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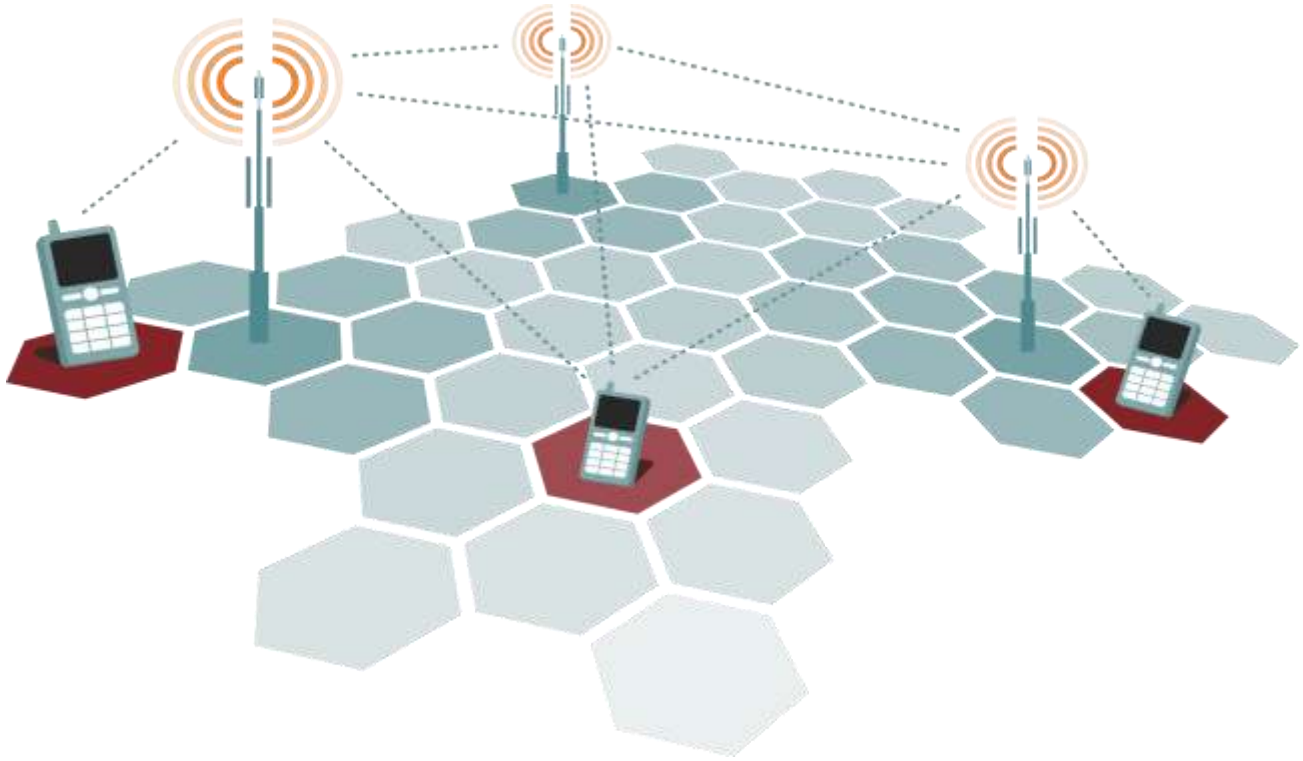

Status of ITU standards in November 2010

Presenter: Jean-Loup Ferrant ITU-T SG15 Q13 rapporteur
sponsored by Calnex Solutions Ltd

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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)**

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agenda

- 1-Overview of available and future recommendations

- 2-Q13 worked on the following items
  - 2.1 Definitions and metrics
  - 2.2-Synchronous Ethernet - Frequency over Eth PHY layer
  - 2.3-Use of time protocols over PSN for frequency distribution, Telecom profiles
  - 2.4-Use of time protocols over PSN for phase and time distribution, Telecom profiles
  - 2.5 OTN evolution
- 3 List of ITU-T SG15 recommendations for synchronization

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1–Status of standards in ITU

	TDM	OTN	SyncE	CES
•Definitions	•G.810			
•Architecture	•G.803	G.8251	•G.8261	•G.8261
•Performance	•G.823/4/5	G.8251	•G.8261	•G.8261
•Functional model	•G.781/783		•G.8264 •G.781	•G.8261
•Clock specification	•G.811/2/3	G.8251	•G.8262	
•Test equipment	•O.171/172	O.173	•O.174	

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New set of recommendations

- ***It was decided in october 2009 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***
- ***In 2010 at the SG15 plenary in June 7 documents were consented***
  - ***G.8260 new recommendation***
  - ***G.8261 Amd1***
  - ***G.8262 new version***
  - ***G.8264 Amd1***
  - ***G.8265 new recommendation***
  - ***G.8265.1 new recommendation***
  - ***G.8251 new version***

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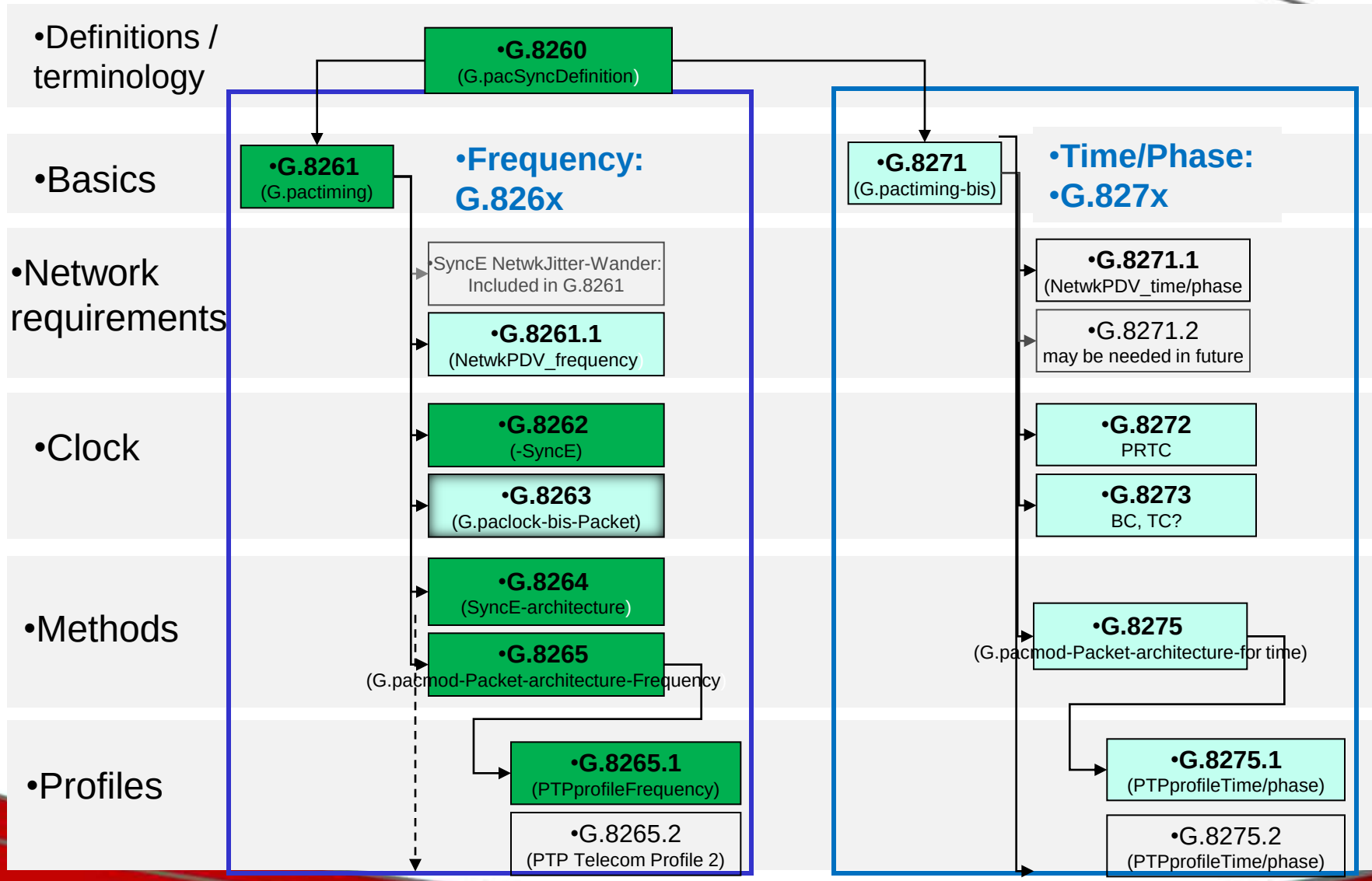
•agreed •ongoing



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•2.1 G.8260 (June2010) Definitions and metrics for the transport of frequency, phase and time

- Equivalent to G.810 for TDM
- Definitions
  - Completed for the transport of frequency over packet networks
  - Future version expected for phase and time
- Metrics
  - G.8260 contains only a general introduction on metrics
  - It was not possible to insert metric definition, even minTDEV defined in G.8261:
    - -Metrics are OK, but
    - -How to characterize a network with these metric?
    - -How an operator can be sure of its network?

More work is needed in Q13, will be addressed in December 2010

•2.2 Synchronous Ethernet evolution

G.8261 Amd1 (June 2010)

- **Definition of network limits for Synchronous Ethernet**

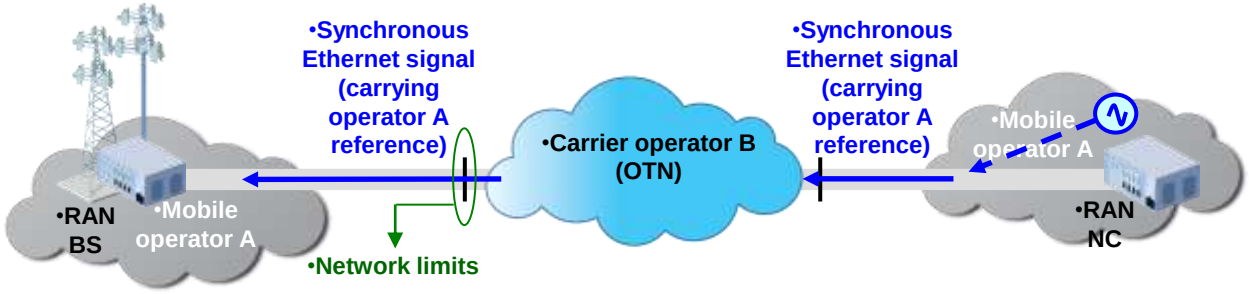
- **Clarification of « reduced Ethernet » functionality in Annex A**
  - **only one direction of the interface carrying synchronization, timing plus ESMC with SSM**

- **G.8262 (june 2010) new version replacing the 2007 one**

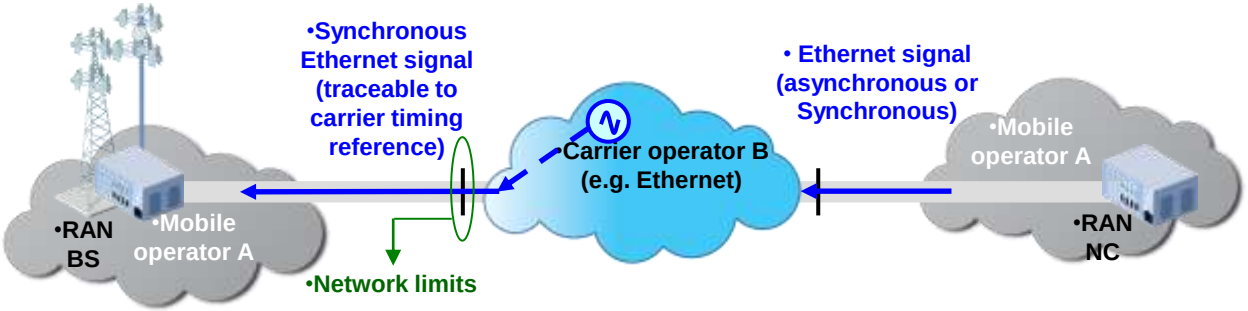
- **Specification of output Jitter at a G.8262 syncE interface**
  - **For 1G and 10 G**
- **Specification of the jitter tolerance at a SyncE interface**
  - **For 1G and 10 G**
- **List of Ethernet interfaces applicable to Synchronous Ethernet**
  Taking into account the special cases
  - **CSMA-CD**
  - **Master-slave**
  - **Auto negociation**
  - **Point to multipoint**
- **Removal of annex A (Reference source selection mechanism) , since included in G.8264 (2008)**

- **G.8264 Amd1 (June2010)**
  - The main evolution is the operation of SyncE in a multi-operator context

Transport of frequency through an intermediate operator



Delivery of frequency by an intermediate operator



•2.3 Transport of frequency

- G.8261 (non SyncE part)
- G.8261.1

- 1588 profile
- G.8265
- G.8265.1

- **G.8261** (non SyncE point)

Evolution of Fig VI.14 defining test case 17 related to routing changes by failures in the network

- **G.8261.1**

New recommendation adressing network PDV will start in December 2010

Its goal is to define PDV with metrics and characterize networks performance, depends on the progress of G.8260 on metrics

- **Telecom profile for the transport of frequency only**

  - **G.8265 (June 2010)**
  - **Addresses only the transport of frequency without the support of the network, intermediate nodes do not participate.**

    - **G.8265 provides high level requirements**
    - **G.8265 defines the general architecture**

  - **G.8265.1 (June 2010)**
  - **Defines the parameters of PTP chosen for the profile**
    - **Type of messages**
    - **Rates**
    - **Mappings**
    - **A specific BMCA for this profile**

•2.4 Transport of phase and time (Under discussion within Q13)

- **G.8271 defines the requirements**
- **G.8262 defines the Primary Reference Time Clock**
- **G.8273 defines clocks for BC, etc**

- 1588 profile
  - **G.8275 defines the network architecture**
  - **G.8275.1 defines the protocol based on PTP**

- **G.8271 (network requirements)**
- **At the October meeting contributions were addressed on:**
  - **HRM**
  - **Network limits**
  - **Noise accumulation model**
  - **Analysis of noise sources**
  - **Evaluation of 2 network scenarios**
    - **Transport of frequency by the physical layer, i.e SyncE**
    - **Transport of frequency via PTP**
  - **Network protection requirements**

- **Expected consent date: November 2011**

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- **G.8272**
- **This recommendation will define the PRTC**

- **At the October meeting progress were done on the definition of the clock giving reference to the time**

Expected consent date: November 2011

- **G.8273**
- **Specification of the clock performance of a boundary clock**
- **accuracy**
- **Noise generation**
- **Holdover**
- **Etc**

This specification is needed in addition to IEEE 1588 specification to specify a boundary clock for use in telecom networks as IEEE 1588 specifies « only » a protocol.

Expected consent date: November 2011

- **Telecom profile for the transport of phase and time**
- **General architecture choices agreed**
  - **Hop by hop, no end to end architecture**
  - **With full support of the network**
  - **First profile will address BC**
  - **TC under evaluation / layer violation**

- **G.8275 (Telecom profile-network architecture)**
  - **Independance or not of the frequency and time planes**
  - **Analysis of Boundary and Transparent clocks**
    - **Effect on the network architecture**
    - **Choice of clock for the first profile**
  - **Evaluation of architecture based on 2 network scenarios**
    - **Transport of frequency by the physical layer, i.e SyncE**
    - **Transport of frequency via PTP**
  - **Network protection architecture**
  - **Analysis of asymetry effect and ways to overcome it**
  - **Expected consent date: November 2011**

- **G.8275.1**
- **telecom profile- protocol definition**
  - **Choice of clock**
  - **One step-two step**
  - **Unicast vs multicast**
  - **PTP mapping**
  - **PTP messages**
  - **PTP messages rates**
  - **Protection mechanism**
  - **PTP domains**
  - **Management aspects**
  - **Security aspects**

Expected consent date: Novembre 2011

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2.5 OTN
-new version of G.8251 (June 2010)

- To follow evolution of G.709, new specifications were added
  - Jitter for multilane interfaces: OTU3.4 & OTU4.4 (tbd)
  - Jitter for Oduflex (tbd)
  - Specification of jitter generation for ODU0 and ODU2e, 1G, 10G, CBR40G
- Introduction of Ethernet in the ODUk clocks

- Based on network simulations the bandwidth of desynchronizer for a 1G Ethernet tributary has been specified as 100 Hz

- Appendix VII introduces a new reference chain, after simulations

-Transport of PTP through OTN

- Under discussion within SG15 WP3

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3-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***

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.8264 (2008), Distribution of timing through packet networks***
    - ***G.8264 Amd1 (2010)***

- **Recommendations for the telecom profile for frequency only**

- ***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)***

- **Recommendations for OTN**

- ***G.8251 (2010) The control of jitter and wander within the optical transport network (OTN)***

Recommendation on Jitter and wander tests equipments

- ***O.171 for PDH***
- ***O.172 for SDH***
- ***O.173 for OTN***
- ***O.174 (2009) Jitter and wander measuring equipment for digital system based on synchronous Ethernet network***

Future recommendations (provisional titles)

- ***G.8261.1* Packet Delay Variation Network Limits applicable to Packet Based Methods (Frequency Synchronization)**

- ***G.8271 (2011) Network requirements for transport of time/phase***
- ***G.8272 (2011) specification of Primary Reference Time Clock***
- ***G.8273 (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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