Standardization in ITU-T Study Group 15 and Q13/15
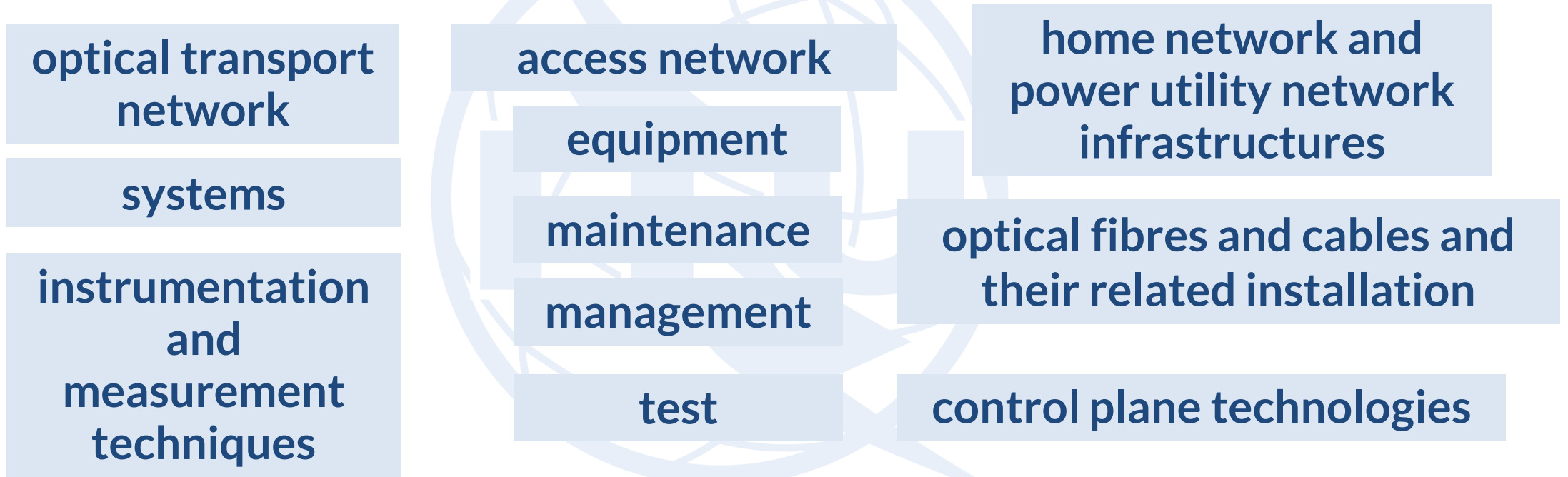
Networks, Technologies and Infrastructures for Transport, Access and Home:
Network synchronization and time distribution performance

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SG15 mandate

SG15 is responsible for the development of standards on:

optical transport network

systems

instrumentation and measurement techniques

access network

equipment

maintenance

management

test

home network and power utility network infrastructures

optical fibres and cables and their related installation

control plane technologies

to enable the evolution toward intelligent transport networks, including the support of smart-grid applications.

SG15 Working Parties

- **WP1/15**: Transport aspects of access, home and smart grid networks

- **WP2/15**: Optical technologies and physical infrastructures

- **WP3/15**: Transport network characteristics
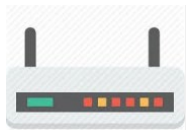
WP1 – Broadband Access

G.FAST — Broadband access up to 2 Gbps

G.mgfast — Next generation G.fast targeting 5-10 Gbps

DTA — G.fast dynamic time assignment (DTA) – downstream/upstream bit-rates responsive to customer traffic

Continue collaboration with broadband forum

G.RoF — Radio over fiber for mobile fronthaul

NG-PON2 — Next generation of converged fiber access going to higher speeds

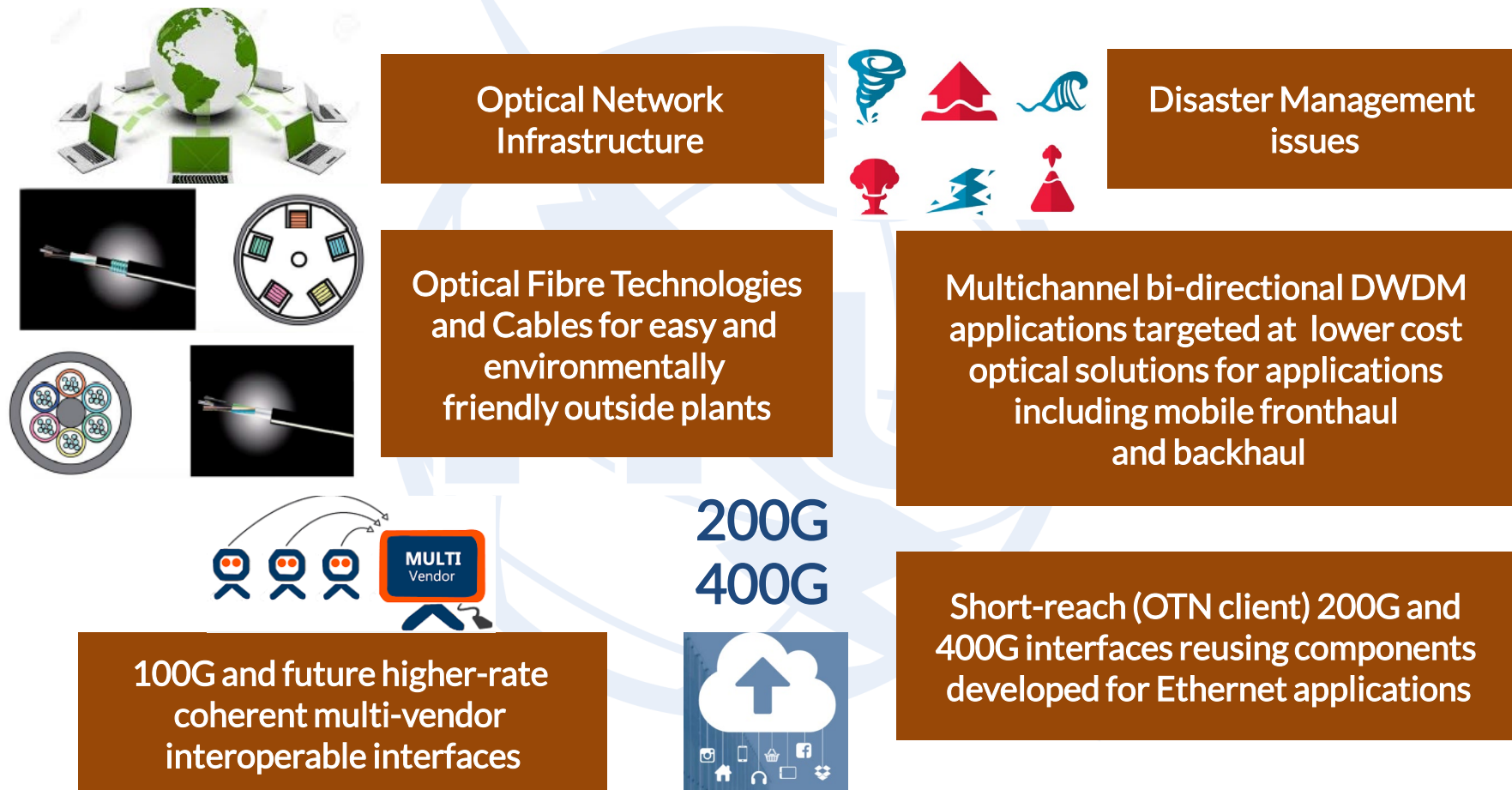Visible Light Communication for home networking

Powerline communication (PLC)

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

WP2 – Optical Technologies

Optical Network Infrastructure

Disaster Management issues

Optical Fibre Technologies and Cables for easy and environmentally friendly outside plants

Multichannel bi-directional DWDM applications targeted at lower cost optical solutions for applications including mobile fronthaul and backhaul

200G
400G

100G and future higher-rate coherent multi-vendor interoperable interfaces

Short-reach (OTN client) 200G and 400G interfaces reusing components developed for Ethernet applications

WP3 – Optical Transport Networks

Transport and synchronization supporting 5G mobile fronthaul and backhaul

Synchronization of packet networks and future OTN networks, e.g., beyond 100G

Architecture and other Transport SDN Aspects

Network survivability (protection and restoration)

New "B100G" OTN interfaces, including the use of coherent G.698.2 interfaces under development

Management aspects of control and transport planes

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

Core Information model enhancement for management of synchronization and optical media
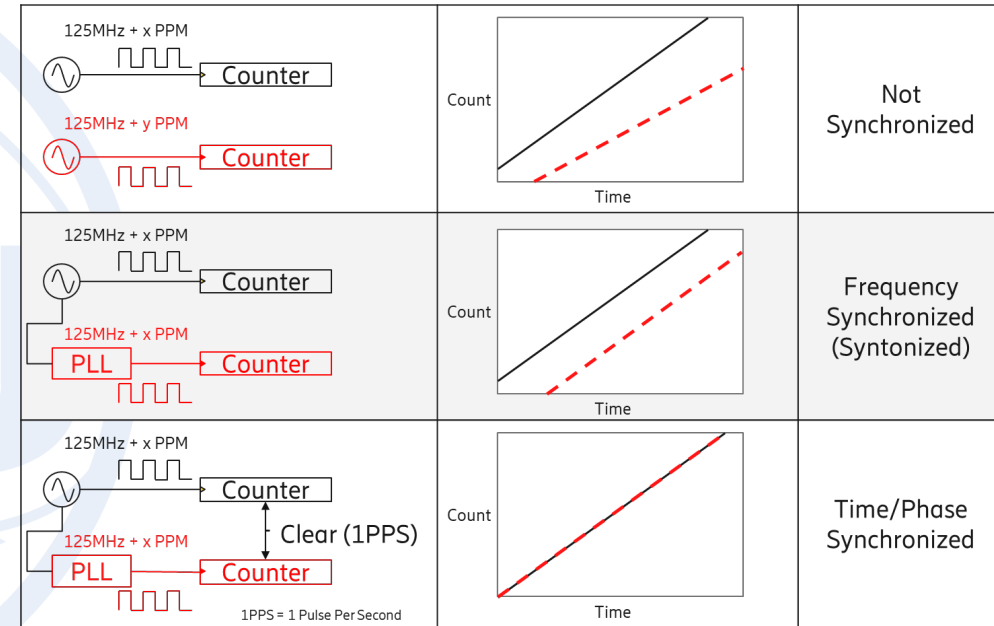
Meetings

- Past meetings since 2017
  - 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
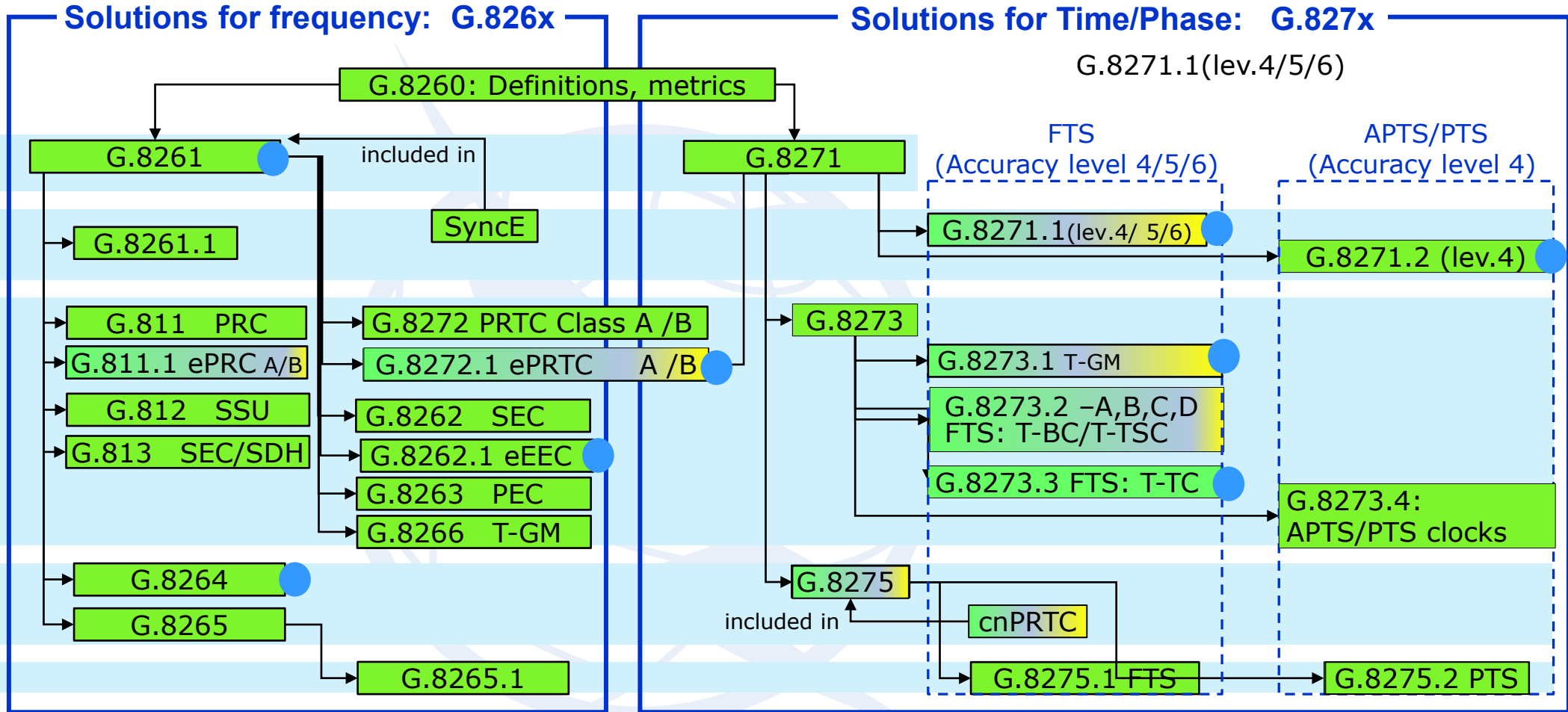- Future SG15 meeting
  - Geneva, 7-18 September 2020

2017-2020
Study Period

Q13: Introduction

- Network synchronization and time distribution performance
  - Networks Timing Needs (e.g., OTN)
  - 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
  - IEEE 1588 profiles
  - Performance, Redundancy, Reliability, etc.
- Networks
  - From SDH to Ethernet, IP-MPLS, OTN, xPON, ... -> MTN
- Recommendations
  - G.826x series (distribution of frequency synchronziation)
  - G.827x series (Distribution fo time synchronzation)
  - G.781, G.781.1 (Sync Layer Functions)
  - «Historical» (G.803, G.810, G.811, G.812, G.813, G.823, G.824, G.825...)

Q13 Recommendations

Solutions for frequency: G.826x | Solutions for Time/Phase: G.827x

G.8271.1(lev.4/5/6)

Definitions / terminology

G.8260: Definitions, metrics

Basics

G.8261 — included in — SyncE

G.8271

FTS (Accuracy level 4/5/6)

APTS/PTS (Accuracy level 4)

Network requirements

G.8261.1

G.8271.1 (lev.4/ 5/6)

G.8271.2 (lev.4)

Clocks

G.811 PRC → G.8272 PRTC Class A /B

G.811.1 ePRC A/B → G.8272.1 ePRTC A /B

G.812 SSU → G.8262 SEC

G.813 SEC/SDH → G.8262.1 eEEC

G.8263 PEC

G.8266 T-GM

G.8273

G.8273.1 T-GM

G.8273.2 –A,B,C,D FTS: T-BC/T-TSC

G.8273.3 FTS: T-TC

G.8273.4: APTS/PTS clocks

Methods Architecture

G.8264

G.8265

G.8275

included in — cnPRTC

Profiles (Protocol)

G.8265.1

G.8275.1 FTS

G.8275.2 PTS

Related recommendations

Synchronization Layer Functions — G.781 G.781.1

Interfaces — G.703

OAM — G.Suppl.SyncOAM

Technical Report — G.Supp.GNSS

Simulation Background — G.Supp.sim

New Rec/Rev/ Amd 09-2020

Legend: Agreed ongoing

Deutsche Telekom , Helmut Imlau, 4.2.2020

Ongoing Studies: Fronthaul (G.8271.1)

- Under analysis guidelines for network dimensioning

- Use of G.8273.2 Clock Class C is generally assumed

- Use of enhanced Synchronous Ethernet

- Initial assumptions : short clock chain (e.g., $M < 3\text{-}5$)

Network Performance measurement still with respect to a common master ?
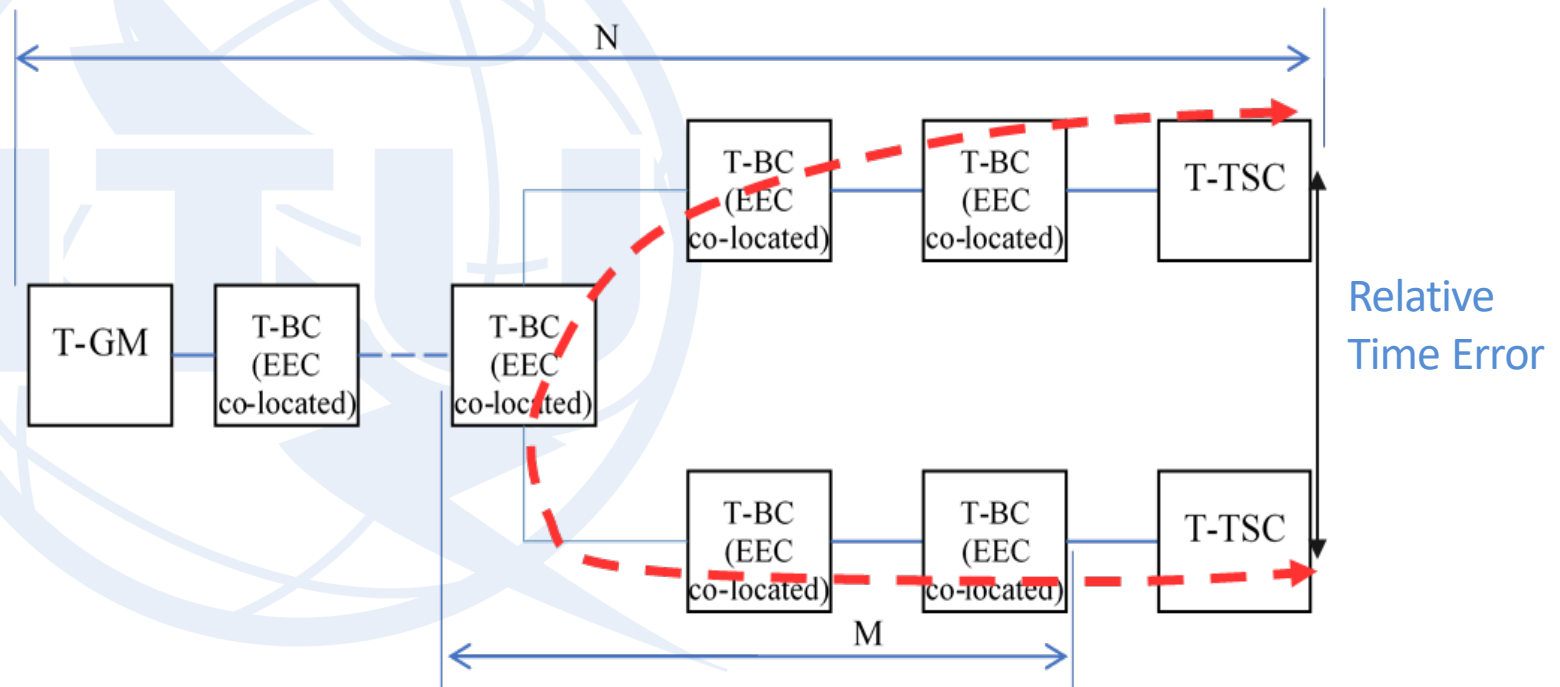
What is Next ?

- MTN, Metro Transport Network (based on FlexE for 5G transport network)
  - Sync Requirements
  - Sync Architecture
  - PTP and syncE distribution
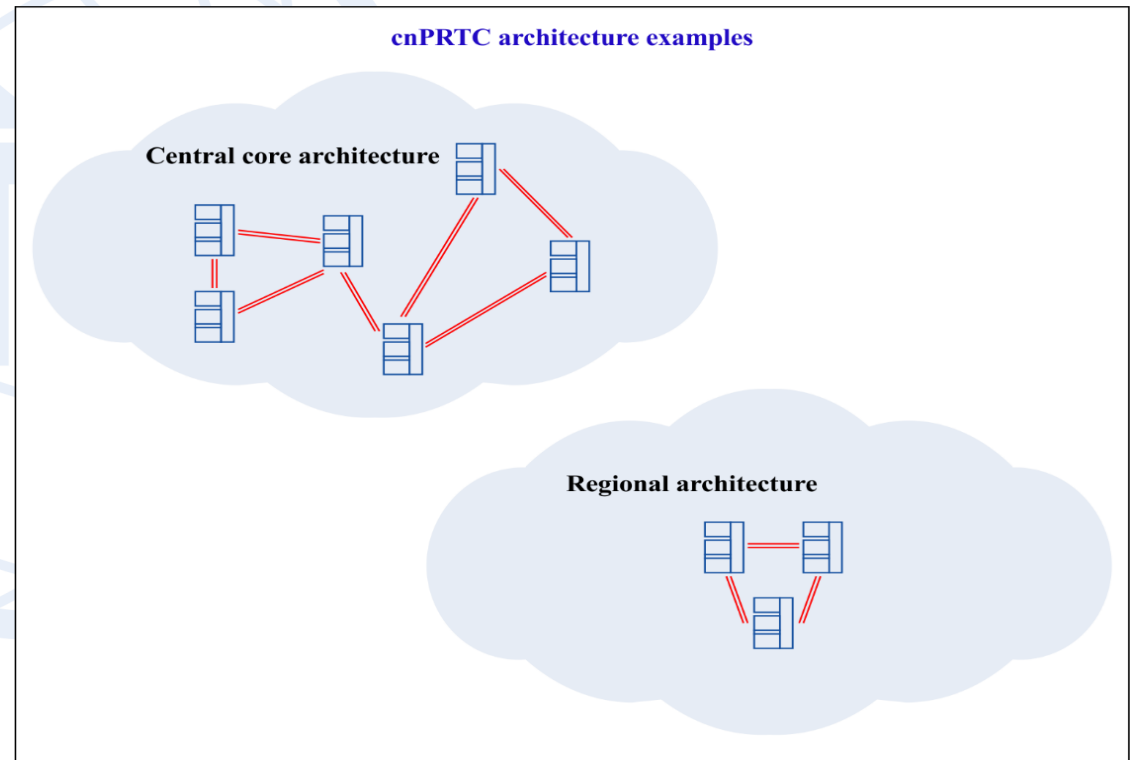 - Clocks
- Complete work on Profile Interworking
- Complete work on cnPRTC (Coherent PRTC)
  - Requirements
  - Methods (high accuracy profile?)
- Address New Sync Requirements
  - Emerging needs in mobile networks (positioning or even use cases with less stringent requirements);
  - Future needs ?

The coherent network PRTC connects primary reference clocks at the highest core or regional network level. This provides the ability to maintain network-wide ePRTC time accuracy, even during periods of regional or network-wide GNSS loss (G.8275)

cnPRTC architecture examples

Central core architecture

Regional architecture

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