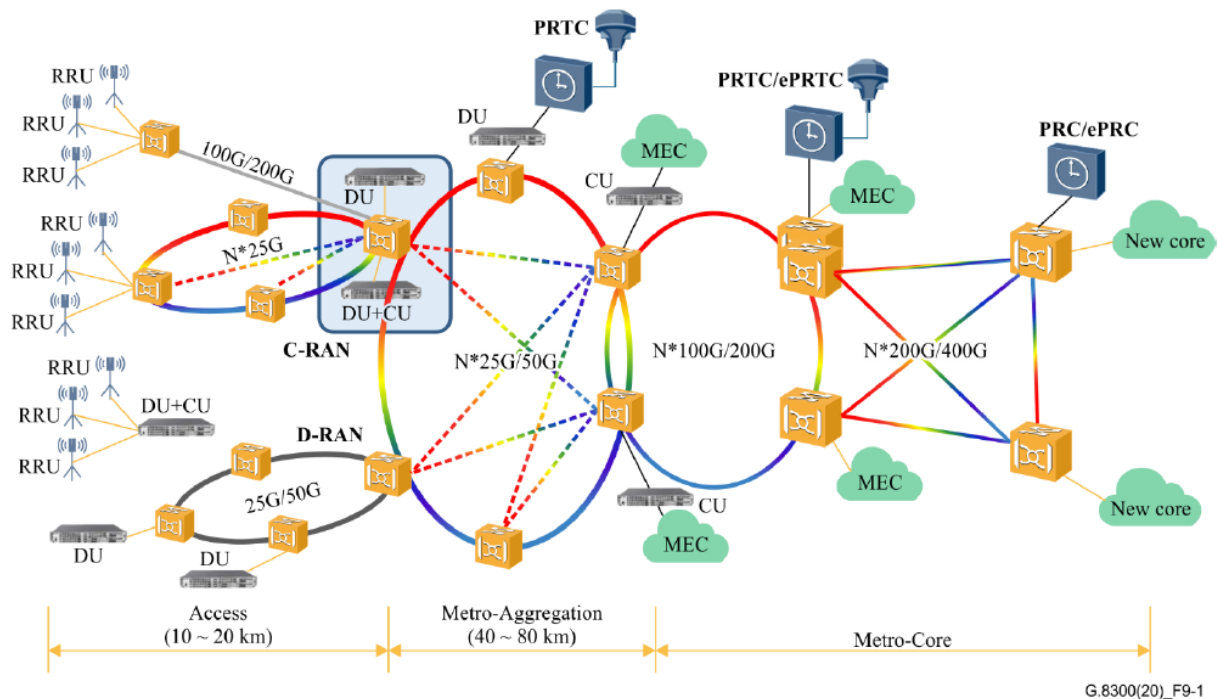


- PTP Monitoring:
 - Various options proposed or under study to address several use cases



Ongoing Studies: MTN (Metro Transport Network)

- Metro Transport Network: Layer one transport network for 5G Transport Technology specified in G.8312



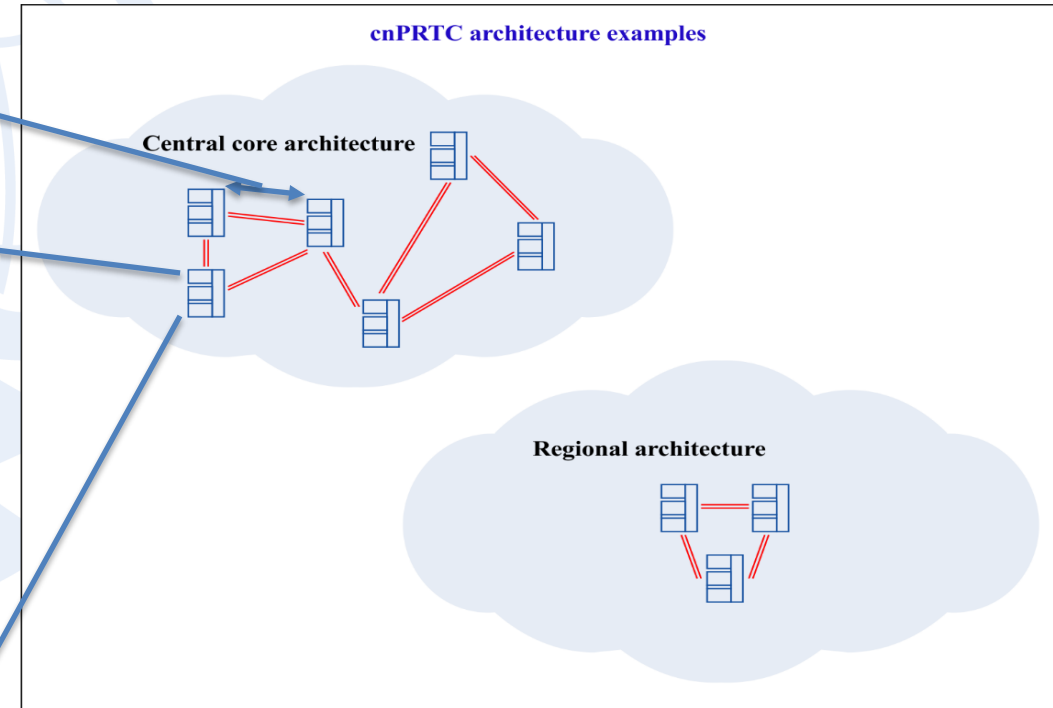
- *G.mtn-sync* under development, to address the related Sync aspects :
 - Sync Requirements
 - Sync Architecture
 - PTP and syncE distribution
 - Clocks
- Reference to existing Q13 Recommendations as applicable (e.g., PTP profile based on G.8275.1)



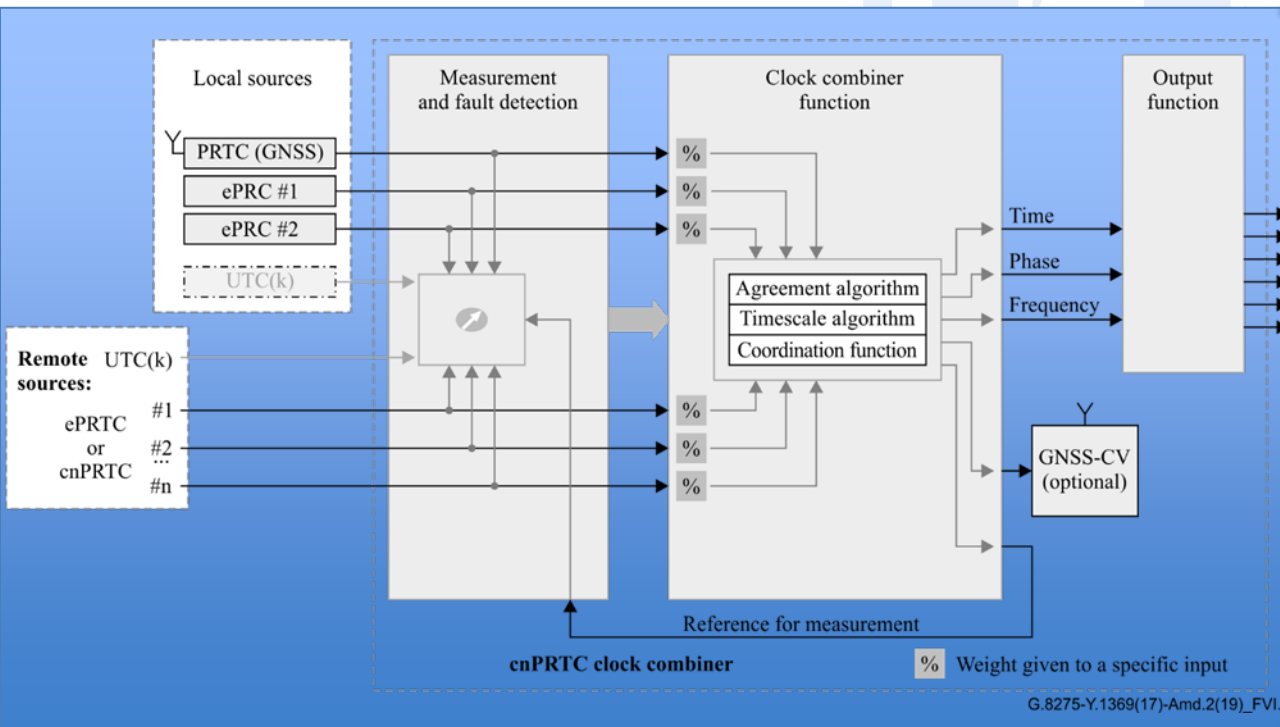
Ongoing Studies: cnPRTC

- cnPRTC (Coherent PRTC):
 - PRTCs network at the highest core or regional network level to maintain network-wide ePRTC time accuracy, even during periods of GNSS loss
- Network Requirements
- Methods (high accuracy profile?)
- Clock Recommendation (G.8272.2)

High-accuracy time transfer class	Maximum absolute time error – $\max TE_L $ (ns)
A	5 ns
B	1 ns



G.8275-Y.1369(17)-Amd.1(18)_FV1.1



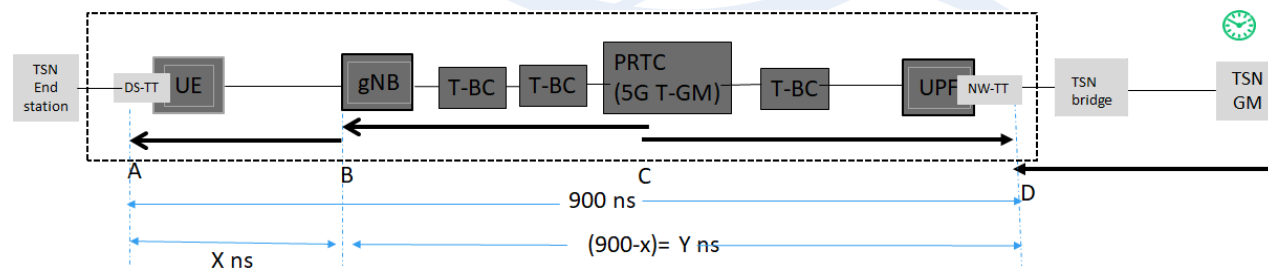
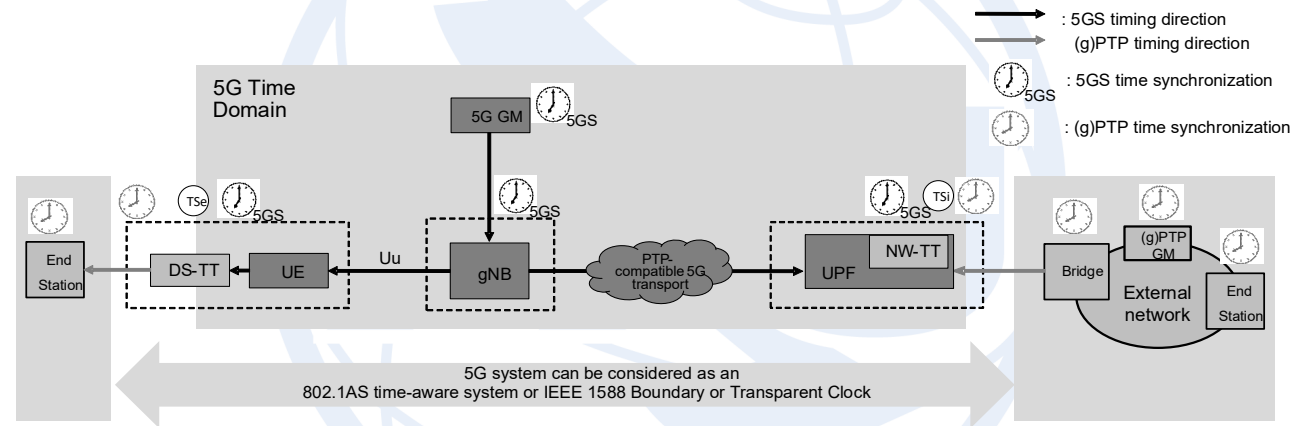
G.8275-Y.1369(17)-Amd.2(19)_FV1.3



New Studies:

5G integration with Industrial Automation ?

- Impact from integration of 5G with Industrial Automation start to be considered.
- Liaison to 3GPP recently sent by Q13 to understand the impact on current architecture



Future Items ?

- Synchronization will continue to be a fundamental function as networks and applications evolve
- Among new items that may be studied by Q13 in the future :
 - Emerging needs in mobile networks (e.g., 5G evolution) and connected applications;
 - Support for enhanced synchronization network management and monitoring
 - Support for enhanced security solutions
 - Continue to enhance Robustness and reliability in the network synchronization solutions (e.g., as related to GNSS backup synchronization references).
 - Timing resiliency over 5G is a new item of interest
 - Needs of new applications with particularly stringent timing requirements (e.g., quantum key distribution (QKD) related applications has been mentioned).

