Status of ITU Q13/15 sync standards WSTS-2013

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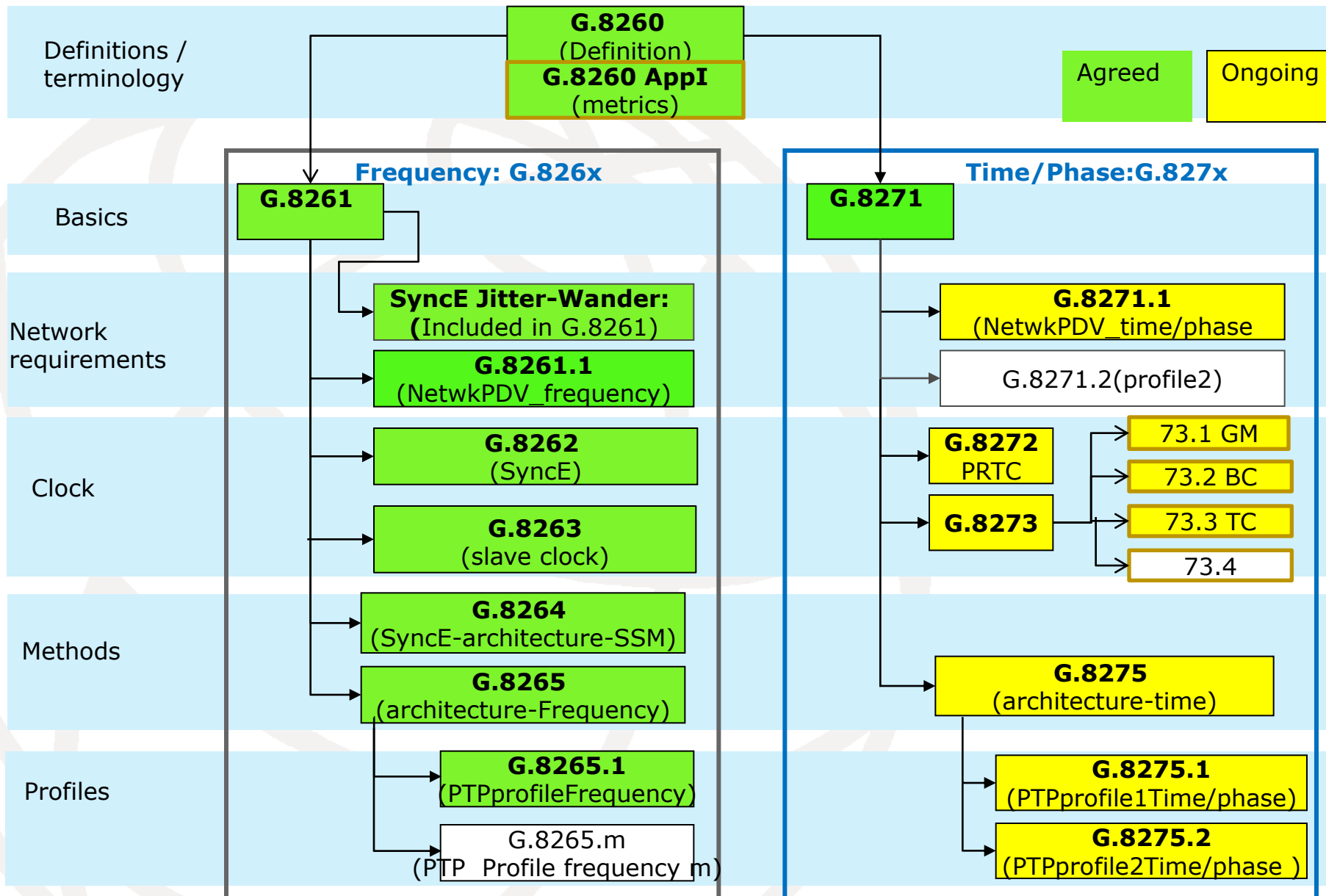
Agenda

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

| Definitions / terminology | **G.8260** (Definition) **G.8260 AppI** (metrics) | Agreed | Ongoing |

Frequency: G.826x

Time/Phase: G.827x

| Basics | G.8261 | G.8271 |

Network requirements
- SyncE Jitter-Wander: (Included in G.8261)
- **G.8261.1** (NetwkPDV_frequency)
- **G.8271.1** (NetwkPDV_time/phase
- G.8271.2(profile2)

Clock
- **G.8262** (SyncE)
- **G.8263** (slave clock)
- **G.8272** PRTC
- **G.8273**
  - 73.1 GM
  - 73.2 BC
  - 73.3 TC
  - 73.4

Methods
- **G.8264** (SyncE-architecture-SSM)
- **G.8265** (architecture-Frequency)
- **G.8275** (architecture-time)

Profiles
- **G.8265.1** (PTPprofileFrequency)
- G.8265.m (PTP Profile frequency m)
- **G.8275.1** (PTPprofile1Time/phase)
- **G.8275.2** (PTPprofile2Time/phase)

2-History

3- Consents in September 2012
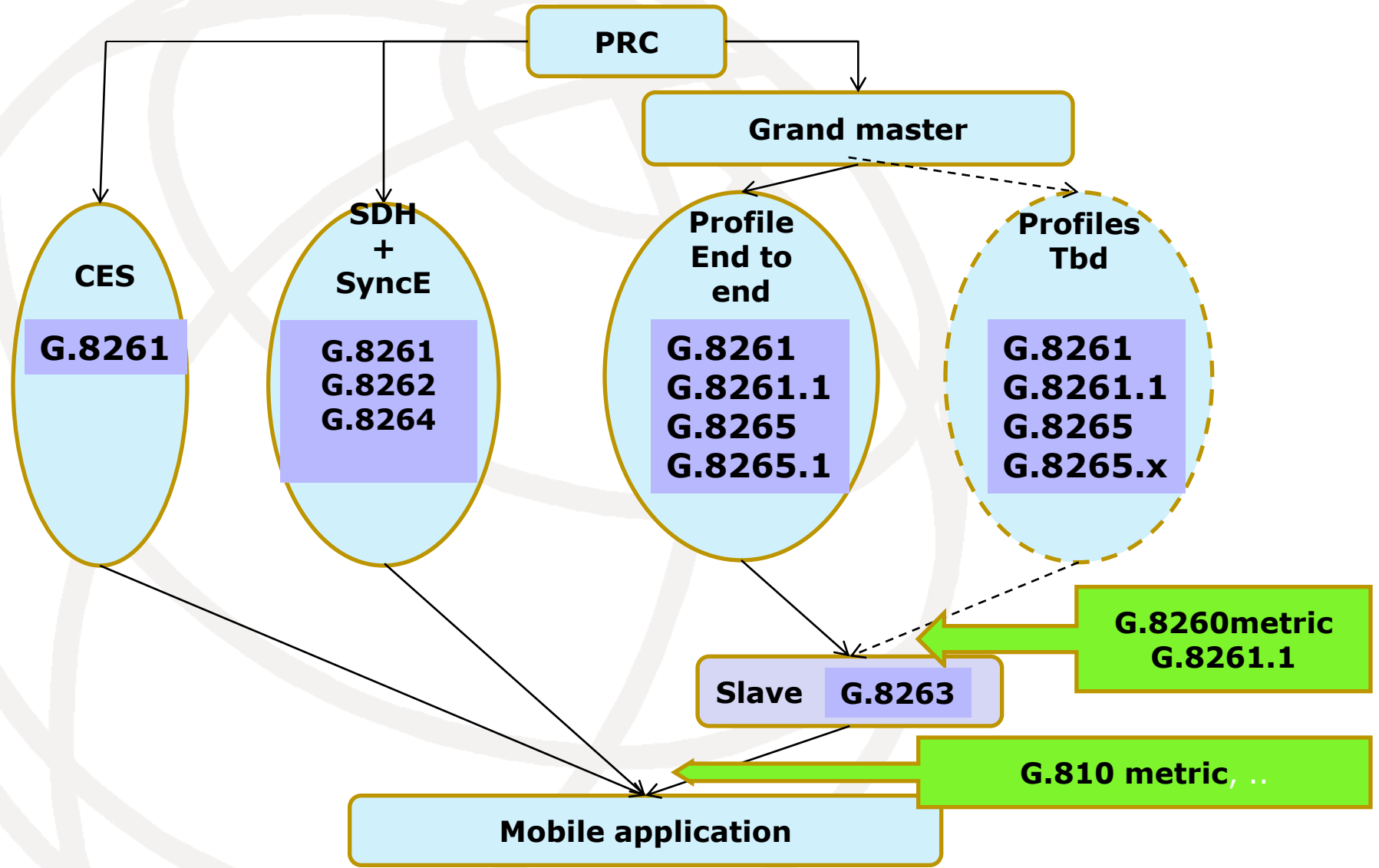   3.1 G.8272- PRTC
        3.2 G.8265.1 Amd2
        3.3 G.8262 Amd2

   + G.8251 Amd3 on OTN

3.1- Transport of frequency in packet networks

3.2- Transport of frequency in packet networks

- All documents are now approved
- Ongoing discussion on
  - G.8260
    - definitions
    - FPP metric : observed floor delay
  - G8261.1
    - network limits
- Amendments on
  - G.8265
    IPV6 mapping added to IPV4
    (All equipments must support IPV4)
  - G.8262
    Considerations for measuring
    Noise Transfer for EEC-Option 2 clocks

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3.3 G.Supp

Decision to create this supplement was taken to make available the technical work done for the definition of the transport of time over packet networks which could not be included in the recommendation due to its size.

Based on the 2 G.8271.1HRMs many simulations were performed to analyse clocks models and networks performance in order to define the architecture, equipment clock an network limits.
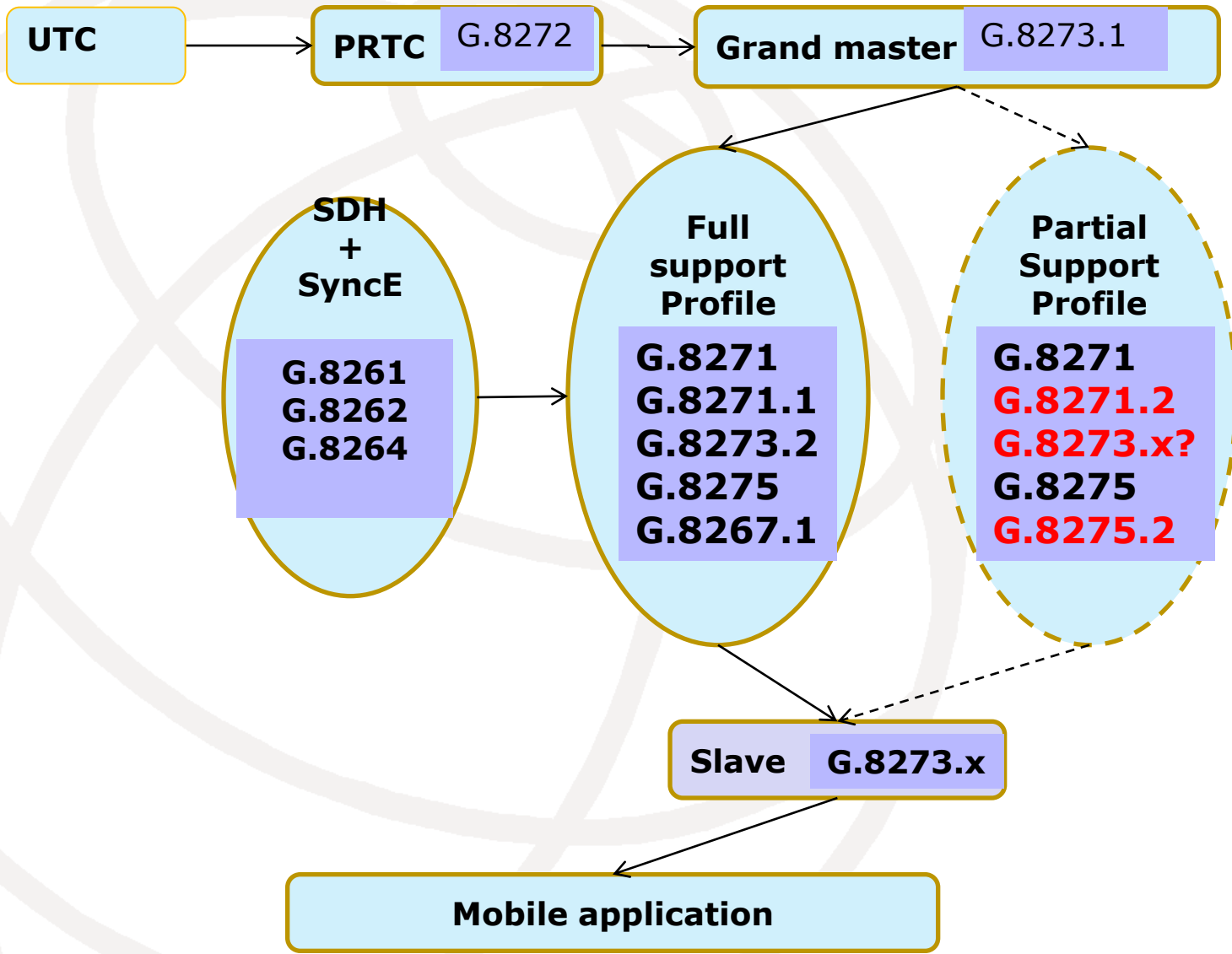
This work was done to provide the technical bases for the definition of G.8271.1, G.8275 and The G.8273 series.

4-1 Transport of time and phase in packet networks

2 profiles based on IEEE 1588 will be developped

    -Full timing support profile (expected July 2013)
     all equipment process the 1588 messages,
     i.e. T-BC and T-TC.

    -Partial timing support (expected ?)
     Some equipment do not process the 1588
     messages, they are « unaware » of 1588.

4-2 Transport of time and phase in packet networks

Calnex

```
UTC  →  PRTC  [G.8272]  →  Grand master  [G.8273.1]
```

SDH + SyncE
- G.8261
- G.8262
- G.8264

→

Full support Profile
- G.8271
- G.8271.1
- G.8273.2
- G.8275
- G.8267.1

Partial Support Profile
- G.8271
- G.8271.2
- G.8273.x?
- G.8275
- G.8275.2

Slave [G.8273.x]

↓

Mobile application

4.1   G.8271
(common to both profiles)

It defines time and phase synchronization aspects in packet networks and the suitable methods to distribute the reference timing used to recover phase and time synchronization according to the required quality.

The main body deals with:
- -Need for phase and time
- -phase and time synchronization methods
- -Network reference model

4.2   G.8275 (common to both profiles)

- **Time and Phase distribution architecture**
    - **General aspects of the distribution**
    - **Protection**
    - **Selection process**
    - **Packet network partitioning**
    - **Clock types**
    - **Security**
    - **Time and phase G.805 model**

- **appendix added in April 2013**
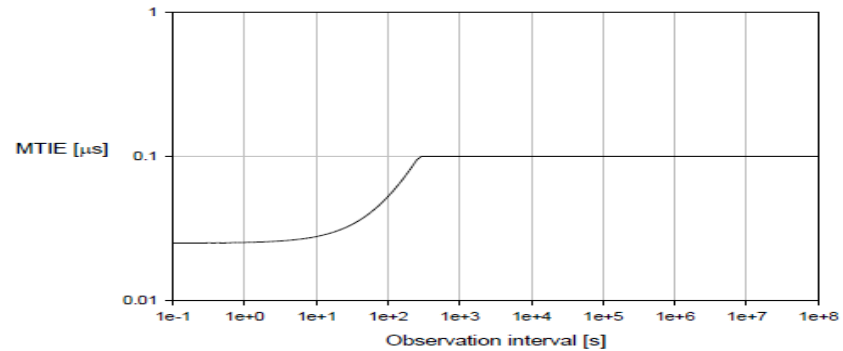   - **Architecture of partial timing support profile**

4.3 G.8272 PRTC (Primary Reference Time Clock) for both profiles

-Position of the PRTC in the network

| UTC | → | PRTC | G.8272 | → | Grand master | G.8273.1 | → 1588 messages |

Note: functional representation, implementation might group PRTC and Grand Master

-Noise definition

-Time holdover
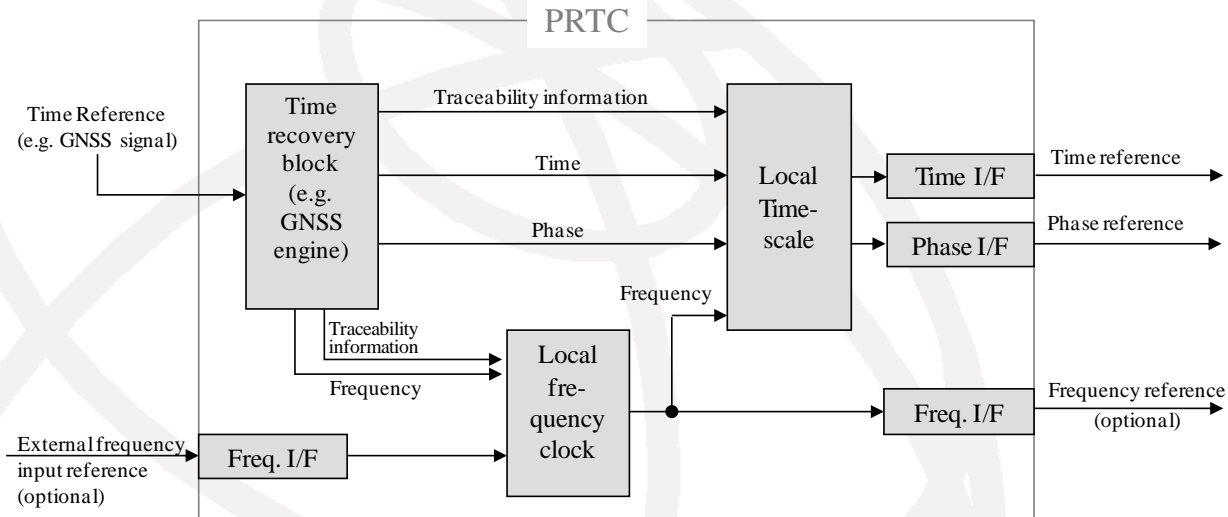-Not yet agreed
-Holdover is extremely short for T compared to F
-   Example Cesium
-       free run for lifetime for frequency
-       Consumes time error budget of mobile in < 2 days

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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

G.8273 Testing Time clocks
- ongoing

G.8273.1 master clock
- ongoing

G.8273.2 Telecom Boundary clock
- Ongoing
- Need for another BC for partial support?
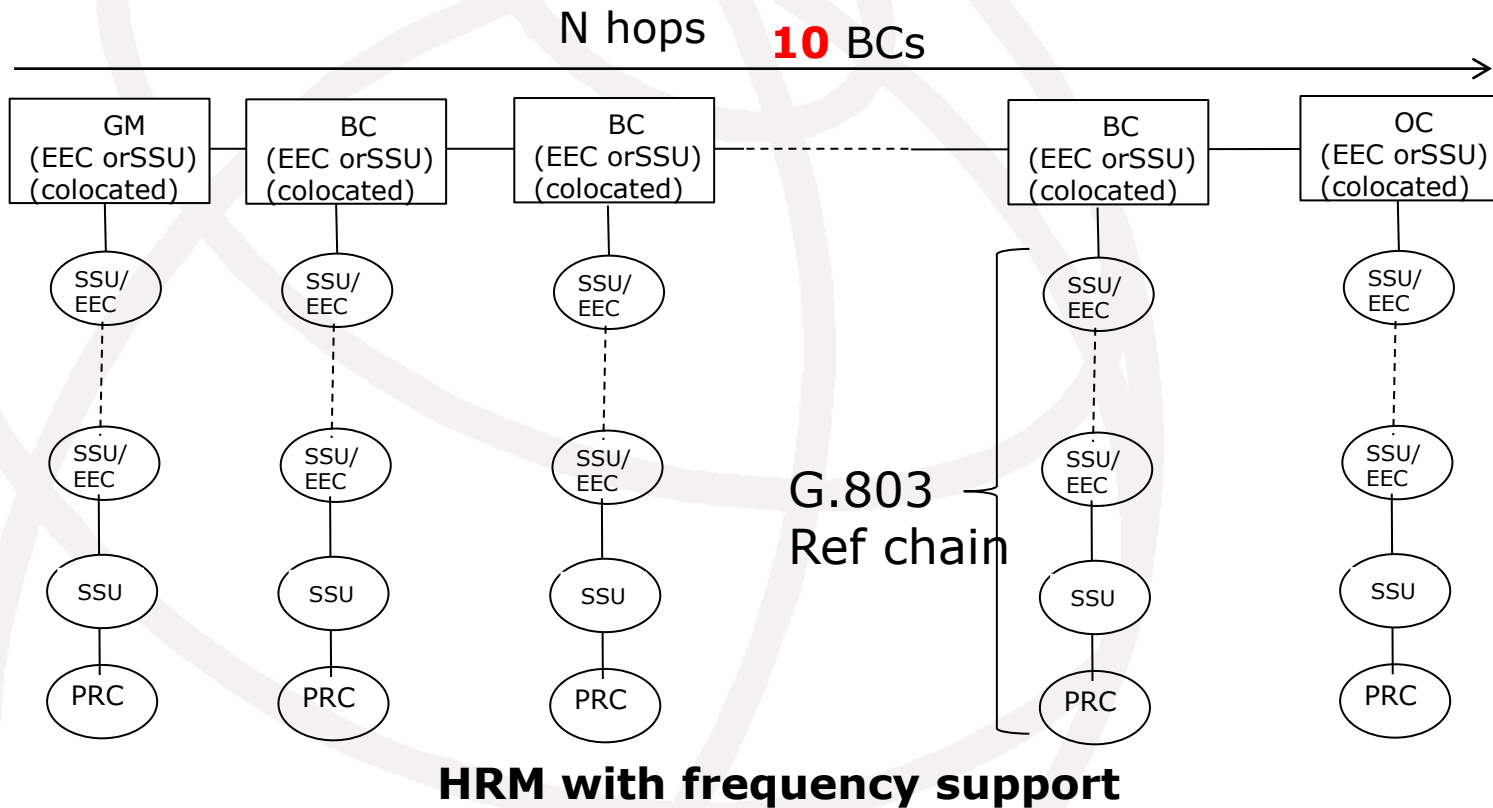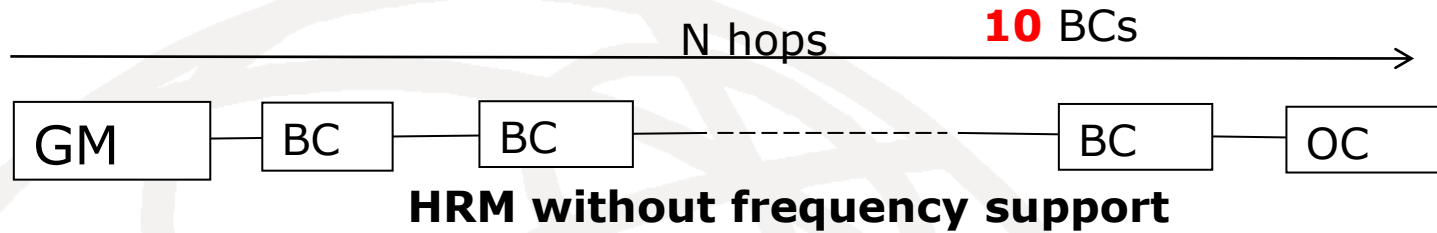
4.2   G.8271.1
(for full timing support profile)

It defines
- **the HRM (hypothetical reference model)**
- **The network limits**

See specific presentation on G.8271.1

4.2-2 HRMs for network limits

N hops   **10** BCs

GM — BC — BC ----- BC — OC

HRM without frequency support

N hops   **10** BCs

GM (EEC orSSU) (colocated) — BC (EEC orSSU) (colocated) — BC (EEC orSSU) (colocated) ----- BC (EEC orSSU) (colocated) — OC (EEC orSSU) (colocated)

SSU/EEC — SSU/EEC — SSU/EEC ... SSU/EEC — SSU/EEC

SSU/EEC — SSU/EEC — SSU/EEC ... SSU/EEC — SSU/EEC

SSU — SSU — SSU ... SSU — SSU

PRC — PRC — PRC ... PRC — PRC

G.803 Ref chain

HRM with frequency support

Note: BC number was reduced from 20 to 10 in San Jose (April 2013) (with some special cases)

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4.4 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.

-The question has been sent to IEEE 802.1Q MAC DA, provisionally agreed by Q13 is compatible with 802.1 answer.
Bridge configuration will be needed

G.8275.1

Full timing support profile for T & φ
- Mapping
  - Only Ethernet mapping (IEEE Annex F) Expected to be consented in July2013
  - IP mapping, requested by many participants, could not yet be agreed in April since:
    - It was said that defining 2 mappings will delay the consent in July
    - It was argued this will increase the cost
    - etc, etc
- Good progress on other parameters
  - Clock class, messages, BMCA, etc

There is still hope to consent Ethernet in July
There is still hope to consent IP after July

G.8275.2

Partial timing support profile for T & φ

-Agreement on IP mapping

Will be studied after G.8275.1 consent in July 2013

G.8271.2

For Partial timing support profile

To be studied
- **HRM to be defined**
- **New simulations needed**
- **network limits to be defined**

5-synchronization standards in ITU SG15

	Circuits			Packets	
	SDH	OTN	SyncE	Frequency	Time
Definitions		G.810		G.8260	
Architecture	G.803	G.8251	G.8261	G.8265	G.8275
Performances	G.823,4,5	G.8251	G.8261	G.8261.1	G.8271.1 G.8271.2
Functional models	G.781	G.8251	G.8264 G.781	G.8261	G.8271
Profiles				G.8265	G.8275.1 G.8275.2
Clock specifications	G.811, G.812 G.813	G.8251	G.8262	G.8263	G.8273 G.8273.x (x=1,2,3)
Simulations					G.SUPP
Test equipments	O.171 O.172	O.173	O.174		

List of ITU-T main recommendations related to synchronization

- **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*
  - *(dec2011) Appendix1 on metrics*

Recommendations for Synchronous Ethernet

- *G.781 (2009), Synchronization layer functions*
- *G.8261 (2008), Timing and Synchronization aspects in Packet Networks*
  - *G.8261 Amd1 (2010)*
- *G.8262 (2010), Timing characteristics of synchronous Ethernet Equipment slave clock (EEC)*
  - *G.8262 Amd1 &2 (2012)*
- *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 (2008), 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 characreisctics 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.8272 (Sept2012) Specification of Primary Reference Time Clock (PRTC)

Future recommendations (provisional titles)

G.8271.1 Network Limits for Time Synchronization in Packet Networks
(for the full support time profile)

G.8271.2 Network Limits for Time Synchronization in Packet Networks
(for the partial support time profile)

G.8273 Specification of clocks for the transport of time/phase

G.8273.1 Telecom Grand Master

G.8273.2 Telecom boundary clock

G.8273.3 Telecom transparent clock (to be confirmed)

G.8275 Packet network architecture for the transport of time/phase

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 basedon the Optical Transport N...
·O.174 (2009)   Jitter and wander measuring equipment for digital system

based on synchronous Ethernet network

Where to get the recommendations?

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

A GIANT LEAP IN 1588V2 PTP MEASUREMENTS

Calnex

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