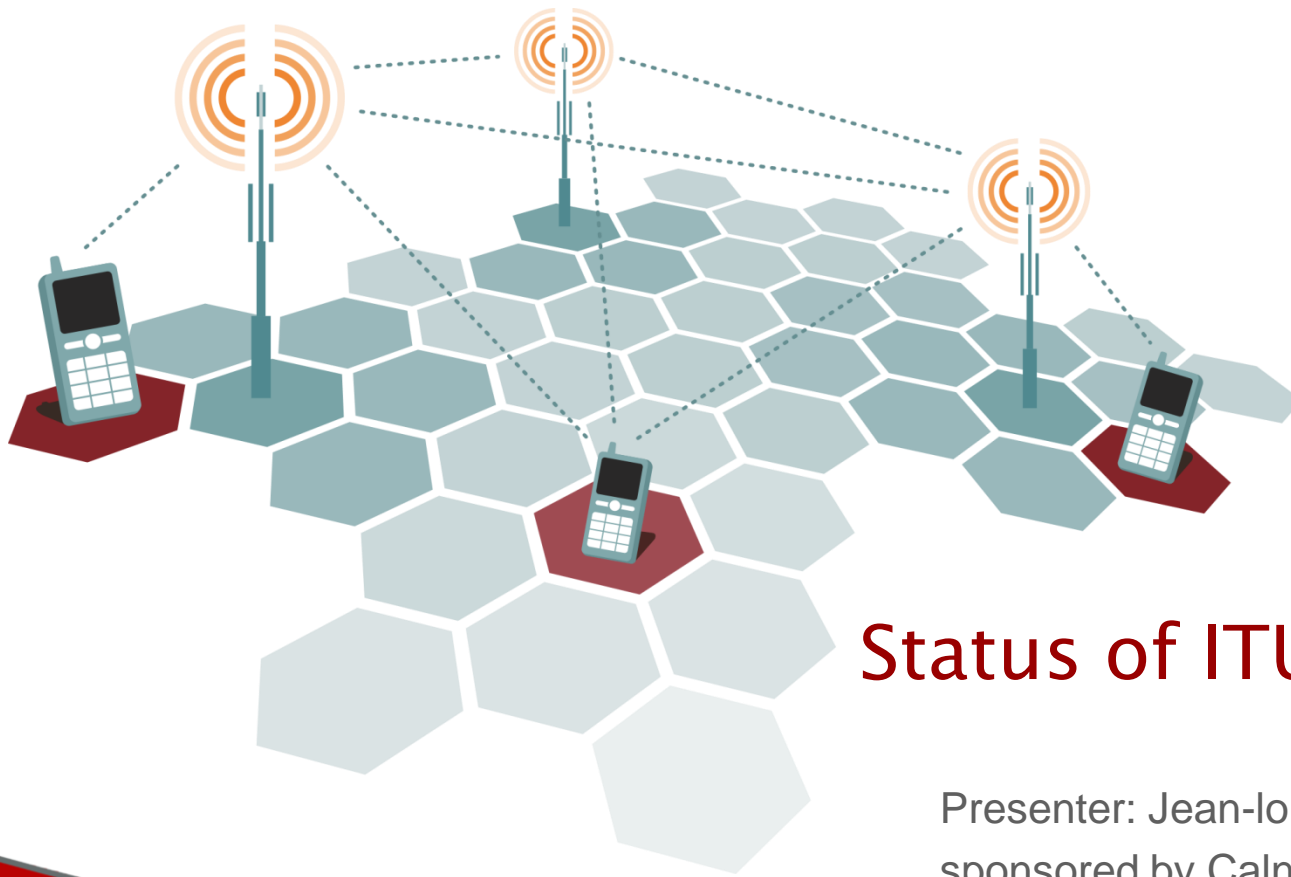




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## Status of ITU standards

Presenter: Jean-loup Ferrant  
sponsored by Calnex Solutions

# Synchronization activity in ITU-T SG15

- Q9**      **Transport equipment and network protection/ restoration  
(responsible for G.781, synchronization layer)**
  
- Q13**      **Network synchronization and time distribution performance**
  
- Q15**      **Test and measurement techniques and instrumentation  
(responsible for the jitter and wander test equipments)**



# agenda

- **1-Overview of available and future recommendations**

- **2-Q13 worked on the following items**

- **2.1-Synchronous Ethernet - Frequency over Ethernet PHY layer**
- **2.2-Use of time protocols over PSN for frequency distribution**
  - **Telecom profiles**
- **2.3-Characterization of PSN- metrics**
- **2.4- time distribution over PSN**
- **2.5 OTN evolution**



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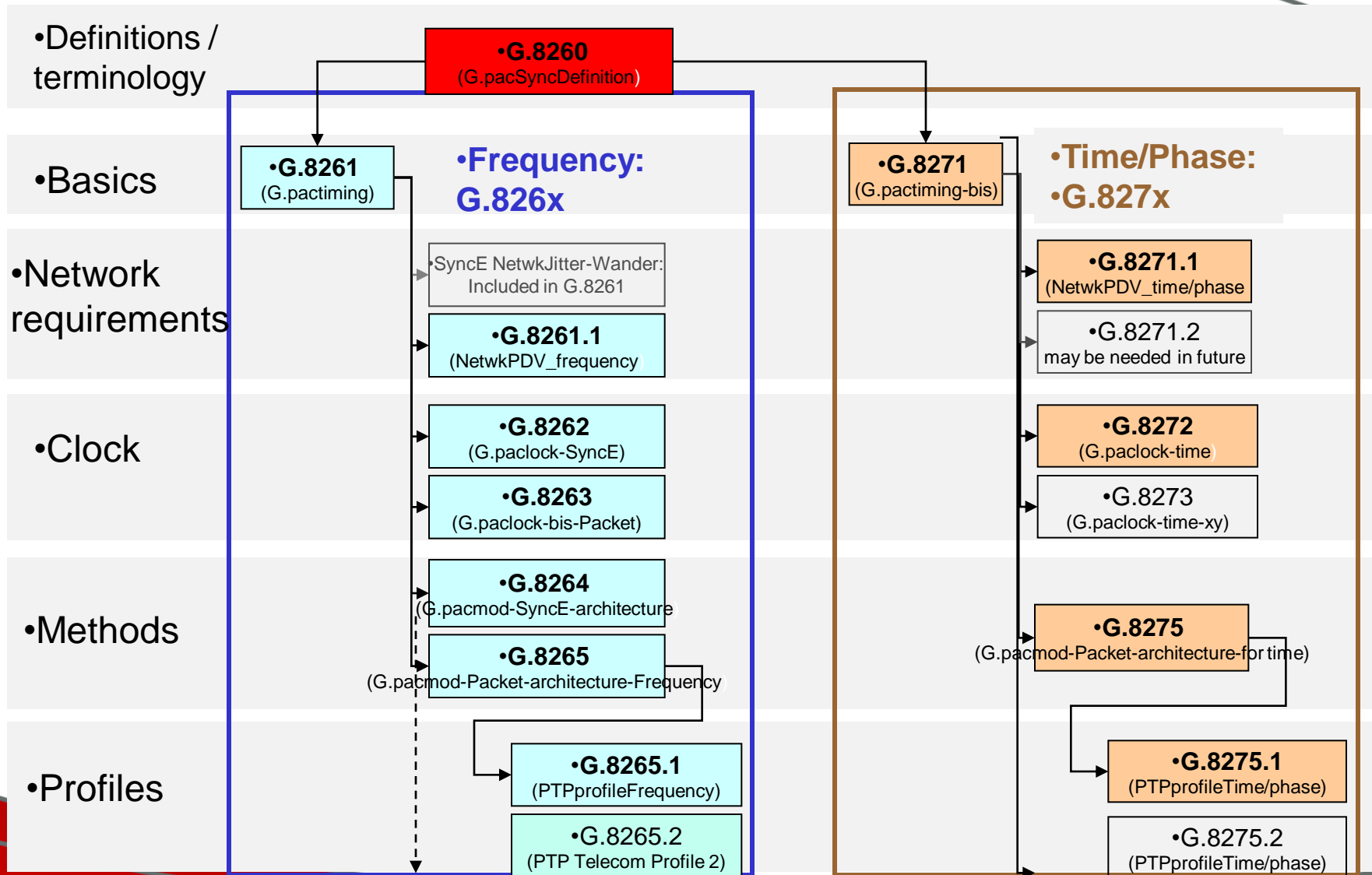
# 1-Status of standards in ITU

	TDM	SyncE	CES
• <b>Definitions</b>	•G.810		
• <b>Architecture</b>	•G.803	•G.8261	•G.8261
• <b>Performance</b>	•G.823/4/5	•G.8261	•G.8261
• <b>Functional model</b>	•G.781/783	•G.8264* •G.781	•G.8261
• <b>Clock specification</b>	•G.811/2/3	•G.8262	•G.8263
• <b>Test equipment</b>	•O.171/172	•O.174	



## New set of recommendations

- *Current organisation of recommendations was not intended to match the transport of frequency and time/phase via time protocols*
- *It was decided in october in Geneva to split the transport of frequency and time in 2 different sets of recommendations*
  - *G.826x serie for frequency*
  - *G.827x serie for time*
- *The G.826x serie will be modified to split between SyncE and time protocol transport*

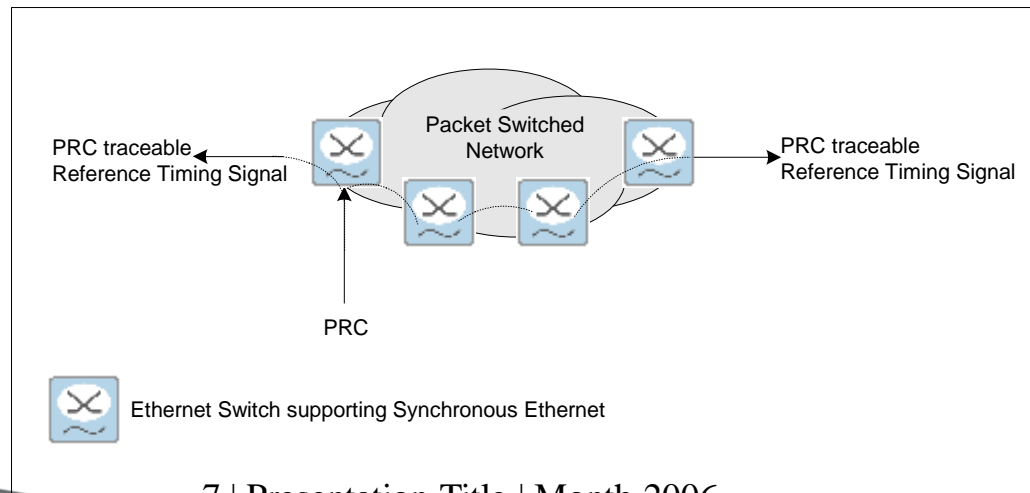




## 2.1-Synchronous Ethernet (1)

- Principle

- Transport a reference frequency in the Eth Physical Layer, not impacted by PDV
- Reuse SDH principles to allow Synchronous Ethernet to interwork with SDH synchronization network
- Ensure interworking with « legacy » Ethernet equipments





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## 2.1- Synchronous Ethernet (2)

- **G.8261**

- Architecture annex A
- EEC clock (synchronous Ethernet Equipment Clock)
- Network limits, based on SDH

- **G.8262**

- This is a « replica » of G.813 option1 for EEC option1 and G.812 type IV for EEC option2
- Same clock parameters as for G.813
- Full compatibility with the G.803 SDH reference chain
- Mix of SEC and EEC can be done in the G.803 SDH reference chain
- Specifies Synchronous Ethernet , STM-N and PDH as interfaces for EEC





## 2.1- Synchronous Ethernet (3)

- **G.8264**
- Frequency transfer using Synchronous Ethernet (section 10)
  - General information
  - Operation modes: synchronous and non-synchronous
- SSM for Synchronous Ethernet (section 11)
  - Definition of the ESMC: Ethernet Synchronization Messaging Channel
    - SSM for Ethernet implements a channel using 802.3 Organization Specific Slow Protocol
    - Event messages and heartbeat defined to meet performance requirement for reference switching in G.781
    - Quality Level data is mapped into a TLV format
    - Future information might be mapped according TLV format



## 2.1- Synchronous Ethernet (4)

- **G.781 (Q9/15)**

- Fig 17/G.781 Synchronization layer atomic function has been updated
- ETH/SD functions has been added
- ETY/LC function has been added

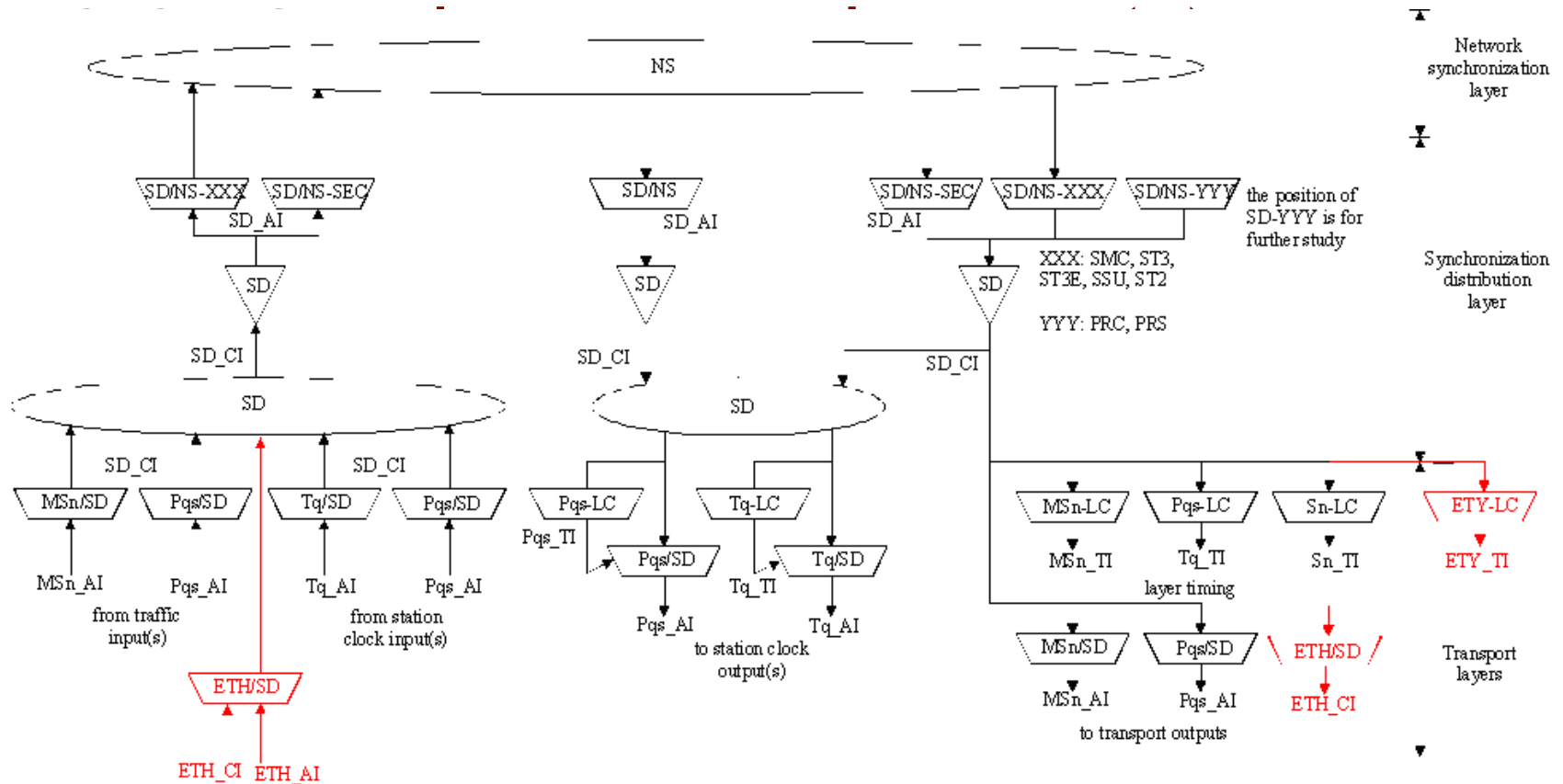
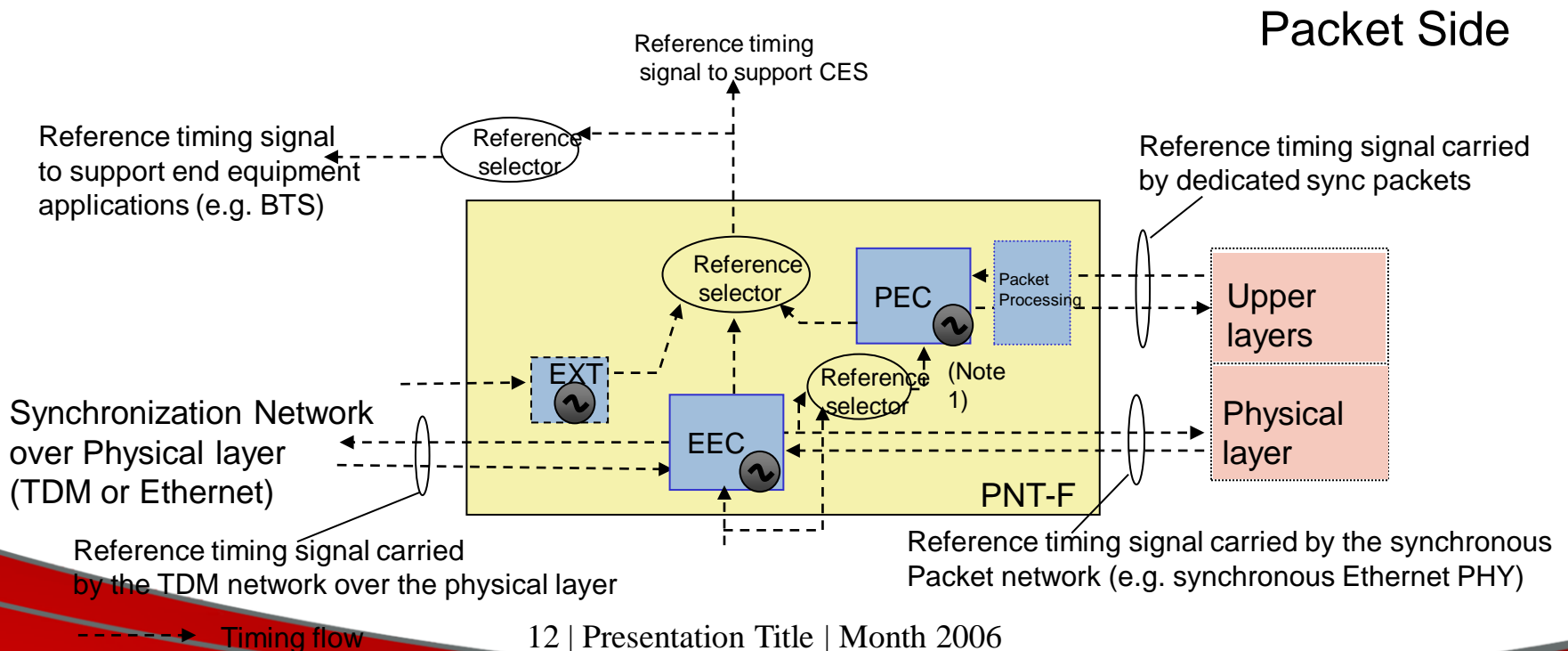


Figure 17/G.781 – Synchronization Distribution and Network Synchronization layer atomic functions



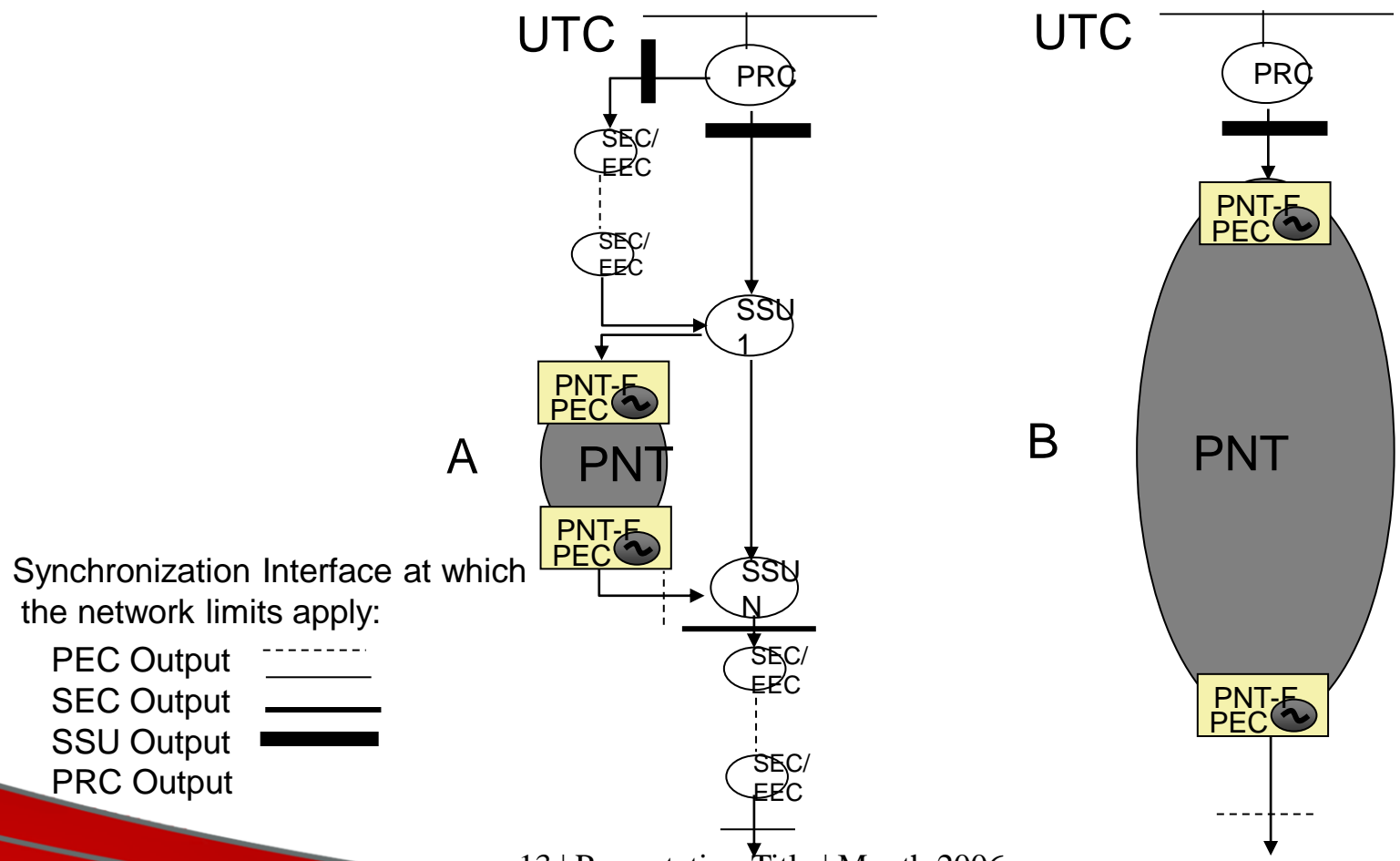
## 2.2- Transport of frequency through PSN - PEC (Packet-based Equipment Clock)

- PEC recovers the timing transported by a time protocol through PSN
  - E.g. it may recover a frequency from a 1588 message flow
  - It will be specified in G.8263



## 2.2- Transport of frequency through PSN - Network limits in G.8261

- Network limits defined similarly to the G.803 sync reference chain





## 2.2- Transport of frequency through PSN – 1588V2 telecom profile

- Q13 agreed to define a **first** telecom profile for the transport of frequency only in an end-to-end case, where intermediate nodes do not process 1588V2 messages.
- The profile will address independantly protocol and performances
- Future profiles may address TC and BC
- More details in a specific presentation



## 2.3- Transport of frequency through PSN - metrics

- Definition of metrics will be part of G.8260
  - Similar to MTIE and TDEV specified in G.810
- Metrics characterize the effect of PDV on packets
- Min TDEV
  - Similar to TDEV, but the mean of the sample window is replaced by the minimum of the sample window
  - Useful when a set of packets present a PDV close to a minimum delay
- MATIE
  - based on TIE

ITU standards



## **2.4 time distribution over PSN**

- Activity lead by mobile networks which need accurate time
- Work started to develop the G.827x serie





## 2.5 OTN

- Simulations under study to analyse jitter and wander accumulation on OTN clients carrying synchronization, e.g. SyncE
- This might lead to:
  - a new sync reference model with OTN island
  - Updated specification of SyncE interfaces
  - Update of G.8251



## 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 Synchronous Ethernet

- ***G.781 (2009), Synchronization layer functions***
- ***G.8261 (2008), Timing and Synchronization aspects in Packet Networks***
- ***G.8262 (2007), Timing characteristics of synchronous Ethernet Equipment slave clock (EEC)***
- ***G.8264 (2008), Distribution of timing through packet networks***



## Recommendation on Jitter and wander tests equipments

- **O.171 for PDH** Timing jitter and wander measuring equipment for digital systems which are based on the plesiochronous digital hierarchy (PDH)
- **o.172** Jitter and wander measuring equipment for digital systems which are based on the synchronous digital hierarchy (SDH)
- **O.173** Jitter measuring equipment for digital systems which are based on the optical transport network (OTN)
- **O.174 (2009)** Jitter and wander measuring equipment for digital system based on synchronous Ethernet network



## Future recommendations ( provisional titles)

- ***G.8260 (2010) Definitions and terminology for synchronization in packet networks***
- ***G.8271 (2011) (ex G.8266) Time and Phase Synchronization Aspects in packet Networks***
- ***G.8271.1 Network PDV requirements***
- ***G.8272 (2011) specification of clocks for the transport of time/phase***
- ***G.8275 Packet network architecture for the transport of time/phase***
- ***G.8275.n Telecom profiles for the transport of time/phase***



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Calnex Paragon Sync

