Status of ITU Q13/15 sync standards WSTS-2014

Jean-Loup Ferrant,
ITU-T Q13/15 rapporteur

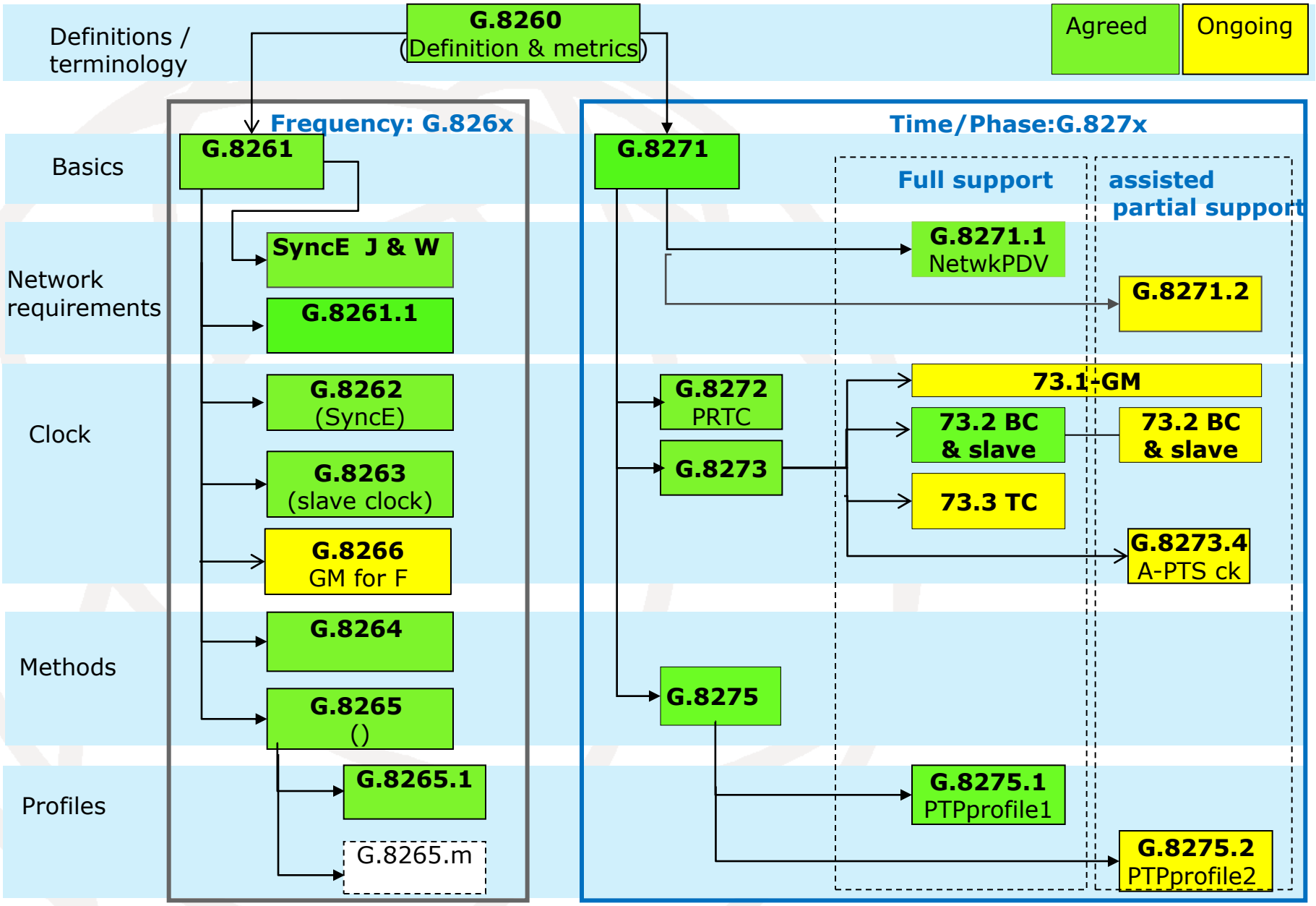
Q13 progress

- 2 plenaries since last WSTS
  - July2013
    - 3 new documents
    - 1 revised documents
    - 4 Amendments
  - April 2014
    - 2 new documents
    - 2 revised documents
    - 4 Amendments
    - 1 Corrigendum

Summary

- I-Synchronization over packet networks
  - Transport of frequency
    - Mainly a maintenance activity
  - Transport of phase and time
    - 2 profiles defined
      - Full support from the network
      - Partial timing support
- II-Synchronization over OTN
  - New requirement to transport F, Ø and T

1-Overview of recommendations



I-2 transport of frequency

- Consented recs in July 2013
  - G.8260 Amd1
    - New definitions
    - Determination of floor delay and reroute impact
    - Exceptionals events effect on network limits
  - G.8261 revision
    - Update according progress of new recommendations
  - G.8263 Amd1
    - Adds an appendix on testing temperature effect

I-2 transport of frequency

- Consented recs in April 2014
  - G.8260 Amd2
    - Time error definitions Improvemen
      - Dynamic time error and maximum absolute time error
  - G.8261.1Amd1
    - Added a subsection recognizing that many networks (HRM1) do not create more than 75 µs of PDV
  - G.8263 Amd2
    - Text for AppendixI on Packet Delay Variation noise tolerance testing

I-2 transport of frequency

- Consented recs in April 2014
- G.8264
  - A new revision has been consented taking into account the previous Amd and Corr.
- G.8265.1(still under AAP)
  - A new revision has been consented taking into account the previous Amd and Corr and taking advantage of the work on G.8275.1 to improve the text.

- New work item
  - G.8266
    - T-GM for frequency

I-2 transport of phase and time

- Consented recs in July 2013
  - G.8271 Amd1 (see S. Ruffini's presentation)
    - Update on Time sync Interface, time error accumulation and time stamping granularity
  - G.8271.1(see S. Ruffini's presentation)
    - New recommendation on network limits and noise accumulation simulations
  - G.8272 Amd1
    - Case of PRTC integrated with T-GM added
  - G.8273 (see K shenoi's presentation)
    - Testing and measurements of time/phase clocks

I-2 transport of phase and time

- Consented recs in July 2013
  - G.8275 (see M Mayer's presentation)
    - text for A-PTS architecture added
- New work item
  - G.8271.2 Network limits for PTS profile

I-2 transport of phase and time

- Consented recs in April 2014
  - G.8271.1(see S. Ruffini's presentation)
  - G.8273 Corr1
  - G.8273.2 (Telecom Boundary Clock)
  - G.8275.1 (see S. Jobert's presentation)
    - (Still under AAP)
- New work item
  - G.8273.4
    - Specification of a clock for A-PTS

I-2 G.8273.2 T. Boundary Clock

- Main characteristics of G.8273.2
  - It specifies the T-BC and the T-TSC
    - As a T-BC terminates the PTP messages, there is no major difference between *requirements* of a T-boundary clock (T-BC) and a T-time slave clock (T-TSC)
    - T-BC defined in the main body
    - T-TSC defined in Annnex C
  - 2 classes of clocks are defined for both T-TBC and T-TSC

Table 2 – T-BC Permissible Range of Constant Phase/Time Error

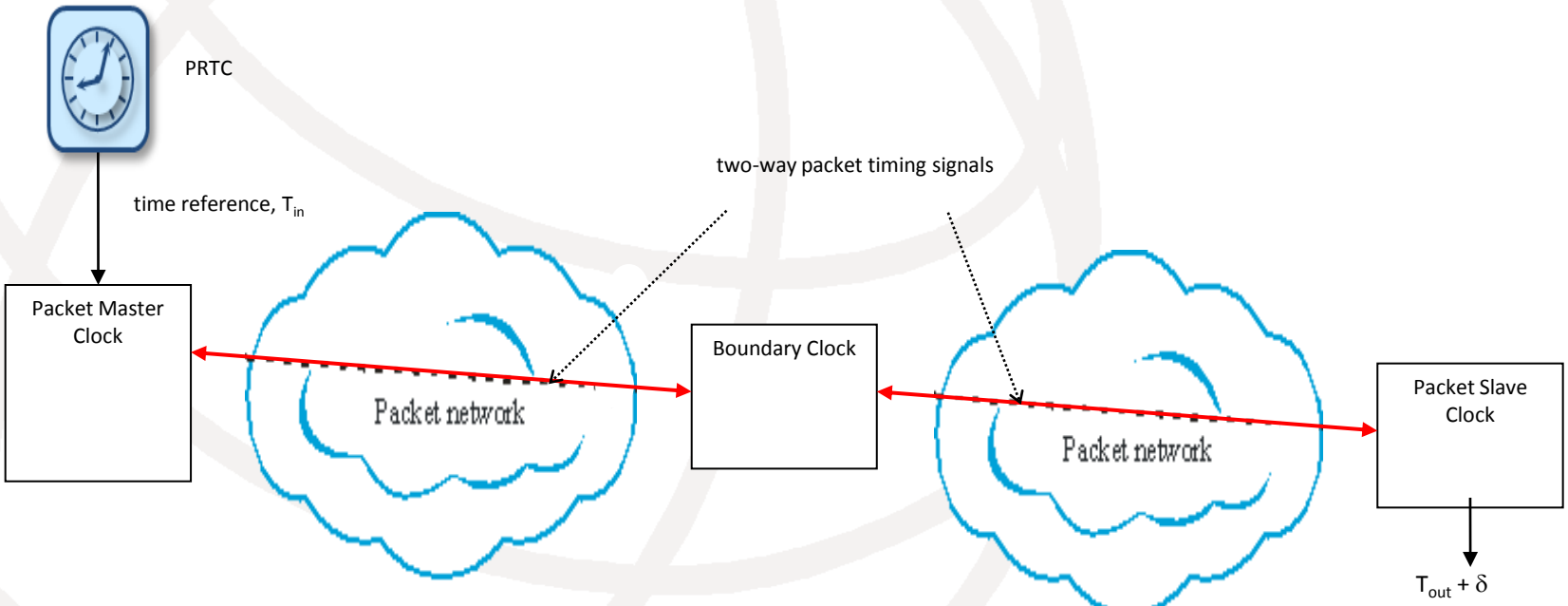
T-BC Class	Permissible Range of Constant Phase/Time Error – cTE(ns)
A	±50
B	±20

I-3 First time profile

- First profile
  - Full timing support from the network
    - It means that all NEs process the PTP messages
    - PTP messages mapped in Ethernet
  - Completed for G.8272 and BC cases
  - Will be upgraded with
    - Stand alone T-GM G.8273.1
    - Transparent clocks G.8273.3

I-4 Second time profile

- Partial Timing Support profile (PTS)
  - **Work item created in July 2013**
  - **General architectural view (G.8275)**
    - **PTP unaware networks separated by T-BCs**

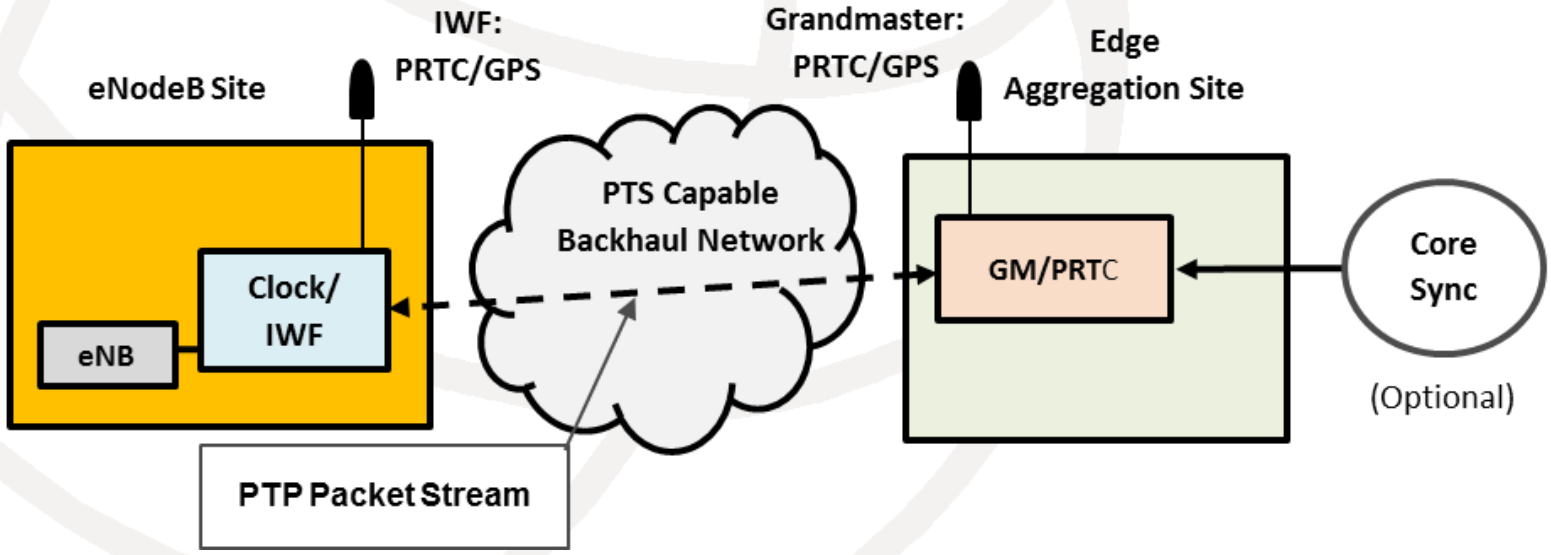


I-5 Partial Timing Support profile

- New recommendations required
  - G.8275
    - Add the « 1588unaware » equipments in the network architecture
  - G.8271.2
    - Define the network limits and HRM
  - G.8273.2
    - Define a new Boundary Clock if needed
  - G.8273.4
    - Defines the clock at the end of the A-PTS profile
  - G.8275.2
    - profile based on IP

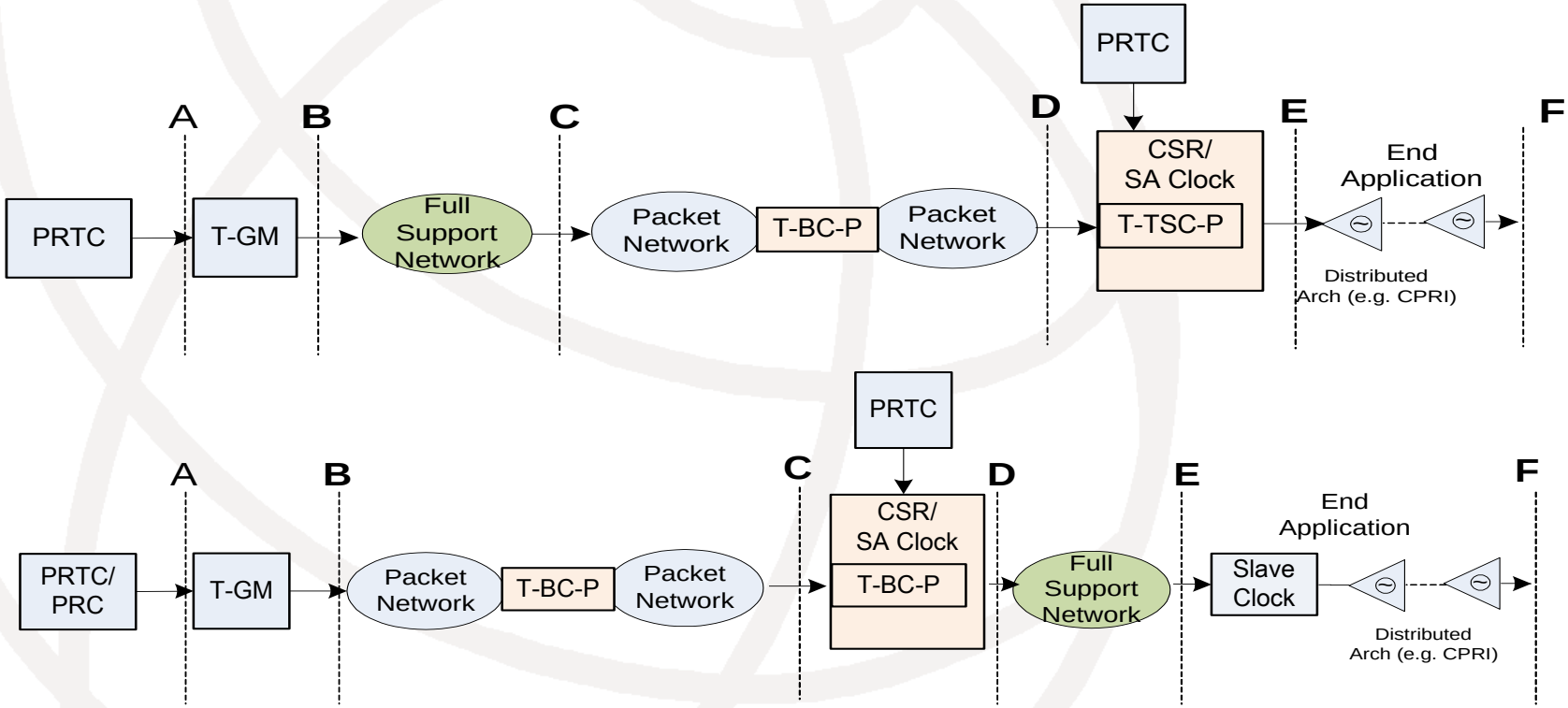
I-6 Assisted PTS profile (A-PTS)

- New ideas brought in October 2013
  - eNode B will be synchronized with GPS receivers in priority
  - PTP will be used only as a backup in case of GPS failure



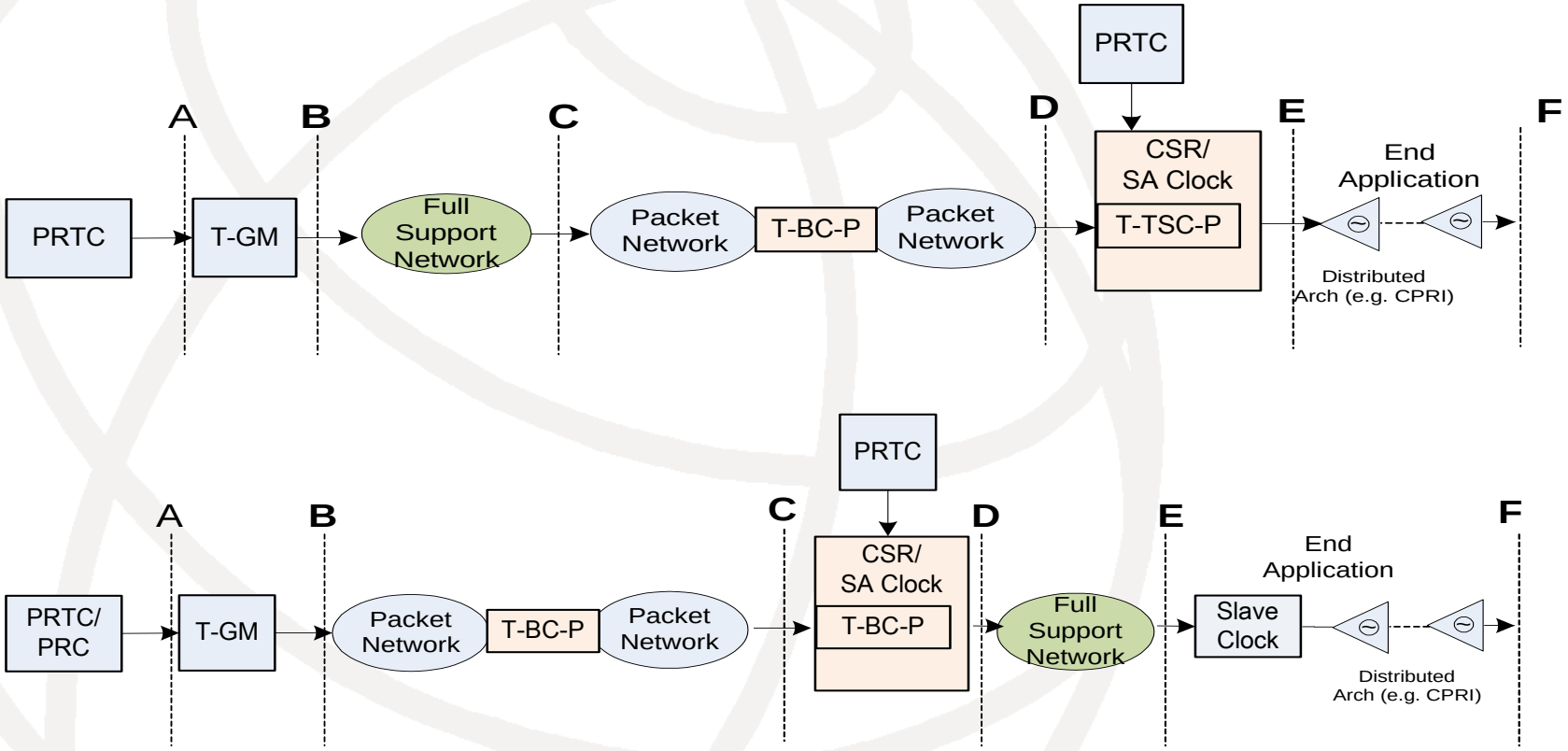
I-7 A-PTS architecture

- Several architectural examples under discussions



I-8 G.8275.2 A-PTS architecture

- Several architectural examples under discussions



4.8- G.8275.2 Current Q13 views

- Is a time profile needed for the protection of the end PRTC?
  - A frequency reference is enough to maintain the time
    - It must be synchronous to the time reference, i.e. to UTC and not only G.811 traceable
    - ITU has already specified a profile for the transport of frequency through unaware networks: G.8265.1
    - G.8265.1 does not consider BCs, an upgrade is needed.

4.9- PTS conclusion

- Operators are requesting urgently a solution to A-PTS (end 2014)
  - A profile based on G.8265.1 is under study
    - Need to consider BC
    - BMCA required?
  - Other ways to transport a F reference exist but were not considered, e.g.
    - SDH, SyncE or even NTP
- Once A-PTS has been completed, a PTS profile might be studied?

II-1 Synchronization over OTN

- Optical Transport Network
  - First Definition in 2001
    - Not part of the synchronization network
    - Asynchronous network equipments
    - Transport of frequency reference via SDH tribs
  - SyncE in 2011
    - New mapping defined to transport tributary SyncE over OTN in timing transparency way

II-2 Synchronization over OTN

- New requirement
  - Transport of timing without SDH or SyncE
- Solution under discussion
  - Transport of frequency over the OTN physical layer, as in SDH
  - Transport of time via 1588 over OTN

Where to get the recommendations?

http://www.itu.int/ITU-T/recommendations/index.aspx?ser=G

Don’t forget …

Wednesday Night is Whisky Night

Jean-Loup Ferrant

jean-loup.ferrant@calnexsol.com

Hollywood’s finest in attendance!

List of ITU-T main recommendations related to synchronization (updated July 2013)

- **G.803 (2000),** ***Architecture of transport networks based on the synchronous digital hierarchy (SDH)***

- **G.810 (1996),** ***Definitions and terminology for synchronization networks***

- **G.811 (1997),** ***Timing requirements of primary reference clocks***
- **G.812 (2004),** ***Timing requirements of slave clocks suitable for use as node clocks in synchronization networks***
- **G.813 (2003),** ***Timing requirements of SDH equipment slave clocks (SEC)***
-
- **G.822 (1988),** ***Controlled slip rate objectives on an international digital Connection***

- ***G.823 (2000), The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy***
- ***G.824 (2000), The control of jitter and wander within digital networks which are based on the 1544 kbit/s hierarchy***
- ***G.825 (2000), The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH)***

- ***G.781 (1999), Synchronization layer functions***

Recommendations for timing over packet networks

- ***G.8260 (2010) Definitions and terminology for synchronization in packet networks***
  - ***Appendix1 on metrics (dec2011)***
  - ***G.8260 Amd1 (july2013), Amd 2 (4/2014)***

Recommendations for Synchronous Ethernet

- ***G.781 (2009), Synchronization layer functions***
- ***G.8261 rev(2013), Timing and Synchronization aspects in Packet Networks***
- ***G.8262 (2010), Timing characteristics of synchronous Ethernet Equipment slave clock (EEC)***
  - ***G.8262 Amd1 &2 (2012)***
- ***G.8263 (2011) Timing characteristics of packet-based equipment clocks***
  - ***G.8263 Amd1 (Jully2013), Amd2 (April2014)***
- ***G.8264 (2008), Distribution of timing through packet networks***
  - ***(revision to be published in 2014)***

Recommendations for OTN

- *G.8251 (2010) The control of jitter and wander within the optical transport network (OTN)*
  G.8251 Amd1 &2 (2011) and Amd3 (2012)
  G.8251 Corr2 (Dec 2011)

Recommendations for the telecom profile for frequency only

- *G.8261 rev(2013), Timing and Synchronization aspects in Packet Networks*
- *G.8261.1 (Dec2011)Packet Delay Variation Network Limits applicable to Packet Based Methods (Frequency Synchronization)*
  - *G.8261.1 Amd1 (4-2014)*
- *G.8263 (Dec2011)Timing characterisctics of packet based equipment clocks (PEC)and packet based service clocks (PSC)*
  - *G.8263 Amd1 (7/2013), Amd2 (4/2014)*
- *G.8265 (2010) Architecture and requirements for packet based frequency delivery*
- *G.8265.1 (2010) ITU-T profile for frequency distribution without timing support from the network (provisional title)*
  Revision to be published in 2014 (still under AAP)

Recommendations for the telecom profile for time and phase

- ***G.8271 (dec2011) Network requirements for transport of time/phase***
  - ***G.8271 Amd1 (July 2013)***
- ***G.8271.1(July2013) Network Limits for Time Synchronization in Packet Networks***
- ***G.8272 (Sept2012) Specification of Primary Reference Time Clock (PRTC)***
  - ***G.8272 Amd1 (July 2013)***
- ***G.8273 (July 2013) Specification of clocks for the transport of time/phase***
  - ***G.8273 Corr1 (4/2014)***
- ***G.8273.2 Telecom boundary clock***
- ***G.8275 (july 2013) Architecture and requirements for packet-based time and phase delivery***
- ***G.8275.1 Telecom profile for the transport of time/phase with full timing support from the network (under AAP)***

Future recommendations (provisional titles)

- ***G.8266 Stand alone T-GM***
- ***G.8273.1 Telecom Grand Master***
- ***G.8273.3 Telecom transparent clock***
- ***G.8273.4 A-PTS clock***
- ***G.8275.2 Telecom profile for the transport of time/phase with partial timing support from the network***

Recommendation on Jitter and wander tests equipments

- ***O.171 (1997) Timing jitter and wander measuring equipment for digital systems which are based on the plesiochronous digital hierarchy (PDH)***
- ***O.172 (2005) Jitter and wander measuring equipment for digital systems which are based on the synchronous digital hierarchy (SDH)***
- ***O.173 (2007) Jitter measuring equipment for digital systems which are based on the Optical Transport Network***
- ***O.174 (2009) Jitter and wander measuring equipment for digital system based on synchronous Ethernet network***