

New ITU-T Recommendations on packet networks

G.8261/Y.1361 – Timing and synchronization aspects in packet networks. This Recommendation defines synchronization aspects in packet networks. It specifies the maximum network limits of jitter and wander not to be exceeded, the minimum equipment tolerance to jitter and wander to be provided at the boundary of packet networks at TDM and synchronization interfaces, and the architectural aspects of synchronous Ethernet. It also outlines the minimum requirements for the synchronization function of network elements.

G.8262/Y.1362 – Timing characteristics of synchronous Ethernet equipment slave clock (EEC). This Recommendation outlines requirements for timing devices used in synchronizing network equipment that uses synchronous Ethernet.

G.8264/Y.1364 – Distribution of timing through packet networks. This Recommendation outlines the requirements for Ethernet networks with respect to frequency transfer. It specifies the SSM transport channel, namely the Ethernet Synchronization Messaging Channel, the protocol behaviour and message format. The Recommendation also details the required architecture in formal modelling language.

ITU Recommendations on TDM

G.781 – Synchronization layer functions

G.783 – Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks

G.803 – Architecture of transport networks based on the synchronous digital hierarchy (SDH)

G.810 – Definitions and terminology for synchronization networks

G.812 – Timing requirements of slave clocks suitable for use as node clocks in synchronization networks

G.813 – Timing characteristics of SDH equipment slave clocks (SEC)

G.822 – Controlled slip rate objectives on an international digital connection

G.823 – The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy

G.824 – The control of jitter and wander within digital networks which are based on the 1544 kbit/s hierarchy

G.825 – The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH)

ITU-T SG15 Question 3 is responsible for tracking and coordinating the development of Recommendations in the OTN area. For more detailed information, the "Optical Transport Networks and Technologies Standardization Work Plan" has been developed.

See www.itu.int/ITU-T/studygroups/com15/otn

SYNCHRONIZATION OVER PACKET NETWORKS

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Synchronization over packet networks

ITU-T has many years of experience in specifying synchronization networks developed during the study of time division multiplex (TDM) networks, e.g. plesiosynchronous digital hierarchy (PDH) with 2 Mbit/s and synchronous digital hierarchy (SDH). These synchronization networks are based on the use of the physical layer to transport a reference frequency from primary reference clocks (PRC) throughout the telecoms network.

As the network moves to a packet switched infrastructure, such as Ethernet and IP, many applications will benefit from the transport of synchronization over packet-switched networks. The introduction of new techniques such as circuit emulation services (CES) led ITU-T to study the transport of synchronization through packet networks during the last study period, 2005-2008.

Other areas of interest are mobile backhaul, the delivery of a frequency with an accuracy of 50 ppb (parts per billion) for frequency division duplex (FDD) and the need to also deliver time for time division duplex (TDD), which led to the development of new Recommendations.

This evolution led to the development of Recommendations addressing the following main items:

- The definition of jitter and wander for CES
The analysis of methodologies suitable for CES timing recovery and the distribution of reference timing signals over packet networks.
- The specification of synchronous Ethernet, which transports a reference frequency on the physical layer Ethernet links providing a continuous bit stream, in the same way as it has been specified for SDH. SDH and synchronous Ethernet interwork in a common synchronization network.
 - The scope of the G.803 reference chain has been extended to synchronous Ethernet
 - Synchronous Ethernet equipment clocks are compatible with SDH clocks
 - An IEEE slow protocol has been specified to transport synchronous status messages (SSM) through synchronous Ethernet links

Additional work is ongoing at ITU-T to develop new Recommendations addressing other aspects of synchronization in the packet network.

The transport of time and frequency through packet network using packet-based methods is one of the areas that will require further studies.

One of the most challenging tasks in this field is the support of the high-phase accuracy required by mobile technologies such as wideband code-division multiple access (W-CDMA) TDD; micro-second range may be required in these cases.

ITU-T will address the performance of can be achieved with some relevant packet protocols in the presence of packet delay variation (PDV). Clock specification for packet-based methods and new metrics for the characterization of PDV will be defined. Part of this work concerns the definition of the telecoms profile for IEEE 1588 V2.

The table below (Table XI.1/G.8261) shows the relationship between the TDM synchronization Recommendation family and the packet synchronization Recommendation family.

Requirements	TDM Network	Packet Network
Functional architecture and network synchronization requirements	G.803, G.810, G.823, G.824, G.825	G.8261
Equipment clock specification	G.812 (Type IV), G.813	G.8262
Synchronization layer functions, functional blocks, timing flow, and SSM	G.783, G.781	G.8264, G.781

