Status of ITU Q13/15 sync standards ITSF-2013

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Agenda

1-Overview of recommendations

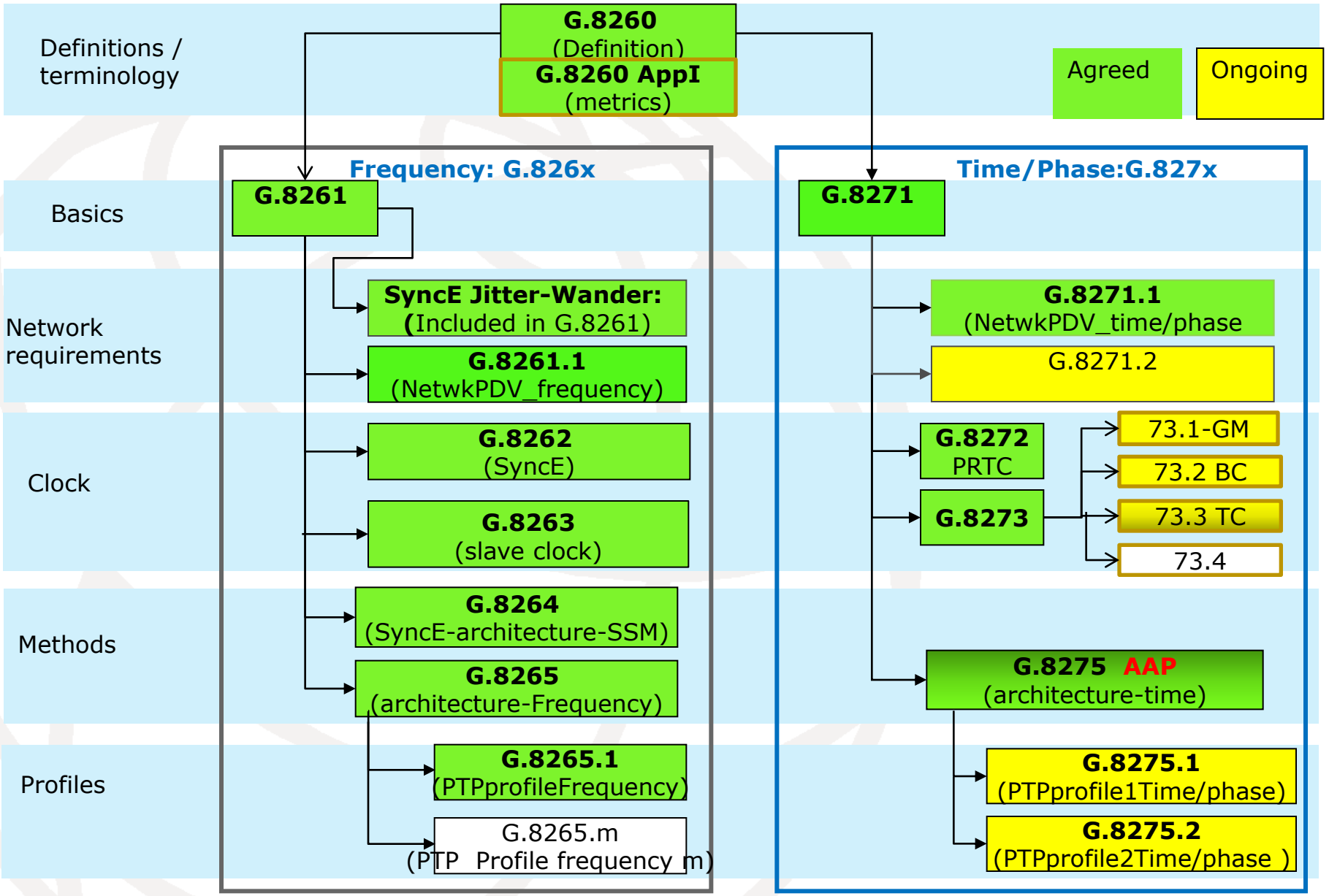
2-History

3-transport of frequency in packet networks

4-transport of time and phase in packet networks

5- ITU-T SG15 recommendations for synchronization

1-Overview of recommendations



5-synchronization standards in ITU Q13 (see list at the end of presentation)

	Circuits		Packets		
	TDM	OTN	SyncE	Frequency	Time
Definitions		**G.810**		**G.8260**	
Architecture	**G.803**	**G.8251**	**G.8261**	**G.8265**	**G.8275**
Performances/ requirements		**G.8251**	**G.8261**	**G.8261.1**	**G.8271.1**
Functional models		**G.8251**	**G.8264 G.781**	**G.8261**	**G.8271**
Profiles				**G.8265**	**G.8275.1 G.8275.2**
Clock specifications		**G.8251**	**G.8262**	**G.8263**	**G.8272 G.8273 G.8273.x (x=1,2,3)**
Simulations					**G.SUPP**
Test equipments	**O.171 O.172**	**O.173**	**O.174**		

2-History

1- Consents in September 2012

3.1 New G.8272- PRTC

3.2 G.8265.1 Amd2

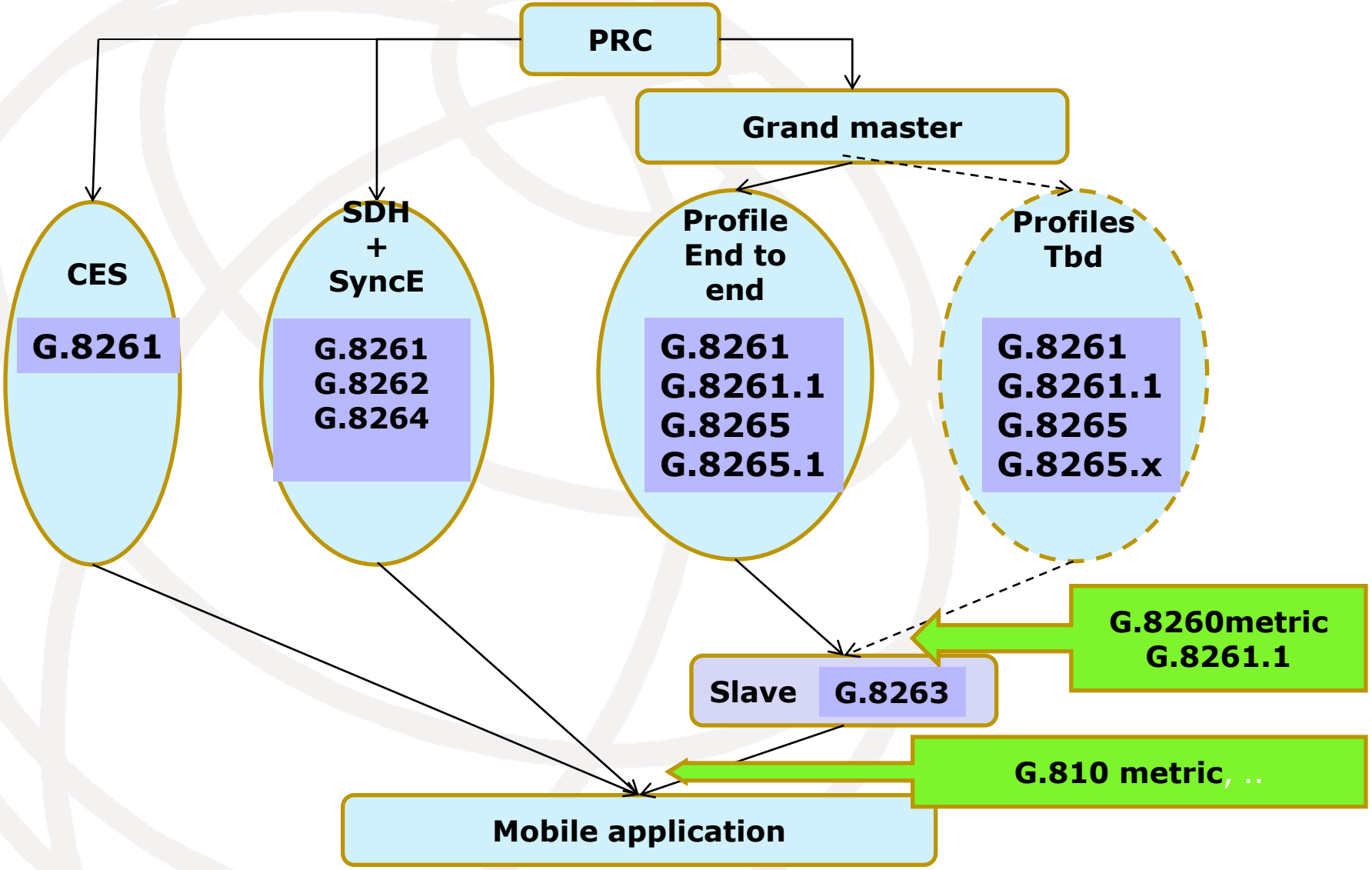
3.3 G.8262 Amd2

\+ G.8251 Amd3 on OTN

2- Consents in July 2013

- Amendment1 to G.8260
- Revision of G.8261
- Amendment1 to G.8263
- Amendment1 to G.8271
- New G.8271.1
- Amendment1 to G.8272
- New G.8273
- New G.8275

3- Transport of frequency in packet networks



3- Transport of frequency in packet networks

- G.8260
- Determination of « observed floor delay »
- Re-route events
  - Not part of network limits, as totally dependant on the network engineering
- Exeptional events
  - Network limits might be exceded

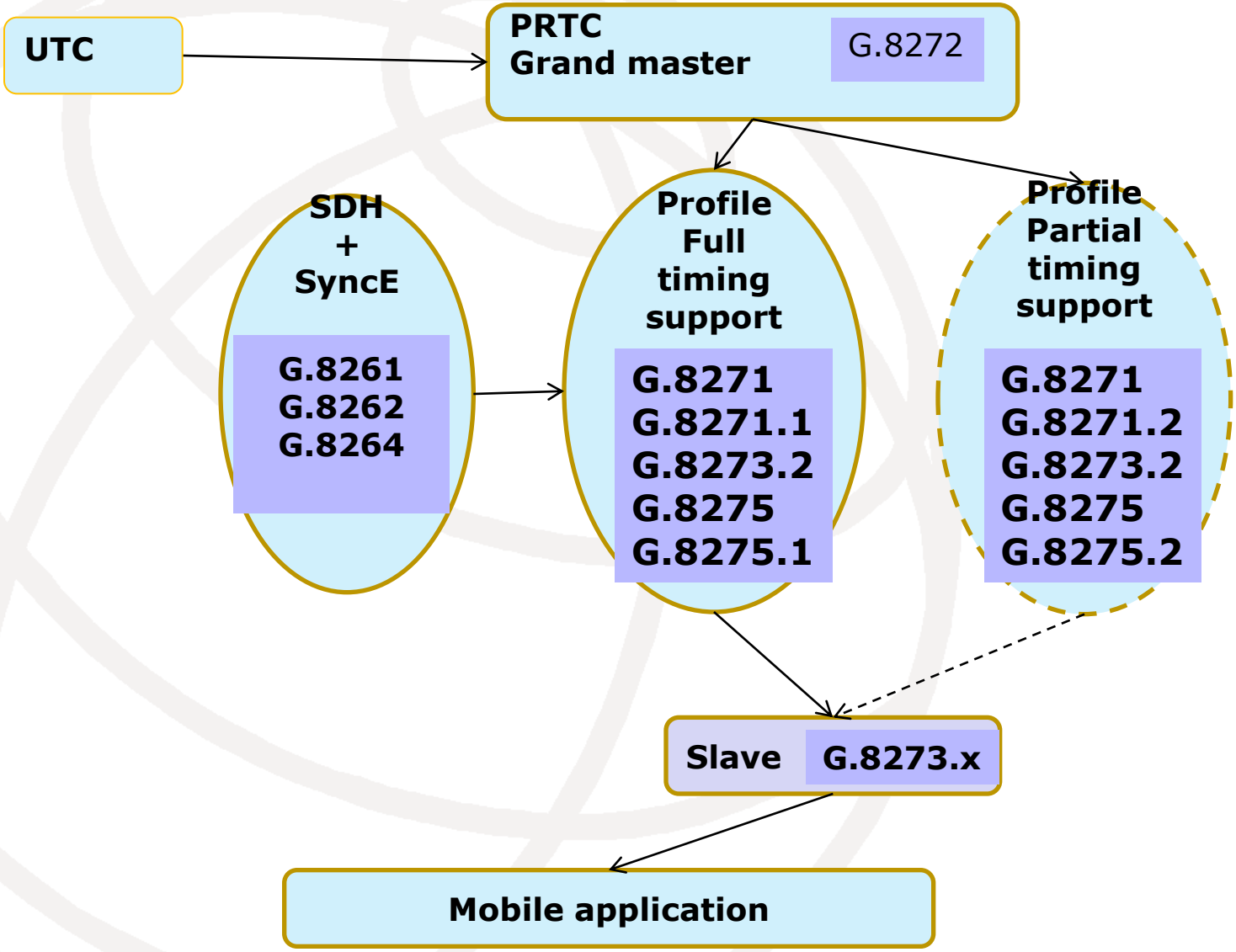
- G8261
  - Small update

-

3- Transport of frequency in packet networks

- G.8263
  - Ongoing discussions on PDV input tolerance
    - Agreement that 150µs G.8261.1 network limit is not going to be reached often in networks
    - But network limit is by definition a worst case
    - Convergent opinion in Q13 that we should also define clocks with a lower PDV input tolerance that could be used in many networks under some assumptions
    - Still under discussion (there is still hope ..)
  - New appendix IV
    Variable temperature testing methodology

4-Transport of time and phase in packet networks



4.2 G.8271

G.8271.1 consented in July

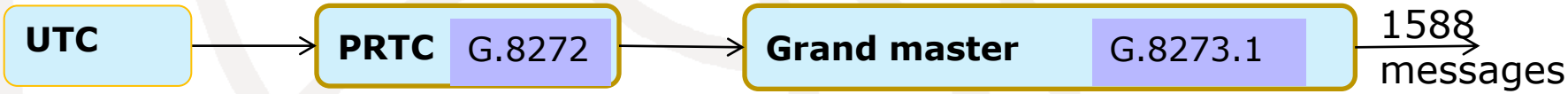
G.8271.2

The activity on these documents will be presented in a few minutes by Stefano Ruffini, their editor.

4.3 G.8272 PRTC
Primary reference time clock

Calnex

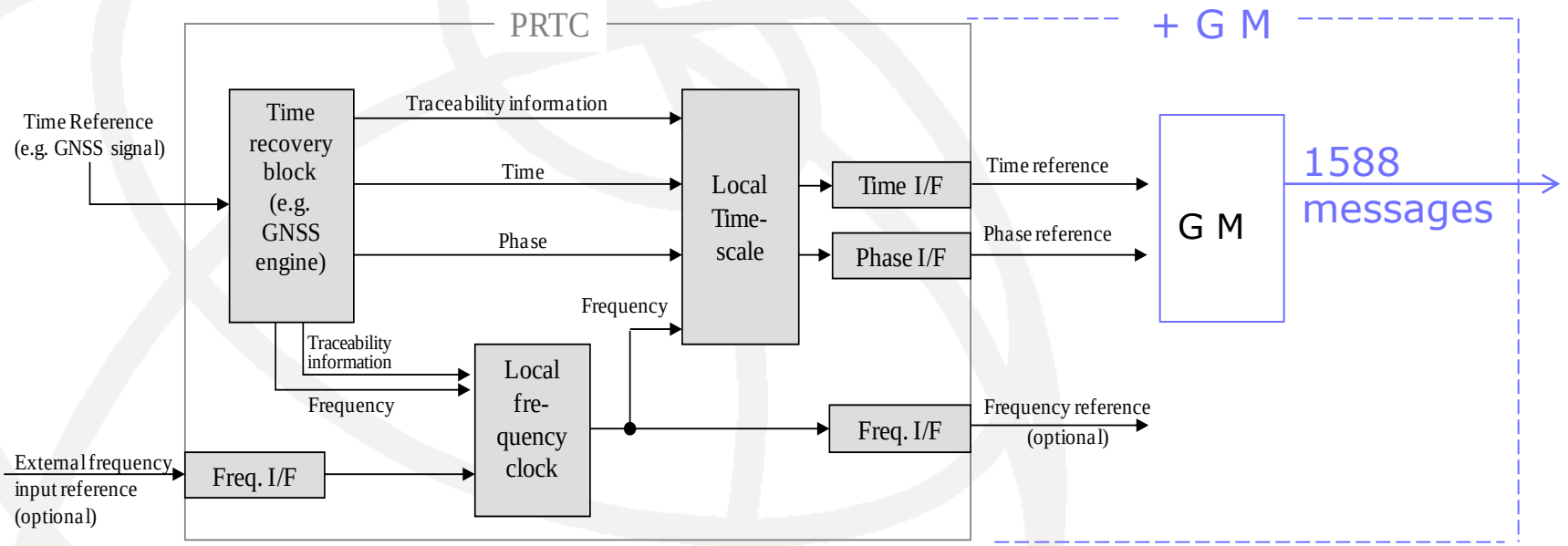
-Position of the PRTC in the network



-Amd1 specifies also the case where the grand master is colocated with the PRTC in a single equipment

4.3 G.8272 PRTC

-Functional model



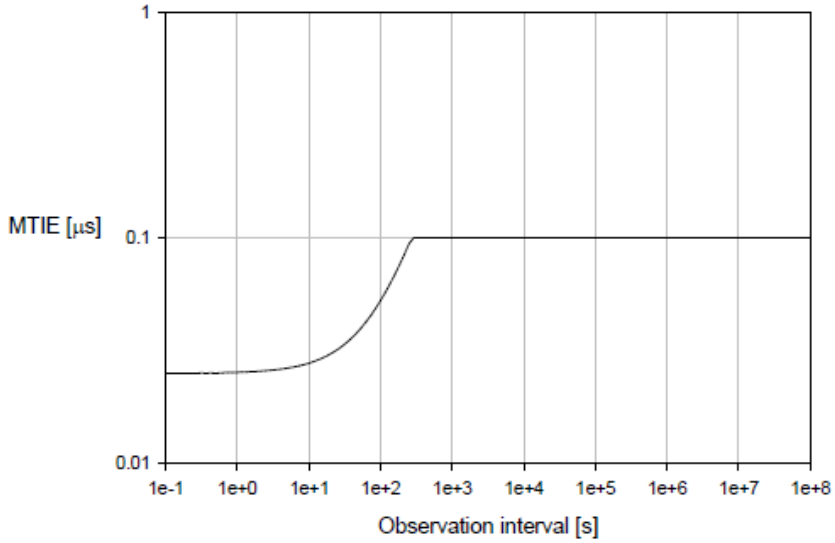
Time recovery: receives and processes the external time provides output signals to generate F , φ and T

Local frequency clock: generate the internal frequency , and might go in holdover or switch to an optional input frequency reference

Local timescale : maintains the local primary time scale

4.3 G.8272 PRTC

-Noise definition
Still valid with embedded Grand Master



-Time holdover
-Not yet agreed

4. - G.8273
Framework of phase and time clocks

G.8273 lists the clocks types for the transport of phase and time

-Grand Master
- Boundary clock
-Transparent clock
-Slave clock

G.8273 has mainly 2 annexes

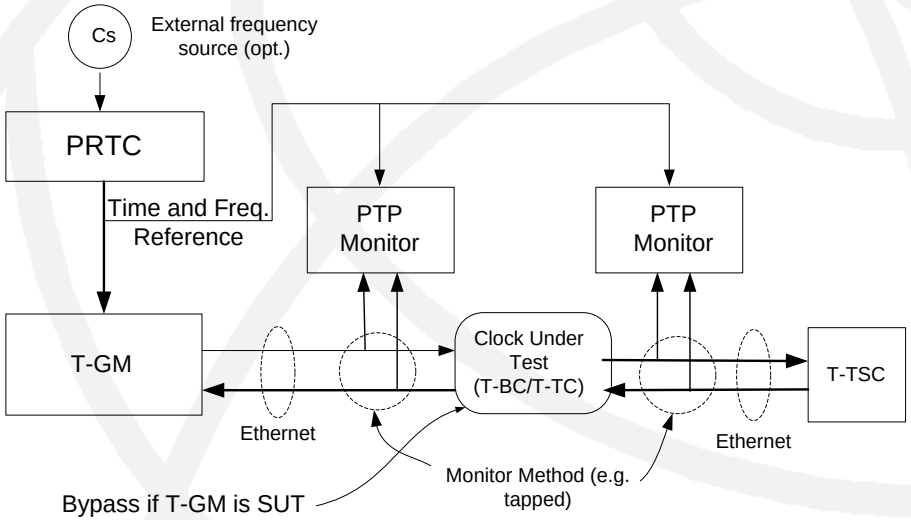
Annex A Testing and Measurement of Time andPhase Clocks

- time stamp error, time transfer error
- Measurement scenarios dealing with time stamps, used messages and time error components

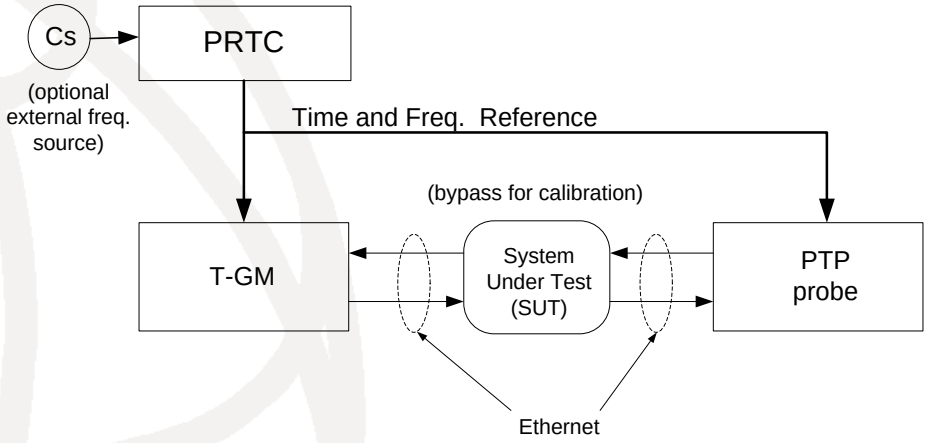
G.8273 Annex B

2 measurement techniques

passive



active



Measurement setup defined for
T-GM, T-BC and T-TSC
T-TC for further study

4. - G.8273.1 Grand Master

Following the Amd1 of G.8272, allowing to merge PRTC and PTP Grand Master, the specification of a stand alone Grand Master is not deleted but postponed.

4.4 G.8273.2 T-Boundary Clock

Note: this recommendation will specify all T-BC clocks needed by the different profiles.
The first version of the recommendation is expected for consent in march 2014, specifying the T-BC defined for the full timing support profile

T-BC for full timing support

Agreement to specify 2 classes of T-BC

- **Since T-BCs can be very different equipment**
- **T-BC type A with Max constant time error 50ns**
- **T-BC type B with Max constant time error 20ns**

- **Agreement on bandwidth**
  - **minimum bandwith 0.05 Hz**

4.5 G.8273.3 Transparent clock

IEEE 802.1Q "layer violation"

-A Transparent Clock, as defined in IEEE 1588, will modify the CorrectionField inside of a PTP header to record the residence time of the packet.

-IEEE 802.1Q answered that it is possible to avoid layer violation

- Some work is still needed on TC

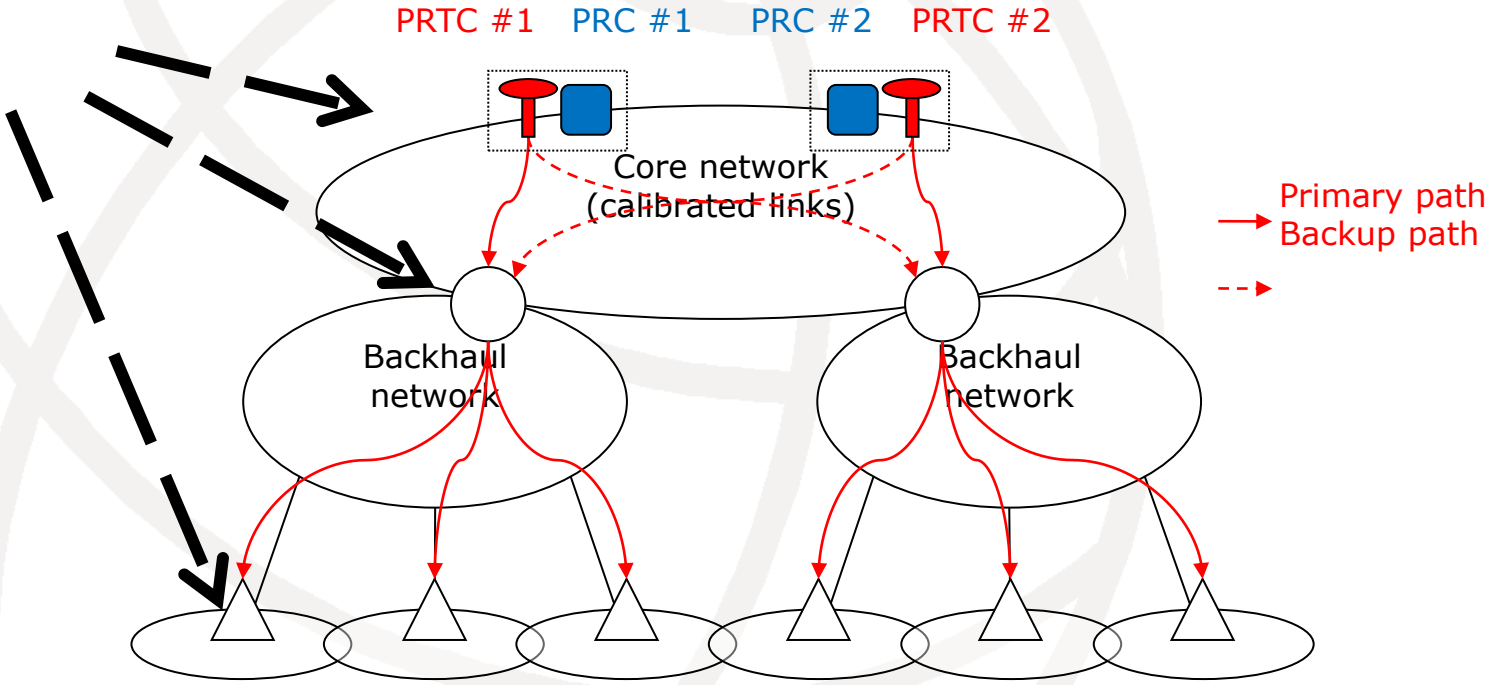
IEEE 802.1 proposal (simplified)

802.1 recommends a solution that is perfectly clean from a layering point of view for the Ethernet multicast encap-Sulation described in Annex F of 1588.

- use the address of the transmitting port as the source address;
- use one of the two multicast addresses listed in Annex F.
- do not send the frame out on ports which are blocked;
- use fields in the PTP message to identify the master clock, as opposed to using the source MAC address.

4.6 G.8275 Network Architecture

G.8275 is under AAP
It describes several possible positions for the PRTC and possible protection by PRC



Note: T-GM are connected to the PRTC in this architecture

4.6 G.8275 (2)

G.8275 contains information on different protection scenarios of the slave clock

1-Phase/time long-term holdover with physical layer frequency synchronization support,
2-Switching to a backup reference with physical layer frequency synchronization support, and
3-Switching to a backup reference without physical layer frequency synchronization support.

Appendix I

was added in July providing some high level Architectural points for Partial Timing Support networks (see G.8275.2 slides)

4.7 G.8275.1

PTP profile for the transport of T & φ within a full timing support network

- **Provisional specifications**

-For T-Boundary clocks
-Ethernet mapping specified at the moment
- studied with frequency provided by the network to the T-BCs
- A BMCA is part of the draft

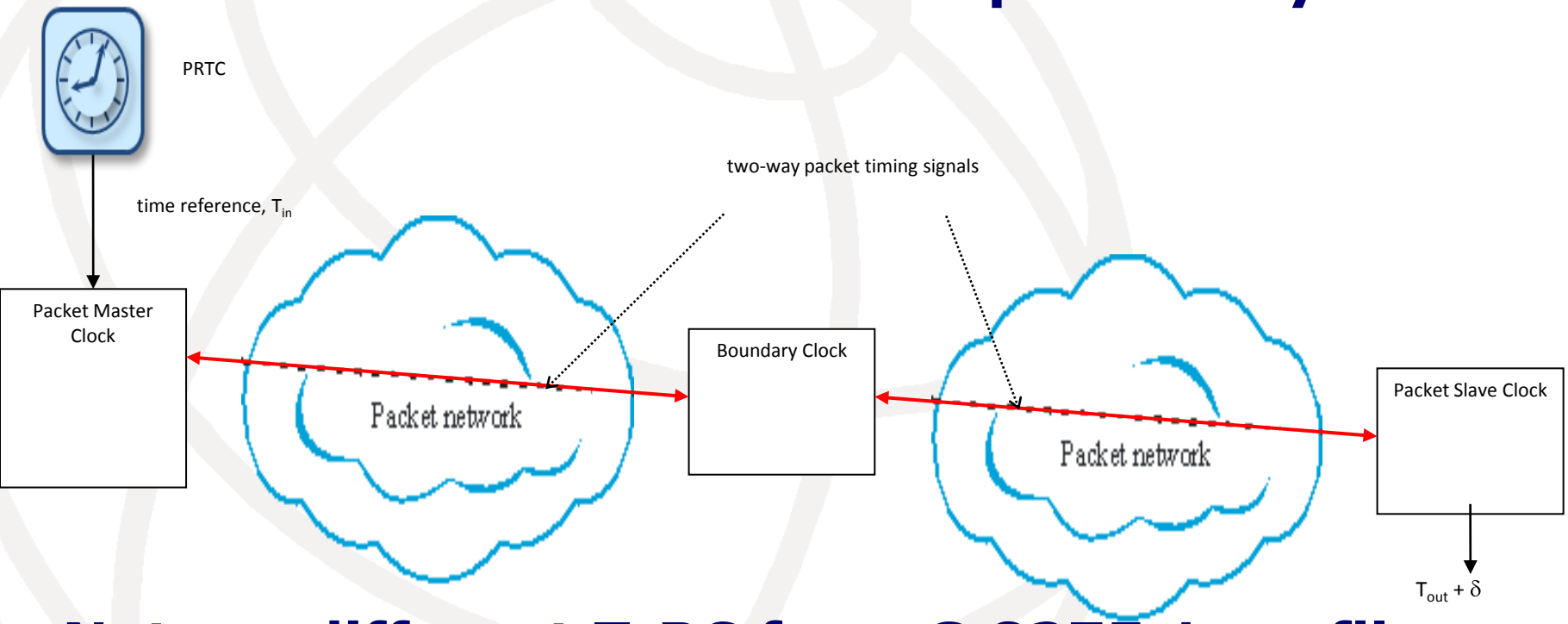
- **Progress**

-A stable text was finished in July 2013
- but could not be consented since several points were added during this meeting
- Consent expected in March 2014

4.8 G.8275.2 PTS profile
(PTS for partial timing support)

-Work item created in July 2013

- General architectural view (G.8275)
- PTP unaware networks separated by T-BCs



Note: a different T-BC from G.8275.1 profile might be required with better filtering of PDV

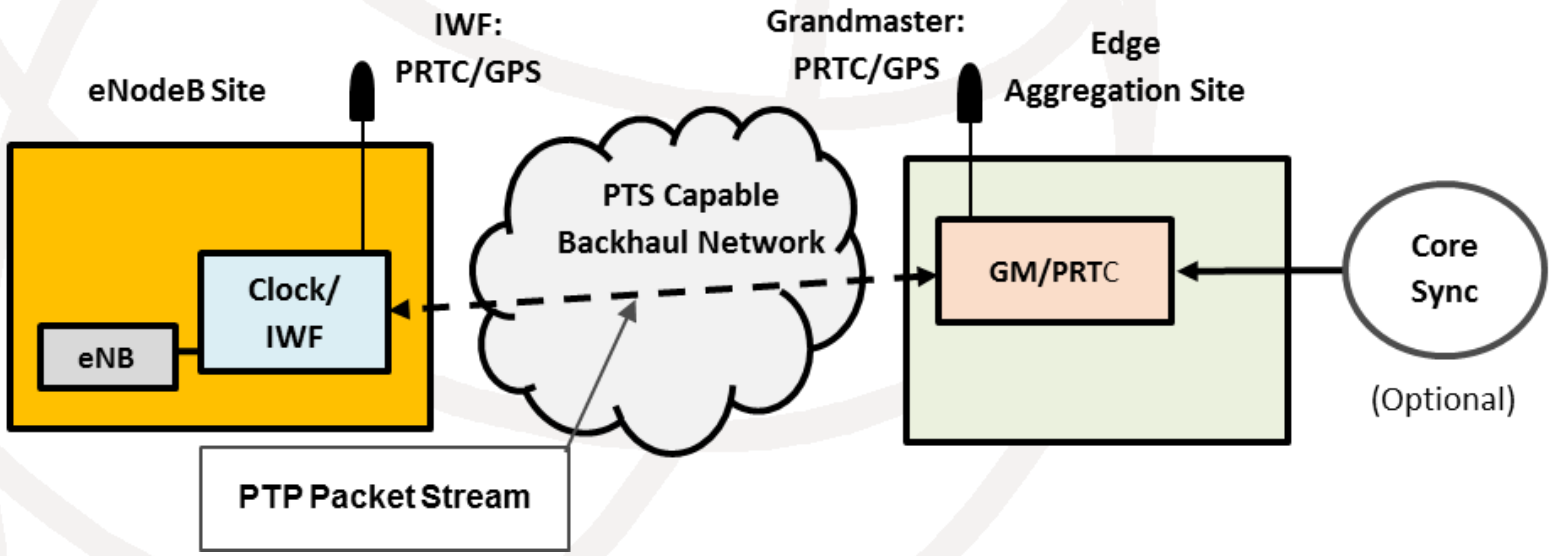
4.8 G.8275.2 A-PTS architecture

New ideas brought in October 2013

The A-PTS concept

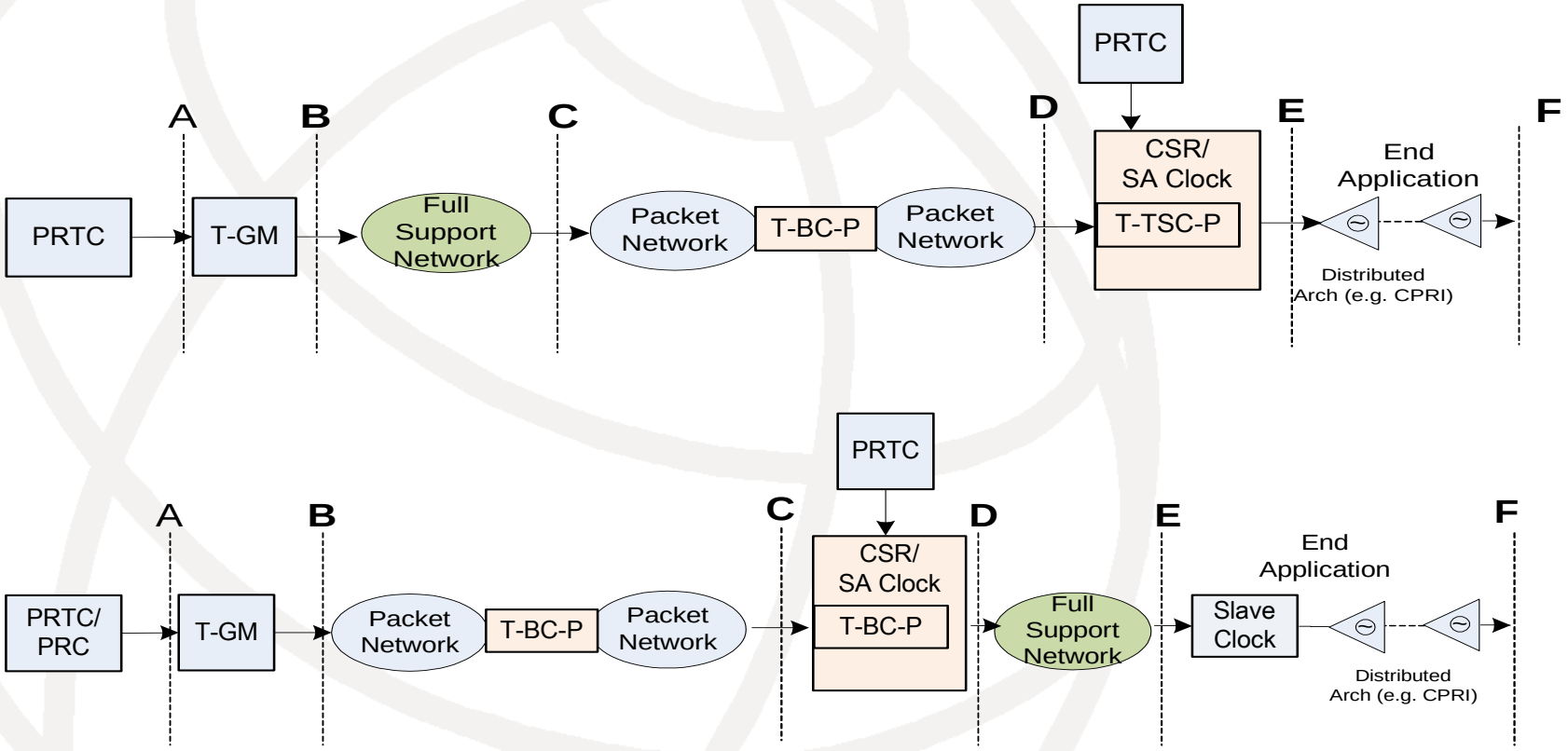
-- eNode B will be synchronized with GPS receivers in priority

-- PTP will be used as a backup in case of GPS failure



4.8 G.8275.2 A-PTS architecture

-- **Several architectural examples were provided requiring more discussions**



G.8275.2 A-PTS issues

Other contributions are needed to support the concept of APTS:

- **Assisted Partial Timing Support Network Profile –**
- **Clock types, PTP profiles**
- **Partial Timing Support uses cases**
- **Slave Classification**
- **Identification of the IWF Profiles**
- **BMCA for APTS**
- **Definition of the IWF, not defined in October**

G.8275.2 Personal Question

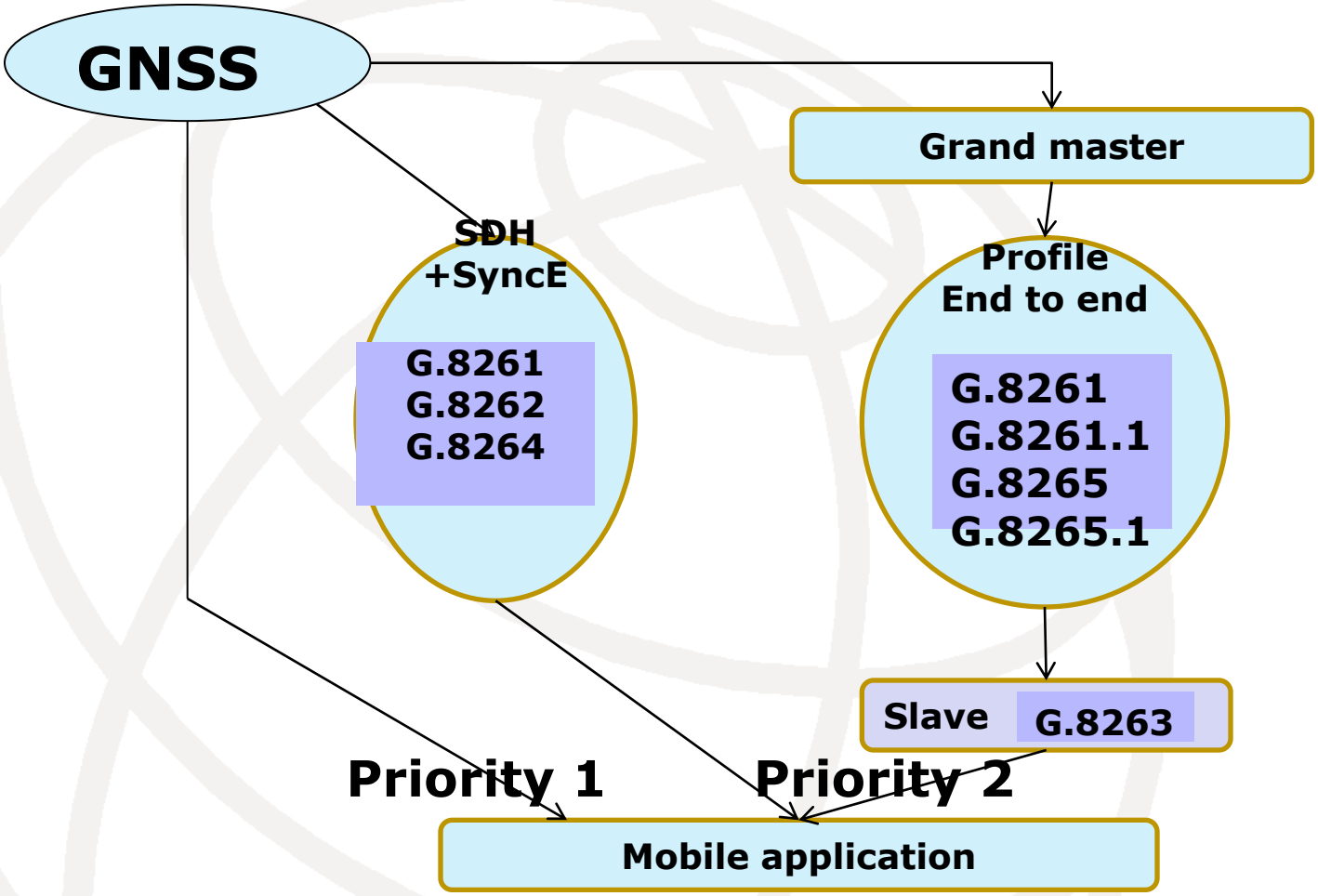
Why a time profile for the protection of the PRTC collocated with the radio equipment?

-PRTCs/GPS have, or must have, a holdover for short signal interruption.

-Why not providing a reference frequency to the PRTC?
--via PTP, (NTP?)
--SyncE, SDH

-ITU has already specified a profile for the transport of -frequency through unaware networks
G.8265.1

An A-PTS architecture?



But

-Frequency and time must have the same source

-The G.8265.1 profile does not support T-BC

A-PTS conclusion

Conclusion
-Since Operators are requesting urgently a solution to A-PTS (end 2014),
-Since the proposed network models are complex,

-A backup solution with a frequency profile,
or even SYNCE could be considered as first solution,
keeping in mind that compatibility with the still undefined G.8275.2 is a strong wish

-Contributions are invited next month if someone sees an interest in this proposal, eg adding G.8265.1 (and/or SyncE) as input to the undefined IWF

4.5 G.Supp

Calnex

This document provides provides the technical bases for the definition of G.8271.1, G.8275 and The G.8273 series.

The current drafts already contains:

- **EEC/SEC, SSU and PRC wander models**
- **simulation of SyncE chains**
- **Wander accumulation model for option 1 and option2 and initial results**
- **Detailed simulation models of a T-BC**

- **Existing material will be added dealing with**
  - **SyncE rearrangements**
  - **analysis of protection scenarios**

Where to get the recommendations?

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

Calnex

Calnex Solutions Ltd

www.calnexsol.com

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Calnex Paragon Sync

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)***

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)***
- ***G.8264 (2008), Distribution of timing through packet networks***
  - ***G.8264 Amd1 (2010)***
  - ***G.8264 Amd2 & Corr2 (Dec 2011)***

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.8263 (Dec2011)Timing characterisctics of packet based equipment clocks (PEC)and packet based service clocks (PSC)*
- *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)*

  G.8265.1 Amd1 (2011) & amd2 (2012)

Recommendations for the telecom profile for time and phase

- ***G.8271 (dec2011) Network requirements for transport of time/phase***
  G.8271 Amd1 (Juky 2013)
- ***G.8271.1(July2013) Network Limits for Time Synchronization in Packet Networks***
- ***G.8272 (Sept2012) Specification of Primary Reference Time Clock (PRTC)***
- ***G.8273 (July 2013) Specification of clocks for the transport of time/phase***
- ***G.8275 (july 2013) Architecture and requirements for packet-based time and phase delivery***

Future recommendations (provisional titles)

- ***G.8273.1 Telecom Grand Master***
- ***G.8273.2 Telecom boundary clock***
- ***G.8273.3 Telecom transparent clock (to be confirmed)***
- ***G.8275.1 Telecom profile for the transport of time/phase with full timing support from the network***
- ***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***